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The use of risk information in Strategic Environmental Assessment and spatial planning

DISSERTATION

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eigene Fotos der Landschaften bei Barcelonnette (Frankreich), Malborghetto-Valbruna (Italien) und Stryszawa (Polen) (von oben nach unten), aufgenommen zwischen September 2011 und April 2012.

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September 2016

Kathrin Prenger-Berninghoff

Declaration

I hereby confirm that the work presented in this thesis, entitled 'The use of risk information in Strategic Environmental Assessment and spatial planning', is my own. I declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. Where information has been derived from other sources, I confirm that this has been indicated in the thesis. This thesis has not been previously submitted for any degree of this or any other university.

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Abstract

Over the past decades, mountainous areas and river valleys in Europe have frequently experienced floods and landslides. In order to limit the damage potential of natural hazards and to reduce negative impacts, society is required to implement risk prevention measures. Decisions on where and how to develop space can significantly influence the vulnerability of the population and reduce the risk of disasters to people. In this respect, specific risk reduction strategies and measures can be implemented at regional and local scales through spatial planning decisions. The ability to make appropriate and convenient decisions on future land-uses is supported by the access to suitable risk-related information. Results of science-based risk assessments constitute an important source of information and evidence base in spatial planning practices, especially in the form of hazard or risk maps and plans. The question is how this information is transferred into legally binding decisions at the local planning level. This is where Strategic Environmental Assessment comes in. SEA is a well-established and already existing procedural framework which promotes risk assessment and management. When integrated into the SEA process, risk assessments can be considered together with other environmental concerns within the planning process. Such an approach could facilitate dealing with disaster risk in spatial planning. Whereas guidelines for the consideration of climate change aspects in SEA exist, which also partly relate to natural hazards, there are hardly any separate methodological frameworks or concepts for integrating aspects of disaster risk into SEA.

Despite the fact that a number of EU regulations for risk reduction provide and aim for a harmonisation of policies among EU Member States, risk reduction approaches still differ considerably in each country. Natural processes develop differently in different environmental conditions depending on aspects such as geological structure, relief, climate, soils etc. This is why their occurrence, intensity and extent varies across European countries and regions. Likewise, spatial planning systems develop in different political and social conditions, e.g. political systems, land ownership patterns and cultural contexts, and hence vary among European countries. Consequently, the ways in which sectoral policies formulate risk reduction strategies and the ways in which these are implemented by spatial planning authorities significantly differ across Europe. While some research projects have examined differences in risk assessment and management approaches, to date there is little clarity about what information or frameworks exactly spatial planners need to purposefully deal with risks.

The main objectives of this dissertation were to develop an understanding about different ways in which risk information is used in SEA and spatial planning and to investigate good ways of dealing with disaster risk. The concept for integrating disaster risk into SEA presented in this dissertation can be used to guide the consideration of risk information during the SEA procedure. Despite the variety of planning systems, and the multitude of socio-economic conditions, the developed concept should ultimately be applicable in all EU Member States. However, due to prevailing differences in assessing and managing risks it will serve different purposes and satisfy different needs. In countries that have separate legally binding hazard or risk reduction instruments, an integration of risk aspects into SEA will support a higher acceptance of the plan, provided a greater public involvement is enabled from the beginning of the planning process. Countries that integrate non-binding risk information into local land use plans and consider and balance risk-related concerns with other interests can make use of this concept to better inform decision-making processes.

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List of Acronyms

ADB	Autorità di Bacino dei Fiumi Isonzo, Tagliamento, Livenza, Piave, Brenta-Bacchiglione *(Basin authority of the rivers Isonzo, Tagliamento, Livenza, Piave, Brenta-Bacchiglione)*
ALARP	As Low As Reasonably Practicable
AZI	Atlas des zones inondables *(Atlas of flood zones)*
BBSR	Bundesinstitut für Bau-, Stadt- und Raumforschung *(Federal Institute for Research on Building, Urban Affairs and Spatial Development)*
BMVBS	Bundesministerium für Verkehr, Bau und Stadtentwicklung *(Federal Ministry of Transport, Building and Urban Development)*
BRGM	Bureau de Recherches Géologiques et Minières *(French Geological Survey)*
CCVU	Communauté de Communes Vallée de l'Ubaye *(Community of communes of the Ubaye Valley)*
CCW	Countryside Council for Wales
CEC	Commission of the European Communities
CEMAT	Council of European Conference of Ministers responsible for Spatial/Regional Planning
CEREMA	Centre d'Études et d'Expertises sur les Risques, l'Environnement, la Mobilité et l'Aménagement *(Centre for Studies and Expertise on Risks, Environment, Mobility, and Urban and Country Planning)*
CERTU	Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques *(Center for Studies on Networks, Transport, Urban Planning and Public Construction)*
CGDD	Commissariat général au développement durable *(General Commisary of Sustainable Development)*
CIPTM	Cartographie Informative des Phénomènes Torrentiels et de Mouvements de Terrain *(Informative maps of torrential events and mass movements)*
CPER	Contrats de plan Etat-région *(State-region planning contracts)*
CRED	Centre for Research on the Epidemiology of Disasters
DDEA	Direction Départementale de l'equipement et de l'agriculture *(Departmental Directorate of Public Works and Agriculture)*
DDT	Direction Départementale des Territoires *(Departmental Directorate of the Territory)*
DIACT	Délégation interministérielle à l'aménagement et à la compétitivité des territoires *(Interministerial Agency for Spatial Planning and Competitiveness)*
DREAL PACA	Direction Régionale de l'Environnement, de l'Aménagement et du Logement Provence-Alpes-Côte d'Azur
DRR	Disaster Risk Reduction
EC	European Communities
EIA	Environmental Impact Assessment
EEA	European Environment Agency

ESPON	European Spatial Planning Observation Network
EXCIMAP	European exchange circle on flood mapping
FRD	Flood Risk Directive
FRMP	Flood Risk Management Plan
GACGC	German Advisory Council on Global Change
GIS	Geographical Information Systems
HFA	Hyogo Framework for Action
ICSU	International Council for Science *(former name: International Council of Scientific Unions)*
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
IRGC	International Risk Governance Council
IRMa	Institut des Risques Majeurs *(Institute for Major Risks)*
ISPRA	Istituto Superiore per la Protezione e la Ricerca Ambientale *(Italian National Institute for Environmental Protection and Research)*
ISSC	International Social Science Council
Istat	Istituto nazionale di statistica *(National Institute for Statistics)*
IUGS	International Union of Geological Sciences
KZGW	Krajowy Zarząd Gospodarki Wodnej *(National Water Management Board)*
LPPD	Local Plan of Physical Development
MEDAD	Ministère de l'Écologie, du Développement et de l'Aménagement Durable *(Ministry of Ecology, Sustainable Development and Spatial Planning)*
MEDD	Ministère de l'Écologie et du Développement durable *(Ministry of Ecology and Sustainable Development)*
MEDDE	Ministère de l'Écologie, du Développement durable et de l'Énergie *(Ministry of Ecology, Sustainable Development and Spatial Planning)*
MEDDTL	Ministère de l'Ecologie, du Développement durable, des Transports et du Logement *(French Ministry of Ecology, Sustainable Development, Transportation and Housing)*
MEEDDAT	Ministère de l'Ecologie, de l'Energie, du Développement Durable et de l'Aménagement du Territoire *(Ministry of Ecology, Energy, Sustainable Development and Spatial Planning)*
MLET	Ministère du Logement et de l'Egalité des Territoires *(Ministry of Housing and Territorial Equality)*
MOVE	Methods for the Improvement of Vulnerability Assessment in Europe
NGO	Non-governmental Organisation
PACA	Provence-Alpes-Côte d'Azur
PADD	Plan d'aménagement et de développement durable *(Project of development and sustainable development)*

PAI	Piano Stralcio per l'Assetto Idrogeologico *(Extract Plans for Hydro-Geological Setting)*
PGT	Piano del Governo del Territorio *(Territorial Management Plan)*
PLU	Plan Local d'Urbanisme *(Local Spatial Plan)*
POS	Plan d'occupation des sols *(Local Land Use Plan)*
PP	Plans and Programmes
PPP	Plans, Programmes and Policies
PPR(N)	Plan de Prévention des Risques (Naturels Prévisibles) *(Plan for the Prevention of (Natural) Risks)*
PPRI	Plan de Prévention des Risques Inondations *(Plan for the Prevention of Flood Risks)*
PRI	Piano Regolatore Intercomunale *(Inter-communal territorial government plan)*
PRGC	Piano Regolatore Generale Comunale *(Urban Master Plan)*
REC	The Regional Environmental Center for Central and Eastern Europe
RTM	Restaurations des Terrains de Montagne
RZGW	Regionalny Zarząd Gospodarki Wodnej *(Regional Water Management Board)*
SAGE	Schéma d'aménagement et de gestion des eaux *(Water Development and Management Scheme)*
SCoT	Schéma de cohérence territorial *(Plan for Territorial Coherence)*
SDAGE	Schémas directeurs d'aménagement et de gestion des eaux *(Master Plans for Water Development and Management)*
SEA	Strategic Environmental Assessment
SEEIDD	Service de l'Économie, de l'Évaluation et de l'Intégration du Développement Durable *(Economy, Evaluation and Integration of Sustainable Development Service)*
SOPO	System Osłony Przeciwosuwiskowej *(Landslide Counteracting Sytem)*
(Loi) SRU	Loi Solidarité, Renouvellement Urbain *(Law on solidarity and urban renewal)*
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Organisation
UNISDR	United Nations International Strategy for Disaster Reduction
WFD	Water Framework Directive
WMO	World Meteorological Organization

Part I:

Introduction

1 Introduction

Natural hazards such as floods, landslides, earthquakes, hurricanes and storm surges are widespread phenomena that frequently occur in many countries in the world. European countries are no exception, which is why the European population is regularly subjected to disasters. When natural hazards occur in populated areas they turn into a risk for human lives and property. In order to limit the damage potential of hazards and decrease negative impacts, society is required to take action and implement measures that promote the reduction of disaster risks. Today, there are different ways at various scales on how to achieve disaster risk reduction. While general frameworks are developed and introduced at international and national scales, more specific strategies and measures are implemented at regional and local scales.

According to global and European reports and studies (CEC, 2009; EEA, 2010; IPCC, 2012; Munich Re, 2015) increases in extreme weather events and disasters due to natural hazards have been observed over the past decades While natural hazards and extreme weather events have increased in frequency or magnitude, the population number and the number of elements at risk have also increased (IPCC, 2012). Thus, vulnerability to disasters is expected to increase as a consequence of urban expansion and more intensive land use. This situation may continue and it may even intensify in the future as a consequence of a combination of projected natural and anthropogenic climate change, demographic and socio-economic changes as well as trends in governance, unless specific measures and strategies are implemented to reduce vulnerability and to promote climate change adaptation (Lavell, 1996, 1999a, 2003; ICSULAC, 2010a,b; UNISDR, 2011 cited in Cardona et al., 2012, p. 70). In this respect, immediate action is required considering that the impacts of such events may become more severe and expensive in the future (Munich Re, 2015, p. 17). This is why, in addition to efforts to mitigate and adapt to climate change, management strategies are needed that help prevent and reduce as well as enable coping with natural hazards and extreme events.

In the context of the internationally negotiated and adopted Hyogo Framework for Action (HFA) in the year 2005 as well as its successor, the Sendai Framework for Disaster Risk Reduction 2015-2030, disaster risk reduction has been declared a central issue for further socio-economic development[1]. Countries that adopted these frameworks are dedicated to pursuing and achieving the defined priorities. Moreover, already in the year 1992 the Rio Declaration on Environment and Development introduced 27 principles and was signed by more than 170 countries. Among others, the right for sustainable development was enshrined and the precautionary and 'polluter pays' principles were internationally recognised (UN, 1992). In addition, in 2011 EU Member States signed the Territorial Agenda of the European Union 2020, which is *"designed to meet European Union challenges posed by the global structural changes of the economic crisis, the growing interdependences of EU regions, demographic and social changes, the diverse impact of climate change and the environment, energy concerns, and the loss of biodiversity, as well as address vulnerable natural, landscape and cultural heritage"* (ESPON, 2013). Countries that signed these agreements are committed to fulfilling the according objectives. Hence, all countries of the EU follow objectives that include a sustainable development of the territory as well as the establishment of a culture

[1] The HFA was adopted by 168 states and can be perceived as an international agreement on the reduction of disaster losses. Declaring disaster risk reduction a priority, improving risk information and building a culture of safety and resilience were three of the five identified key priorities for action (UNISDR, 2007, p. 1). The Sendai Framework aims to continue the work initiated by the HFA while introducing a number of innovations.

of prevention, precaution, safety and resilience towards impacts caused by socio-demographic and climatic changes.

While dealing with natural hazards used to be primarily disaster reactive until the 1990s, the frequency of disasters, their growing intensity and the failure of preventive structures required a rethinking of existing strategies. This is why the International Strategy for Disaster Reduction (ISDR) *"reflects a major shift from the traditional emphasis on disaster response to disaster reduction, and in effect seeks to promote a 'culture of prevention'"* (UNISDR, n.d.). Moreover, other institutions and initiatives have demanded a paradigm shift from a mere defence against hazards towards a management of risk. For instance, the Swiss National Platform for Natural Hazards (PLANAT) realised, that prevention had primarily focused on frequently occurring events, while the safety of the society is rather threatened by rare events. Existing prevention structures in Switzerland are not sufficient in the face of extreme events with low probability of occurrence but high intensity, however (PLANAT, 2002, p. 4). Instead of focusing on the question of how a society can best be protected (defence-oriented approach), risk management sets the degree of safety a society demands in relation to the price it is willing to pay (PLANAT, 2002, p. 8), i.e. the consequences it is willing to accept.

Today the question of acceptability plays a particularly crucial role in how a society deals with disaster risk. It is the society itself which is required to determine the level of risk it is willing to accept in the face of a specific threat. Acceptable or tolerable impacts in turn require the definition of objectives, in order to be able to adjust necessary measures to according objectives. This means that political goals need to respect what a society is willing to accept. However, the question is how political goals can be defined and legitimised. After all, the management of risks is expected to be challenged by a high complexity and major uncertainties (OECD, 2003, p. 13). The problem is that spatially relevant decisions taken under uncertainty are hardly justifiable. Therefore, the consideration of risk perception as well as stakeholder participation become important in this context. In order to deal with uncertain outcomes *"that affect different parts of the population to different degrees it is essential to integrate the knowledge, values, and interests of stakeholders into the risk policy making process*" (Renn, 2015, p. 8).

1.1 Problem definition

Spatial planning is directly related to the management of risks and can play an important role in the reduction of the vulnerability of a society towards disasters. Decisions on future land use have to be made thoroughly and deliberately due to the long-term effects of any spatially-relevant decision. This is why spatial planning always has to anticipate the consequences of its decisions. By doing so, uncertainty about future effects can be reduced and confidence in the legitimacy of the authority in charge can be improved (Fleischhauer, 2006a, p. 10). Spatial planning has even been perceived as the most promising approach for promoting sustainable risk prevention (Burby et al., 2000, p. 99). There is hence no doubt about the crucial role of spatial planning in disaster risk reduction.

The ability to make appropriate and convenient planning decisions is supported by the access to suitable risk-related information. A suitable evidence base is essential for an effective and target-oriented decision-making process. Disaster risk can only be effectively managed and adverse impacts prevented when consulting a comprehensive collection of risk information. The UNISDR (2015, p. 11) explains in this context that *"in order to reduce disaster risk, there is a need to address existing challenges and prepare for future ones by focusing on monitoring, assessing and understanding disaster risk and sharing such information and on how it is created; strengthening disaster risk governance and coordination across relevant institutions and sectors and the full and meaningful participation of relevant stakeholders at appropriate levels […]"*. Hence, in addition to acknowledging the need for understanding disaster risk and sharing risk information, it underlines the need for stakeholder coordination and participation. This also involves spatial planning authorities, who, through the use of risk information, would be able to (RCC, 2011, p. 13):

- Identify areas at risk from impacts of natural hazards;
- Identify areas most suitable for development and setting development goals;
- Provide an evidence-base to formulate adequate risk reduction strategies and measures as well as zoning regulations, e.g. building codes.

Due to the importance of risk information, one of the main goals of the Sendai Framework involves the increase of availability of and access to risk information and assessments (UNISDR, 2015, p. 12). This information should be as reliable and accurate as possible in order to be able to reflect the situation and describe the status quo as well as possible. A lack of data and information and the inability to interpret it will most likely hamper the decision-making process and result in inappropriate or incorrect decisions being made. Even worse would be a complete information-free decision making. The implementation of the Sendai Framework is therefore guided by the principle that *"disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data […], as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge"* (UNISDR, 2015, p. 13). For the further elaboration of the present study it is important to keep these requirements for risk information (accessibility, up-to-dateness, comprehensibility, scientificity) in mind and to highlight the need for risk-informed decision making. The principle also points out that in addition to having adequate risk information, successful risk reduction also requires effective dissemination and communication of this information. Only when communicated in a target-oriented, effective way, risk information may enable people to act to reduce prevailing risks and safeguard lives and human assets. Accordingly, priority no. 1 of the Sendai Framework requires a better understanding of disaster risk by demanding that *"policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment"* (UNISDR, 2015, p. 14). In this respect, main aims of priority no. 1 include promoting *"the collection, analysis, management and use of relevant data and practical information and ensure its dissemination, taking into account the needs of different categories of users, as appropriate"* as well as the development, periodical updating and dissemination of *"location-based disaster risk information, including risk maps, to decision makers, the general public and communities at risk of exposure to disaster in an appropriate format"* (UNISDR, 2015, pp. 14–15). Since spatial planning actors and authorities belong to the main addressees of risk information, effective communication and dissemination to spatial planners is crucial in order to ensure an adequate understanding and application of this information. However, risk information is not always communicated in an appropriate format or user-friendly way, since contents of maps in particular do not necessarily match the requirements of all end-users. Especially when including elements of uncertainty, communication of risk-related aspects is challenging.

Moreover, incorporating risk information into spatial planning necessitates an active involvement of stakeholders – including the public. Greater stakeholder involvement is supposed to have a stronger impact on local government actions, which is why comprehensive plans are more likely to be implemented when stakeholders have been sufficiently involved (Burby, 2003, p. 33). Public involvement can promote and legitimise many different types of plans. Regarding disaster risk reduction, active public involvement during the preparation phase of spatial plans is important, as planning decisions might cause opposition from citizens or groups who only realise after the adoption of a plan that its contents violate their interests (Godschalk et al., 2003, pp. 750–751). Enabling and encouraging early public involvement may avoid late opposition from the population towards a plan.

While spatial planning in general is an important actor and contributor in promoting disaster risk reduction, the Strategic Environmental Assessment (SEA) is considered a key tool for risk reduction at the plan, programme and policy level. SEA is well-established by European legislation and constitutes an already existing procedural framework for natural and technological risk assessment and management (Greiving, 2004, p. 16; Greiving and Fleischhauer, 2006, p. 117). Accordingly, *"this framework would be a great chance for establishing risk assessment and management as an obligatory task within every decision about a spatial plan or programme"* (Greiving, 2004, p. 16). Integrated into the SEA process, the assessment of risks would not need to represent a separate assessment procedure during the planning process, but could be completed together with the assessment of several other environmental concerns.

For the last few years, climate change has been a topic for SEA in several guidance documents for practitioners already (e.g. CCW, 2007; Environment Agency, 2011; OECD, 2008b; REC, 2011; The Scottish Government, 2010). The idea of integrating "climate proofing" into environmental assessment procedures, which involves the aim of adapting plans and programmes to future impacts of climate change via SEA and environmental impact assessment (EIA), has been subject to various discussions (Birkmann and Fleischhauer, 2009, p. 114; Deasley et al., 2011; Larsen, 2011; Runge et al., 2010, p. 166). The main aim of climate proofing consists in ensuring a high degree of resilience and adaptive capacity towards current and future climatic changes with regard to promoting a sustainable spatial development. Potential negative impacts of environmental and climatic changes should therefore be considered during the planning process (Birkmann and Fleischhauer, 2009, p. 123). In contrast, only some initial work had been carried out that more specifically referred to the topic of disaster risk in SEA when this research work started (in particular work done by Greiving, 2004; OECD, 2010b; Profice, 2011). Despite the strong interlinkages between climate change and disaster risk, both topics need to be treated separately as climate change and disaster risk communities involve different practitioners, different languages and distinctive approaches (OECD, 2010b, p. 3). The topic of risk assessment and management therefore has to find its separate way into SEA and shall be treated individually. An integration of both climate change and disaster risk aspects into environmental assessments has recently been enforced by the latest amendment of the EIA Directive in 2014. According to the revised EIA Directive the scope of the EIA now also covers issues such as climate change and risk prevention. Respective revisions to the SEA Directive are likely.

The importance and contribution of spatial planning-related decisions in regard to risk prevention as well as the use of SEA as an appropriate institutional framework for bringing about disaster risk reduction have not been fully recognised, however. In addition, specific legal requirements for an integration of risk assessments into SEA are currently missing. Moreover, impediments exist that impair a proper linkage of risk prevention, community planning and sustainability and thus limit the integration of disaster risk aspects into spatial planning (Schneider, 2002, p. 147) as well as into SEA. Finally, *"it is often forgotten that spatial planning can only provide part of the solutions in practice: sectoral policies have already formulated their own policy strategies, applying their own methods, according to their own objectives and available funds"* (Biesbroek et al., 2009, p. 234). This is why many solutions to challenges such as climate change and disaster risk are primarily the responsibility of sectoral authorities. These are often not open to a purposeful weighing up process including different planning alternatives. It is still one of the many tasks of spatial planners to coordinate and weigh up different local preferences with sectoral objectives (Biesbroek et al., 2009, p. 234). Hence, the mismatch between the coordinating task of spatial planning and the regulating task of sectoral planning in some sectors has to be considered when looking at the different ways of spatial planning in dealing with risk information.

How sectoral policies have formulated their strategies, how risk management strategies and measures are designed and by which authorities they are implemented depends on the respective legal framework of each country (Fleischhauer et al., 2012, p. 2788). These differ considerably among European countries as shown by Newman and Thornley (1996, p. 29), for instance, who group European countries into different legal-administrative families. The reason is that spatial planning systems develop in different political and social conditions (political system, land ownership pattern, cultural context) in different countries. The distinction between legal-administrative families influences the way how risk reduction measures are taken and how risk information is communicated, processed and turned into legally binding planning regulations. Moreover, the way decisions are taken is also influenced by different cultural contexts, i.e. risk cultures, which define individual and societal risk perception. Legal factors and risk perception furthermore determine, to what extent risk information is available and stakeholders are involved in the decision-making process. Consequently, differences in planning systems shall be considered in order to understand the ways of dealing with risk in spatial planning and SEA.

According to these explanations, two main assumptions are formulated which influenced the research objectives and main guiding questions that will be introduced in Chapter 1.2:

1) Existing regulations have different impacts on the generally given tasks of spatial planning in each of the case study sites.
2) The varying roles of spatial and sectoral planning actors and instruments in different planning cultures as well as the legal-administrative frameworks significantly influence the use of and the need for risk information in spatial planning and Strategic Environmental Assessment in the case study sites.

While the legal-administrative basis as well as planning systems differ between European countries, the central goals of spatial planning are broadly accepted: Sustainability and resilience are two ultimate planning goals[2] (Beatley, 1998; Burby, 1998b; Burby et al., 2000; Tobin, 1999). This holds also true for SEA. Environmental assessment and sustainable development have always been closely linked (Jones et al., 2005a, p. 2). In addition, SEA can also be used to support the development of more resilient plans or programmes (Eales et al., 2011). Resilience in turn promotes a sustainable development, which means that *"strengthening the capacity of societies to manage resilience is critical to effectively pursuing sustainable development"* (Lebel et al., 2006, p. 2). This is why there is an urgent requirement for the practical implementation of plans and measures which promote a resilient community development in order to foster long-term sustainability.

In spatial planning it is important to consider spatial and temporal dimensions of a hazard. In order to correspond to the concept of sustainability, spatial planning has to consider intra- and inter-generational aspects. While a decision might be beneficial for one part of the population it might have adverse effects for another part of the population. This also involves future generations. Hence, the link between disaster risks and the concept of sustainable development becomes apparent. The consideration of future generations and their interests implies the need for regulative spatial planning (Greiving and Fleischhauer, 2006, p. 110). Spatial planning has to *"anticipate the consequences (or chances and risks) of actions from the beginning of a planning process, as part of the planning goal findings"* and take account of *"a continuous evaluation and review of fixed planning goals, implemented measures and their effects on the environment"* (Greiving and Fleischhauer, 2006, p. 110). Final decisions are based on normative statements and regulations prepared by national or supranational policies.

In disaster risk literature, sustainability and resilience are often regarded as *"the guiding principles behind effective hazard planning"* (Tobin, 1999, p. 13). In order to achieve sustainable development and resilience, reducing risks is crucial. Accordingly, risk assessment and management should be integrated into the planning process to achieve greater resilience and sustainability by means of procedural and methodological requirements (Greiving and Fleischhauer, 2006, p. 115). The practical implementation of respective plans and measures that promote sustainability and resilience lags behind, however. Reasons for this mismatch are comprehensive and complex relationships between the sustainability and resilience of a community and the hazards it might be facing (Tobin, 1999, p. 13). Moreover, policy makers still lack dedication to preventing hazards and damages as well as the ability to elaborate mitigation programmes. Accordingly, planning for sustainability and resilience is not an easy task and implementation has proved to be a challenge (Schneider, 2002, p. 142).

1.2 Aim and objectives

Despite the challenges that a sustainable and resilient planning approach implies, efforts should be made to integrate these aspects into spatial planning and SEA. This can be achieved by adequately considering the topic of disaster risk and by using risk information in planning processes with the goal of reducing vulnerabilities towards disasters. However, until today there is no real guidance on how to translate this idea into the actual planning processes. In addition, there appears to be little clarity as to what risk-related

[2] On the one hand, spatial planning should consider aspects of sustainability e.g. through weighing up economic, ecological and social costs and benefits by taking account of private property rights. On the other hand, spatial planning should ensure that new development in hazard-exposed areas is fulfilled and accomplished as resiliently as possible, so that the damage potential in the area is kept to a minimum (Burby, 1998b, p. 18).

information precisely spatial planners need in order to adequately deal with risks in spatial planning and transform risk information into (legally binding) planning regulations. First, more detailed knowledge about planning practices is needed in order to define what current ways of dealing with risk information are. Moreover, there is a need for some general guidance on how to promote a better community development in regard to disaster resilience and sustainability.

Accordingly, this research aims to identify ways how to adjust planning practices to sustainability objectives and all the more resilience objectives. It makes use of a comparative case study approach in order to make it possible to evaluate and compare different ways of dealing with risk in spatial planning. A particular focus lies on the role of SEA in promoting such a resilience approach by examining ways to integrate risk assessment and management into the SEA process. The first research objective of this study is to produce knowledge about ways in which risk information concerning floods and landslides is used in SEA and spatial planning and converted into legally binding spatial planning regulations in different national spatial planning systems. This will help us understand how municipalities in different countries deal with risks at the local planning level. On the basis of the knowledge gained, the different planning practices of the municipalities concerned can be analysed, compared and evaluated. As a result, commonalities and differences can be identified. In this context, the rationale behind the different planning practices can be understood as well. Finally, guidance will be given to provide a cross-country planning approach to dealing with disaster risk in SEA and spatial planning in an effective way. The provision of harmonised risk assessment methodologies is considered vital for valid results of risk assessments (Greiving and Fleischhauer, 2006, p. 110). In contrast, the formulation of general measures that are applicable in all planning systems and address all types of hazards does not seem promising, and the development of predefined instruments and measures that constrain planning practices are likely to fail (Greiving and Fleischhauer, 2006, p. 110). As Greiving and Fleischhauer (2006, p. 110) explain, *"because of the variety of planning systems and the multitude of natural and socio-economic settings and the pre-existing differences in the national planning systems, a formulation of coherent instruments or concrete mitigation measures is nearly impossible"*. In addition, numerous relevant hazards that interact and result in cumulative effects make a one-size-fits-all approach difficult (Greiving and Fleischhauer, 2006, p. 110).

In summary, the following research objectives can be formulated:

1. To explore spatial planning systems and practices with a particular focus on those procedures in which risk information is used in local land use planning and SEA.
2. To identify commonalities and differences between the case study sites as well as good ways and difficulties or deficiencies in using risk information in spatial planning and SEA.
3. To determine effective ways and elements for dealing with risk information in the light of global changes.

The study focuses on spatial planning at the local level. Although natural hazards and extreme events, especially floods, usually cover a greater area without consideration for administrative boundaries, the local level is regarded as more appropriate than the regional level in the present work. One of the reasons is that in many European countries, especially in Western Europe, local authorities are those responsible for physical planning (Larsson, 2006, p. 32). This means the responsibilities at the local planning level are more comprehensive than those at the regional level. Larsson (2006, p. 32) points out that without the local planning level and its planning instruments, community development is hardly possible. It is the responsible authority which agrees upon a certain concept and measures in order to reduce the risk. Moreover, specific risk prevention measures can be more easily implemented at the local level than at the regional level, since the local level usually has legally binding planning instruments that support the implementation of predefined measures. Local authorities *"have the power to initiate a plan, to make the first draft, organize possibilities for the citizens to give view-points and objectives and then approve a maybe modified plan"* (Larsson, 2006, p. 32). Accordingly, due to more comprehensive responsibilities and the ability to formulate legally binding planning regulations, it is the local planning level where risk prevention measures are actually implemented and where specific decisions in favour of risk reduction are taken.

A further reason for focusing on the local planning level is the fact that *"disasters are more the result of human and societal activities shaping spatial patterns of damage potentials and coping capacities rather than the changes in the frequencies and magnitudes of the extreme hazards themselves"* (Peltonen, 2006, p. 155). Socio-economic and demographic changes as well as spatial developments will most likely induce greater losses than those caused by extreme weather events (Sarewitz et al., 2003, p. 807). In addition, the local planning level has the task to acquire the required information about the suitability of land for development. With its local spatial plans it has suitable instruments at hand: *"Land use plans enable local governments to gather and analyze information about the suitability of land for development, so that the limitations of hazard-prone areas are understood by policy-makers, potential investors, and community residents"* (Burby, 1998b, pp. 1–2). Local planning authorities are important entities for disaster risk reduction as those are the authorities mainly assigned with deciding on future land uses, i.e. being responsible for activities that shape spatial patterns.

Based on the assumptions introduced in Chapter 1.1 as well as the aforementioned research objectives, two main descriptive and normative research questions are determined that guide this work. The guiding questions influenced the choice of methods employed for this study, which will be dealt with in Chapter 2. The first guiding question is formulated as follows:

1. How is risk information used in spatial planning and SEA?

This question pursues the objective of defining the consequences an evidence base has on the basic tasks of spatial planning. In order to achieve this objective, the following sub-questions are formulated:

- Which risk information is used?

The question refers to the type of risk information used in planning processes. These can be hazard maps or risk maps, but also other types of information such as scientific studies or records from past events. This necessitates a survey on whether risk information is available in the first place. The question also refers to the scale, both spatial and temporal, of existing risk information.

- How is risk information produced and communicated?

This question refers to the way that experts produce information about risks, i.e. the methods and procedures involved, and how risk information is communicated to the end users, i.e. ways how experts communicate with spatial planners. It also addresses the problem whether and how uncertainty is communicated and to what extent the public is involved.

- How is risk information used during the planning process and turned into (legally binding) planning regulations about type and intensity of land use(s)?

This question refers to the way in which information about risks is turned into (legally binding) planning regulations during the planning process. It encompasses both, legal provisions on how to deal with disaster risk and actual planning practices. Attention is paid to the question whether spatial planners are able to understand and apply existing risk information. Finally, it also addresses the problem of uncertainty and how spatial planning deals with uncertainties connected to risk information and future developments of a territory.

- How is risk information used in the SEA process?

This question more specifically refers to how risk information is used during the SEA process and whether risk information is used at all, respectively. The main concern is to identify whether SEA practices address the problem of disaster risk and if so, how the problem is dealt with in the environmental assessment of spatial plans.

The second guiding question is formulated as follows:

2. How should risk information be used in spatial planning and SEA?

This question is aimed at identifying whether the goals that are predetermined by the EU Flood Risk Directive (FRD) and the EU SEA Directive are attainable through the examined "on-site" practices. EU Directives can be used as a valuation standard and target system. Hence, these documents constitute the value level in the present case. Planning practices as outlined by the interview partners and as identified by similar research initiatives are analysed in Chapter 8 in order to determine whether the actual practices are target-aimed, i.e. whether they contribute to fulfilling the objectives of the Directives. The EU Flood Risk Directive and the SEA Directive are considered most important in the context of this work. This is why particular focus was put on the objectives outlined by these two Directives, which are formulated as follows:

- <u>EU Flood Risk Directive</u>: *"The purpose of this Directive is to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community"* (CEC, 2007b).
- <u>EU SEA Directive</u>: *"The objective of this Directive is to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment"* (CEC, 2001b).

The second main guiding question is divided into the following sub-questions:

- What should risk information look like?

The answer to this question can be derived from the two Directives. The FRD includes quite detailed provisions in regard to the characteristics and contents of flood hazard and risk maps. In Article 6 the Directive determines that both flood hazard and flood risk maps should be prepared for three different return periods (CEC, 2007b):

1) floods with a low probability, or extreme event scenarios (e.g. a likely return period of 300 years);
2) floods with a medium probability (likely return period ≥ 100 years);
3) floods with a high probability, where appropriate (e.g. a likely return period of 20 years).

Moreover, the Directive specifies in Article 6, which elements exactly should be shown on these maps (CEC, 2007b):

- the flood extent;
- water depth or water level (as appropriate);
- the flow velocity or the relevant water flow (where appropriate).

Flood risk maps, in addition to being prepared for the three return periods mentioned above, shall also show the potential adverse consequences which are expressed as follows (CEC, 2007b):

- the number of inhabitants potentially affected;
- the type of economic activity of the area potentially affected;
- special installations that might cause pollution;
- other information that the Member State considers useful.

This is the content of flood hazard and risk maps that should be provided to end users and decision-makers in order to achieve the objective as outlined in Article 1. This means that these elements can serve as an indication of whether practices in the case study sites are carried out in accordance with the main objective of the Directive.

The SEA Directive lists specific criteria for determining the likely significance of effects in Annex II (see Chapter 5.2.1). These criteria, or characteristics respectively, need to be considered in SEA practices in the case study sites in order to correspond to the requirements of the Directive. Only if these criteria are considered in SEA practices, the legislative framework set by the EU has been properly implemented. Most of these aspects can be directly related to disaster risk. This is why the analysis will pay particular attention to whether these criteria are considered in SEA practices in the case study sites.

In general, the starting point of the analysis of SEA and spatial planning practices in the case study sites should be the question by means of which categories and indicators the chances of an effective implementation of both Directives and, based upon this, a reasonable use of risk information in SEA and spatial planning may be measured.

- **How should risk information be made available so that spatial planning can fully exploit its potential within risk management?**

This research work aims to define how exactly adequate information has to be made available, i.e. what requirements exactly risk information needs to fulfil to be purposefully used in SEA and spatial planning. This means that, on the one hand, the study aims to identify potentially constraining risk information, and, on the other hand, it tries to determine ways to better support risk management within SEA and spatial planning. For instance, it aims to identify and determine ways of how risk information can be integrated into SEA to support planning procedures. SEA constitutes an appropriate means for editing information in such a way that it can be integrated into the decision-making process. The question is whether this feature is explicitly taken into account and whether risk information is used and integrated into the SEA procedures and if not, how such an approach can be promoted.

- **How should spatial planning or planning strategies anticipate uncertainty?**

To answer this question, differences in planning cultures as well as different risk perceptions need to be taken into account. Among others, this question requires a definition of the consequences of uncertainty related to climate change for dealing with risk information in spatial planning. It can be assumed that the ways uncertainty is dealt with differ between the case study sites, since planning cultures and the respective perception of risk vary. Therefore, this question is supposed to figure out whether general statements can be made on how to deal with uncertainties.

1.3 Structure of the study

After an introductory chapter, the second chapter deals with the research methodology. First the methodological framework will be explained. In the following, the chosen research design – the case study approach – will be outlined and a basic introduction of the selected case study areas will be provided. Finally, the methods that were applied during the research are presented in detail. Afterwards the theoretical foundation is laid. After a clarification of central terms such as risk, hazard and vulnerability as well as their interrelations, risk concepts in natural and social science are presented in Chapter 3. Furthermore, the risk governance approach with all its components is described. The fourth chapter focuses on spatial planning systems and cultures in Europe and includes a description of how aspects related to disaster risk may be integrated into the planning process. In the fifth chapter, the role of Strategic Environmental Assessment in dealing with disaster risk is examined, including a preceding outline of the single SEA stages. Chapter 6 introduces the empirical part of the study by presenting the case study sites in more detail. It outlines administrative structures, spatial planning systems as well as SEA practices with the help of a literature study and the study of legal documents. Chapter 7 introduces the approach that was employed to carry out the empirical study. It establishes and explains which aspects have been considered for the interviews and what contents were further examined during the field work period. Chapters 8 and 9 present the outcomes of both literature study and expert interviews. First, in Chapter 8, the legal basis is introduced for dealing with disaster risk and legally required practices are explained. Subsequently, in-practice examples from the case study sites are used to highlight current ways of dealing with risks in spatial planning. The ninth chapter then focuses on in-practice examples that highlight current ways of dealing with risks in SEA. Both chapters refer to problems and good ways of assessing and managing disaster risk. In Chapter 10, the results of Chapters 6 to 10 are summarised and the first part of the research questions is answered in an interim conclusion. Chapter 11 introduces the concept that has been developed for an integration of disaster risk assessment and management into the SEA process. It starts with an explanation of basic requirements and then outlines the consideration of disaster risk aspects for each SEA process. Ultimately, it refers to the feedback provided by SEA experts regarding the concept and discusses difficulties and shortcomings related to it. The twelfth chapter answers the remaining research questions, provides a conclusion of the study, and provides a final outlook.

2. Research methodology

A research approach involves a philosophical paradigm[3], a research design as well as specific methods (Creswell, 2014, p. 5). This study makes predominantly use of qualitative social research methods. Due its rather open and flexible approach, qualitative social research takes into account the fact that sophisticated and heterogeneous problems with numerous influencing factors and causalities cannot be captured in their entirety by applying quantitative methods (Leimbrock, 1995, p. 56). Qualitative research is more likely to capture a chosen topic in-depths in its full complexity. In contrast to quantitative research, it focuses on a deeper understanding of facts and conditions as well as on the topic itself rather than on statistically proving facts and theories. The present study does not only analyse the prevailing planning and risk prevention instruments in different planning systems and address the question of how risk information is used in spatial planning, but it also discusses, elaborates and suggests options of how risk information should be used. Hence, the application of qualitative research methods seems most suitable. After all, examining planning practices and approaches to risk reduction requires identifying how and why certain processes and methods are implemented and what the results of prevailing planning practices are. According to several authors (Miles et al., 2014, p. 11; Silverman, 2011, p. 17; Yin, 2014, pp. 10–11) how and why questions are best suited to the use of qualitative research and the application of a case study design. As a consequence, design and methods have to be related to a qualitative research approach.

In the following, after explaining the epistemological orientation (Chapter 2.1), the chosen research design (Chapter 2.2) and the research methods (Chapter 2.3) for this empirical study will be presented in detail.

2.1 Methodological framework

Since it should be the general goal of any research work to gain scientific evidence which preferably contributes to problem solving, it is important to define at the beginning, how the researcher intends to gain scientific insight with his research work. Delivering scientific insight can be achieved in different ways, e.g. by empirical research, mathematical or logical analysis etc. This is a matter of scientific theory, which deals with the logical, methodological and epistemological fundamentals of empirical science (Lauth and Sareiter, 2005, p. 11). Scientific theory encompasses different "schools" which are all characterised by a specific scientific position, e.g. the analytical-nomological paradigm, which is represented by the "critical rationalism" approach, the hermeneutical-dialectical paradigm, which is represented by the "Frankfurt school" (Stier, 1999, p. 6) and others[4]. Scientific theory helps to address the questions of how to build theories and hypotheses and which research design and methods help to produce scientific evidence in each particular case (see Figure 1).

[3] Guba and Lincoln (1994, p. 105) distinguish between four paradigms in qualitative research: positivism, postpositivism, critical theory and constructivism. Other authors choose different terms such as philosophical worldview, strategy etc. For more information on the different paradigms see Lincoln and Guba (1985), Guba and Lincoln (1994) or Crotty (1998).

[4] For a more detailed explanation of the different positions see Schnell et al. (2011).

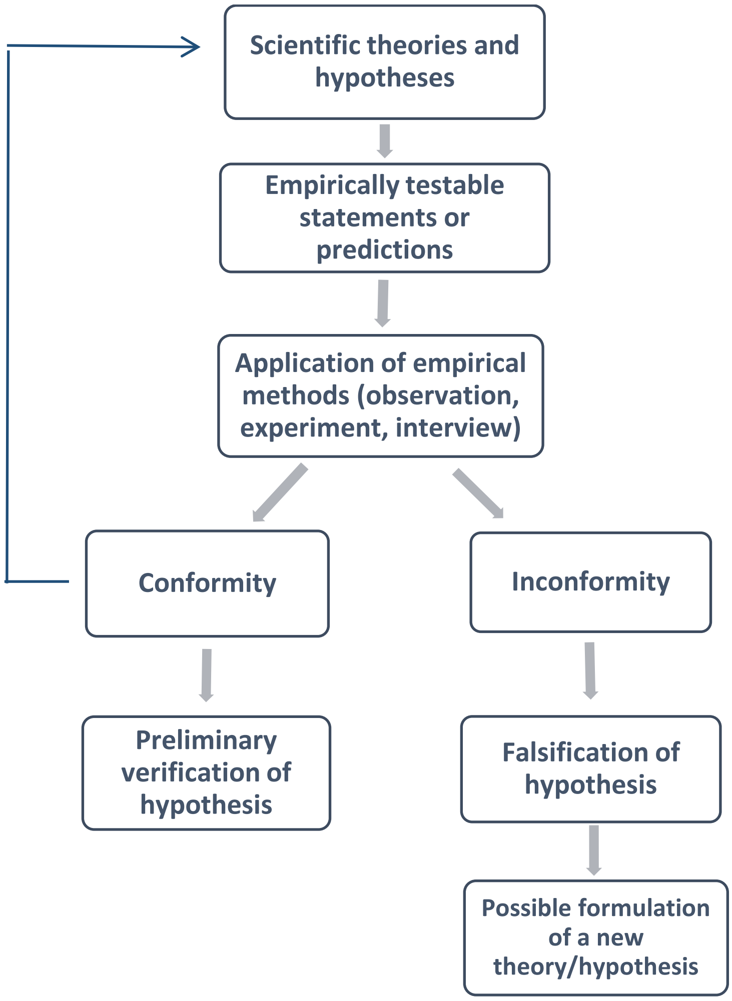

Figure 1 Process of gaining scientific evidence as suggested by Karl Popper (Source: recreated and slightly altered from Lauth and Sareiter, 2005, p. 98, own translation)

It is widely accepted within the scientific community and the wider public that scientific research may promote problem solving in decision-making processes, which also involves spatial planning decisions. The question is which approach should be chosen that best contributes to gaining scientific evidence in this context. The first guiding question ("How is risk information used within the planning process") induces that answers can already be partly found through desktop research and document analysis. At least the legal foundations for carrying out risk assessments as well as general rules and national regulations on how to deal with risks in SEA and spatial planning can be identified by a thorough analysis of legal documents. Furthermore, approved spatial plans as well as completed environmental reports provide evidence of how risk information was actually transformed into (legally binding) planning regulations. However, certain aspects of the planning practice can only be identified or verified when empirically examining specific cases. For instance, questions regarding the type of risk information used during the SEA and plan-making procedure, communication of risk information, particular needs of users of risk information or the way risk information is processed during the planning process cannot be addressed by merely looking at existing documents. Hence, it was considered necessary to choose an empirical approach that helps to shed light on potential difficulties or deficiencies in dealing with disaster risk or in using risk information. Such an approach enables the formulation or development of guidelines or concepts that help to facilitate planning processes. Furthermore, in-practice examples sometimes show a different picture of how things “should” technically be done. Divergences from the norm can only be recognised when examining real-life cases.

While the first guiding question encompasses a descriptive step, i.e. an analysis of current frameworks and practices, the second question (“How should risk information be used?”) implies a normative step. This normative step involves an evaluation of the current status quo. A valuation is always connected to value-laden objectives. Defining objectives and target states is central to any planning and management process. Without clarifying the objectives that are pursued, there will be no clear and transparent justification for planning, which might lead to difficulties and dissent in decision-making and implementation (Scholles, 2008, p. 279). Planning decisions and measures therefore always have to be evaluated against existing objectives and norms. After all, the aim of spatial planning should be to achieve the given objectives as far as possible. Accordingly, planning decisions should be taken and measures implemented that correspond to the given objectives.

Objectives are associated with the value dimension of spatial planning. In spatial planning the value dimension has to be distinguished from the factual/information level. While the information level encompasses statements regarding the status quo (resulting from an inventory and analysis of the current state), i.e. current conditions and issues, descriptions of statistical coherences, hypotheses, prognoses etc., the value dimension is related to human action, comprising normative statements such as requirements, regulations, provisions, recommendations and value judgements (Scholles, 2008, p. 279). Every normative and valuing statement is related to specific facts and circumstances, which means that normative statements connect the information level with the value dimension (Scholles, 2008, p. 280). In this respect, a “naturalistic fallacy” is to be avoided in the sense that one should not extrapolate instantaneously from the status quo to the target state. After all, normative statements can only be drawn from premises that already include normative statements (Jessel and Tobias, 2002, p. 147). If premises (e.g. scientific knowledge) do not involve a normative aspect, they do also not comprise a valuing dimension (Scholles, 2008, p. 280). This means that scientific knowledge as such, without inclusion of normative statements, does not allow for an evaluation. In fact, it is often rather difficult to convert positive statements on environmental aspects (information level) into normative recommendations (value dimension) (Kühling and Hildmann, 2003, p. 65). However, science may contribute to defining goals by using scientific knowledge to suggest sub-objectives and operational objectives that support the implementation of predefined main objectives (Scholles, 2008, p. 280).

In the present study, the results of the analysis carried out in connection with the first guiding question serve as a basis for answering the second guiding question, thus connecting descriptive contents with normative statements. In this second, normative step, spatial planning processes are examined and evaluated towards achieving the given risk reduction objectives. Hence, spatial planning related risk management constitutes the value dimension at which an evaluation of risk takes place and measures are selected that support goal attainment. In this case, EU Directives were used as an evaluation standard and system of targets. After all, EU Directives include overall agreed objectives and targets which should be achieved by effectuating certain practices and by implementing certain measures. Besides, they are applicable in the same way to any of the EU Member States. EU Directives therefore represent a valid system of political and planning aims. In this context, risk assessment, or results of risk assessments respectively, constitute the information level and factual knowledge. This study therefore aims to empirically examine in-practice examples in order to determine whether risk information is applied in spatial planning related risk management processes in a way that the given objectives and targets of EU Directives can be reached[5].

For addressing and answering the two guiding research questions an empirical research approach was chosen which is based on the philosophy of the critical rationalism. Empirical science is mainly based on observations and experience. Atteslander (2008, pp. 4–5) describes empirical (social) research as systematically capturing and interpreting (social) phenomena. In this sense "empirical" means that theories or working hypotheses can be tested in real world environments. Accordingly, the main principle of empirical research methodology can be formulated as follows: *"All statements of an empirical science have to be verifiable through experience and in principal they have to be falsifiable through experience"* (Stier, 1999, p. 6, own translation). By applying appropriate research methods (see below) statements being initially made can either be preliminarily verified or falsified (see Figure 1). This conforms to the very idea of critical rationalism, an epistemological philosophy founded by the Austrian philosopher Karl Popper, which is widely accepted by the global research community as an epistemological basis for empirical research[6] (Stier, 1999, p. 6). Popper intended to solve the problem of induction by following the idea of falsifiable theories, because in his opinion a complete inductive proof by singular observation statements is not possible, which is why unrestrictedly general statements cannot be induced (McFarlane, 1990, p. 1). Still, while theories which turn out to be false have to be refuted, those that are verified for that particular case can be preliminarily accepted. More tests are then needed to further approve the previous results (Kromrey, 2006, p. 40; McFarlane, 1990, pp. 1–2). McFarlane (1990, p. 2) points out that *"while it cannot be said of a particular theory that it is true, it can be said that it is the best available"*. Empirical science attempts to approach the reality step by step by continuously carrying out research and refuting or preliminary approving hypotheses[7].

The assumptions and main guiding questions that motivate this work require an empirical approach (see above) in order to be able to answer the questions and either preliminarily verify or falsify the statements. Chapter 2.2 will now further outline the research design applied for this empirical study.

[5] It should be highlighted, that risk management as such will not be examined and dealt with in detail as part of this study. This work is not about the implementation of mitigation, preparedness, response or recovery measures and mechanisms or about the question, how risk management should be carried out. Instead, as the title suggests, this work will focus on the ways how risk information, i.e. outcomes of risk assessments, is used. It is concerned with the process of how risk-related information is treated, dealt with and finally turned into (legally binding) regulations for land use. Hence, in this case, risk information as such is attached more value than the ways to manage risks.

[6] Karl Popper based his theory on the assumption that verifying a theory is not an appropriate approach for gaining evidence. In contrast, a main statement of the critical rationalism is that all propositions made have to be falsifiable – provided they are incorrect (Kromrey, 2006, p. 38). By falsifying theories step by step, only true statements will remain. This attempt of falsification in critical rationalism, which today is often referred to as postpositivism, is found in qualitative just as in quantitative research (Denzin and Lincoln, 2003 cited in Mayring, 2007; Silverman, 2011, p. 359).

[7] In addition, empirical research must be objective. As Atteslander (2008, p. 6) explains, it has to go beyond a subjective description of reality or existing phenomena. The capture of data must be intersubjectively comprehensible and examinable, which means that any researcher should be able to monitor the single steps undertaken and understand the outcomes and the resulting data respectivel. Research has to be carried out in a way which makes it traceable for third persons (Stier, 1999, p. 11), so that the whole research process becomes controllable. As a consequence, the methodological approach to this study as well as data collection and analysis will be exposed as best as possible. For further explanations on the problem of guaranteeing objectivity see Stier (1999); Kromrey (2006); Schnell et al. (2011).

2.2 Research design

The research design chosen for this research is a case study approach, more precisely a comparative study approach. Examining a case study helps to gain more knowledge of complex phenomena and supports research in which the focus is on a contemporary phenomenon within its real-world context (Yin, 2003, p. 13, 2014, p. 16) – such as natural hazards in this case for example. Hartley (2004, p. 323) explains that case study research *"consists of a detailed investigation, often with data collected over a period of time, of phenomena, within their context"* in order *"to provide an analysis of the context and processes which illuminate the theoretical issues being studied"*. In this way questions like "how", "why" and "with what result" can be answered (Schramm, 1971, p. 6; Yin, 2014, p. 10). Case study research may contribute to a better understanding of all aspects, coherences and backgrounds related to in-practice spatial planning and planning-related disaster risk reduction with the goal to identify ways that in the end optimise the use of risk information and facilitate decision-making processes in favour of resilient community planning.

The necessity to apply a case study approach by determining study sites is given for a spatial specification is needed in regard to answering the main guiding questions and fulfilling the objectives. Since it is not possible to examine all European countries in their entirety, a selection has to be made to identify and characterise existing problems spatially. The case study approach helps to fulfil these objectives, since it is possible to examine behavioural patterns, institutions, organisations as well as local structures and related political-administrative acting (Leimbrock, 1995, p. 59). It is considered the best research design for this work, as it allows examining planning practices for disaster risk reduction by not only looking at legal-administrative conditions but also at the actual implementation of policies and regulations and potential benefits and drawbacks related to it. Examining administrative, political and legal aspects is one side; understanding issues related to the implementation and realisation of given standards (laws, provisions, procedures etc.) is another. After all, certain behavioural patterns and practices might shed light on advantages and disadvantages of given legal-administrative structures and ways to use risk information. Consequently, when intending to identify how risk information is used, it is not sufficient to just examine the existing legal basis, but to look at the practical implementation. This can only be done when looking at real and specific cases. Furthermore, a case study approach in the present study also allows conclusions to be drawn and reasons to be identified of why risk information is used in a certain way and what are perhaps barriers or restrictions to using it in a different way. Based on results and takeaways from the adopted case study approach, recommendations for improvement or facilitation of decision-making processes can be formulated and suggestions of how risk information should be used can be developed.

The focus within the comparative case study approach taken here is not only on one single case study, but it is rather directed towards examining two or more cases by applying, if possible, the same research framework. A comparative study supports a better understanding of certain practices and the "how" and "why" of their implementation on the one hand as well as, for instance, their relation and dependence on respective administrative and legal systems on the other hand. Such a multiple-case study approach has turned into a common design in empirical research, including, for instance, community planning (Yin, 2003, p. 1). Hantrais (1995) suggests that a study can be understood as cross-national comparative

> *"when individuals or teams set out to examine particular issues or phenomena in two or more countries with the express intention of comparing their manifestations in different socio-cultural settings (institutions, customs, traditions, value systems, lifestyles, language, thought patterns), using the same research instruments either to carry out secondary analysis of national data or to conduct new empirical work. The aim may be to seek explanations for similarities and differences, to generalise from them or to gain a greater awareness and a deeper understanding of social reality in different national contexts"*.

A comparative design can be particularly useful, because *"it embodies the logic of comparison in that it implies that we can understand social phenomena better when they are compared in relation to two or more meaningfully contrasting cases or situations"* (Bryman, 2008, p. 58). These cases or situations may be nations, organisations, communities etc. Consequently, comparative research methods are ideally suited for cross-country and cross-cultural studies to identify, analyse and explain commonalities and disparities across nations and societies (Hantrais, 1995).

An advantage of a comparative (multiple-case) cross-national design, compared to a (single) case study design is the evidence gained from multiple cases, which is deemed more compelling than those of single case studies and may therefore be considered as more robust. After all they are not limited by the peculiarities of single-case designs (Herriott and Firestone, 1983, p. 14). Miles et al. (2014, p. 30) summarise the usefulness of multiple case designs by suggesting that they *"offer the researcher an even deeper understanding of the processes and outcomes of cases, the chance to test (not just develop) hypotheses, and a good picture of locally grounded causation"*[8]. A further advantage is that comparative research takes cultural differences into account (Bryman, 2008, pp. 58–59). With reference to the present research work, conclusions can be drawn with regard to the influence and guidance of national systems and frameworks (political-administrative, legal, spatial planning) on respective disaster risk policies, management strategies, instruments and activities. This is particularly important for this study, as the ability to draw inferences from the given framework conditions at national and/or regional level about the respective implementation and application at a more local level or individual basis is vital for the results and the outcome of this research. Finally, the appearance of current spaces and territories has been considerably formed and shaped by human beings. It is the social relations among people that influence the territorial development of an area. As a consequence, culture, habits and beliefs decisively affect the respective development of that area. This means that *"urban and regional planning and development are strongly rooted in and restricted to the cultural context or traits of a society"* (Knieling and Othengrafen, 2009c, p. xxiii). Therefore, planning and development need to be adjusted to the respective cultural backgrounds, i.e. be responsive to the actual cultural context, as well as the institutional settings and thus be practiced differently in countries and regions (CEC, 2007a; Friedmann, 2005b, p. 29; Knieling and Othengrafen, 2009a, p. 42). In order to be able to identify expected differences in both practices and attitudes towards dealing with risk information in spatial planning and Strategic Environmental Assessment dependent on national or regional characteristics, a cross-national study is considered imperative.

[8] There are also reasons to argue against the multiple-case study approach. Problems related to a comparative approach include, for instance, the urge to intentionally detect differences and find contrasting characteristics while not realising or neglecting potential similarities, the lack of external validity and/or generalisability as well as the need for comparable data (Bryman, 2008; Yin, 2003). In cross-national case study research, language may constitute an obstacle as well (Hantrais, 1995).

Due to nature and scope of this dissertation, the comparative study was carried out as a cross-national research by examining three case study areas in three European countries:

- Wieprzówka and Stryszawka catchments in the region Małopolska (Poland)
- Ubaye valley in the Provence-Alpes-Côte d'Azur region (France)
- Fella river catchment in the Friuli Venezia Giulia region (Italy)

For conducting a cross-national study countries should be carefully selected, as the mix of countries typically affects the quality and comparability of available data (Hantrais, 1995). In the present study, cases were selected in three Member States of the European Union. The reason for this choice is that, even though each country has its own national regulations and legal-administrative systems, the EU can exert a certain influence in some topics with help of EU Directives, such as the Strategic Environmental Assessment Directive, the Water Framework Directive (WFD) or the Flood Risk Directive. European Directives themselves are universal for all Member States of the European Union. Although they have to be implemented into national law, which requires an individual adaptation to national contexts, they provide for a common basis for all Member States. Therefore, they ensure a certain degree of comparability for basic requirements in the addressed topics that need to be met by each EU Member State.

The mentioned case study areas were chosen by focusing on hydro-meteorological hazards such as river floods, flash floods, landslides, debris flow etc. All three case study areas have experienced natural hazards in the past and are exposed to future hazards (see also Chapter 6), which is why some risk management procedures and measures have already been put in place. Furthermore, the case study sites are expected to experience substantial impacts related to climate change and may expect essential changes in socio-economic development. Both climate change and socio-economic changes represent an important component of spatial planning and therefore require special consideration.

The same research framework was applied to all three case study sites, ensuring comparability among the sites and allowing a certain degree of generalisation of findings – when applicable – across the European Union[9]. Both Western and Eastern European countries form part of the research work, accounting for the fact that former socialist countries such as Poland have experienced different spatial developments as compared to older EU Member States such as France and Italy.

The very characteristic of this research works lies in the comparison of the use of risk information in spatial planning and Strategic Environmental Assessment. Following the above cited description of cross-national comparative research by Hantrais (1995), this study seeks explanations for similarities and differences in the application and use of risk information in different national contexts and planning

[9] Mason (1996, p. 6) and Silverman (2011, p. 385) state that qualitative research should aim at developing explanations that are generalisable to some extent. This statement is supported by Mayring (2007), who argues that generalisation is important in qualitative research, *"but we have to specify what sorts of arguments or inferences are aimed at with generalization and what procedures of generalization are used"*. Since case studies do not necessarily provide a basis for scientific generalisation (Yin, 2003; Bryman, 2008), Yin (2003, p. 10; 2014, p. 40) points out that case studies aim at generalising theories (analytical generalisation), while they are not generalisable to populations or universes (statistical generalisation). The latter is distinct for empirical studies using surveys and following quantitative procedures which enumerate frequencies. Analytical generalisations *"depend on using a study's theoretical framework to establish a logic that might be applicable to other situations"* (Yin, 2012, p. 18). In the end, the sought-after generalisation is rather more of a "working hypothesis" (Cronbach, 1975 cited in Yin, 2012, p. 19). For more information on generalisation in case study research see Mayring (2007); Silverman (2011) and Yin (2012; 2014).

systems. Although generalisation is considered as problematic, the realisation of a multiple-case design allows a certain way of generalisation by comparing results and outcomes among the examined cases. A description of how this research was carried out in the case study site will be provided in Chapter 2.3.

It should be mentioned that this work was carried out in case study areas of countries in which different languages are spoken. Specific terms including the planning and risk related terminology had to be translated into English. The use of different languages can lead to inaccuracy in attempting an exact or literal translation. Frequently, a simple, literal translation is not sufficient or adequate for expressing the exact signification of a certain term. This is why the English translation of terms used in this work does not always represent the actual meaning of the term in its original language. Therefore, the according terms are always mentioned both in their original language and with their English translation. That way it is made clear, which original term the English translation refers to[10]. The terms are described whenever possible, so that their meaning and sense can be better understood.

Case study areas

Figure 2 Selected case study areas in three European countries (Source: own illustration)

The selected case study sites are all located in mountainous regions of their respective countries: The Wieprzówka catchment lies in the Polish Beskid Mountains, which are part of the Western Carpathians, the Ubaye valley lies in the French Alps and the Fella river catchment lies in the Italian Alps (see Figure 2). The

[10] The mentioning of the original terms is seen as absolutely necessary, as other authors have used different translations for the same terms. In order to avoid confusion, a clear link between the original term and its respective English translation is essential.

case study sites will now be shortly introduced[11]. A more detailed description of the administrative and planning systems will be given in Chapter 6.

Research carried out in the Polish case study area addressed the Wieprzówka and Stryszawka catchments and here three municipalities ("gminas"): Wieprz, Stryszawa and Andrychów. The total number of inhabitants of the three municipalities amounts to circa 66.700. All three municipalities are located in the Lesser Poland region (Małopolska voivodeship) in the southwest of Poland, of which Kraków is the capital city. The Lesser Poland region is divided into nineteen counties ("powiaty") and 3 city counties (Kraków, Tarnów, Nowy Sącz). While Stryszawa belongs to Sucha County ("powiat suski"), both Wieprz and Andrychów belong to Wadowice County ("powiat wadowicki") (see Figure 3).

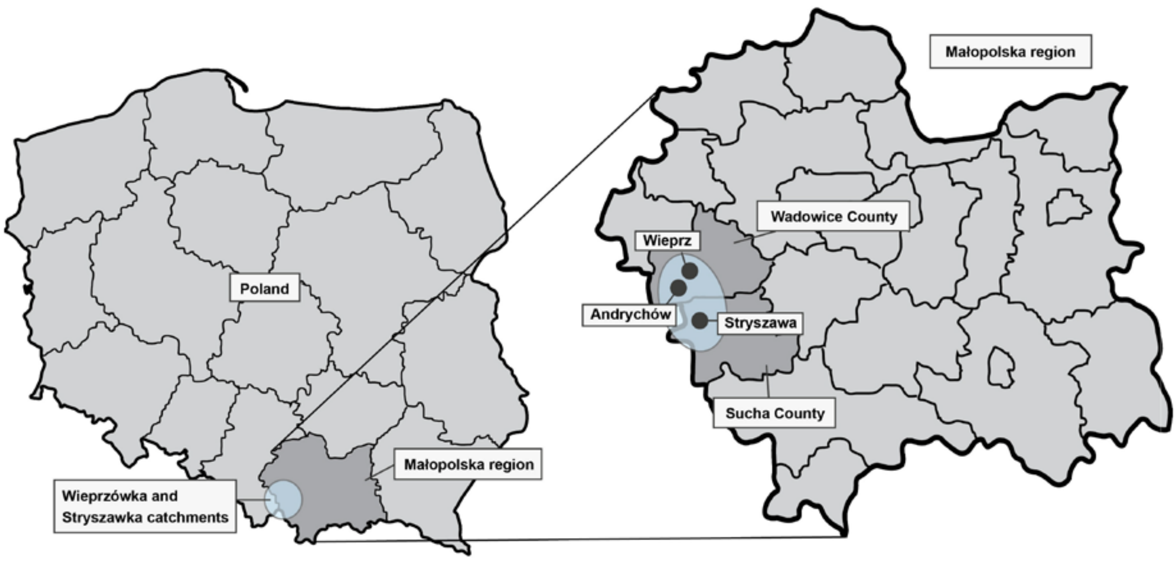

Figure 3 Location of the Polish case study area (Source: own illustration)

The case study area is situated in the Carpathian Mountains and foothills. More precisely, the area covers parts of two mountain groups: the Żywiec Beskids and the Little Beskids ("Beskid Mały"). The Wieprzówka river – passing Andrychów and Wieprz – and the Stryszawka river – passing Stryszawa – are smaller streams, with the Wieprzówka catchment extending over an area of 139.5 km² and the Stryszawka catchment extending over an area of 154.4 km².

The French case study area is located in the region "Provence-Alpes-Côte d'Azur" in the southeast of France. The Ubaye valley lies in the department 04 "Alpes-de-Haute-Provence", of which Digne-le-Bain is the capital and office of the prefect. Several municipalities are located in the valley. The municipality of Barcelonnette, a sub-prefecture in the department 04, as well as surrounding municipalities such as Jausiers, Saint-Pons and Faucon-de-Barcelonnette form part of this study (see Figure 4). Besides, all these municipalities belong to the community of communes of the Ubaye valley ("communauté de communes de la vallée de l'Ubaye"), an inter-municipal union and cooperation that consists of 14

[11] The description of the case study sites partly stems from the presentations of the case studies of the CHANGES project on the project's website: http://changes-itn.eu.

municipalities of the Ubaye valley with a total of circa 7.500 inhabitants[12] (CCVU, 2015b). The largest municipality of the valley is Barcelonnette with circa 3.000 inhabitants (effective 2012).

The Ubaye valley is situated in the southern French Alps. The Ubaye river covers an area of approximately 200 km² with a total length of about 22 km and a maximum width of 10 km (OMIV - Observatoire Multidisciplinaire des Instabilités de Versants, 2015). On its way to the lake of Serre-Ponçon, where it meets with the Durance river, it is fed by several smaller creeks.

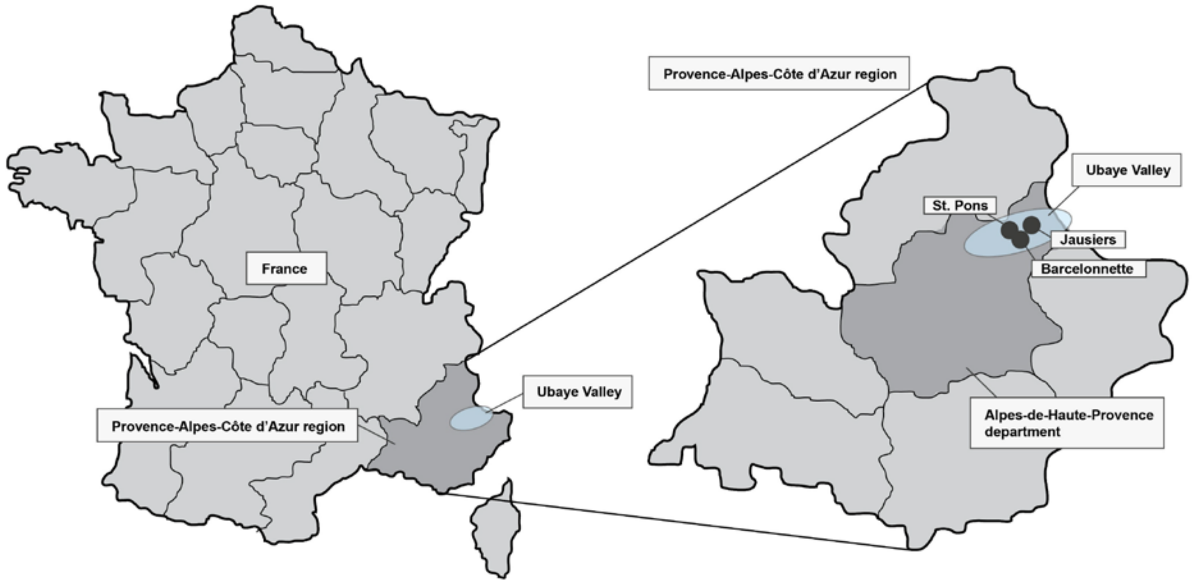

Figure 4 Location of the French case study area (Source: own illustration)

The Italian case study area is located in the very north-eastern corner of the country, close to the Austrian and Slovenian borders. The Fella river catchment lies in the province of Udine in the Friuli Venezia Giulia region, of which Trieste is the capital. The valley is known as "Val Canale" (Channel Valley). Research was mainly carried out in the municipalities of Malborghetto-Valbruna and Pontebba (see Figure 5).

As shown in Figure 2, the catchment is located in the Italian Alps, more precisely between the Carnian and Julian Alps in the discharge area of the Fella river. The river Fella is a tributary of the Tagliamento river, which is the biggest river in north-eastern Italy.

[12]As the valley allows for both, summer and winter tourism, the actual number of people staying in the area is temporarily higher.

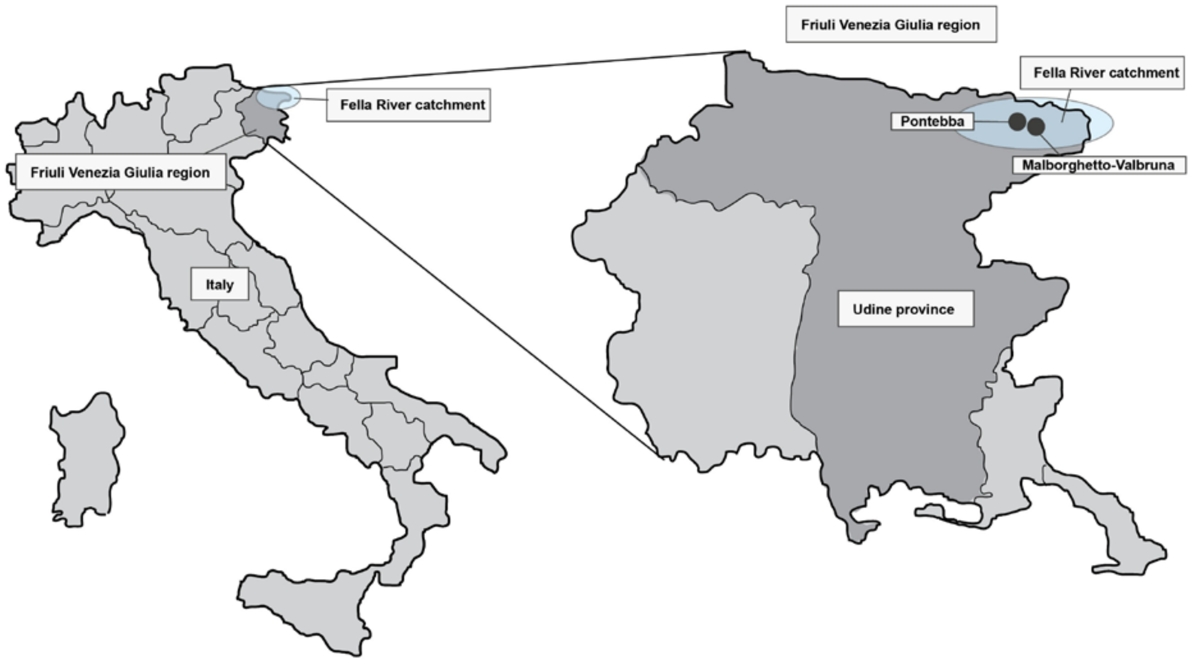

Figure 5 Location of the Italian case study area (Source: own illustration)

While this research was directed towards municipalities within these valleys or catchments, it was not always possible to meet and address the spatial planning experts which were responsible for local spatial plans in those municipalities (see Chapter 2.3). The rural character of all these case study sites made it necessary to expand the focus. In order to be able to speak with experts in the fields of spatial and sectoral planning it was necessary to contact persons outside these rather tightly defined case study sites. Therefore, research work was also carried out in places outside the “narrower” case study sites, if required. It has to be stressed, that in this research work the place or municipality itself was not the centre of attention, but the experts and their expert knowledge regarding spatial planning processes and instruments in places with the same or similar natural hazard conditions as the selected case study sites. For this research focuses on the use of risk information in SEA and spatial planning, it does not make a major difference whether spatial planners work on plans in the Ubaye valley, for instance, or on plans of a neighbouring valley or of municipalities in a neighbouring department or province. It is important that they all meet similar geological conditions, face the same problems in regard to natural hazards and are not subject to different regional laws. In case of the French case study site it was in fact necessary to contact persons in the neighbouring department 05 “Hautes-Alpes” which is also located in the region “Provence-Alpes-Côte d’Azur”. Due to the fact that natural and physical conditions in both departments are similar and there are neither legal-administrative differences nor differences in spatial planning approaches and their legal bases, it was not considered a problem to interview experts living and working in a different department than the one the actual case study site belongs to.

In this respect the case study areas are exemplary case studies, while the research itself is not necessarily spatially-related in a sense that the results are only valid for the particular municipalities that were selected. Accordingly, the case studies represent certain “types” of areas and it is rather the “type” that is of interest for this research work, and consequently the fact how spatial planning is performed in general, rather than the actual municipality itself.

Poland, France and Italy differ in both legal-administrative structures and in their planning systems (see Chapter 6). The aspired comparison between the selected case study areas should therefore not aim at identifying ways to simply transfer certain structures or practices – which would not be easily possible due to mentioned differences in framework conditions – but at determining, how these different conditions at a national or regional level influence the ways in which risk information is communicated, used and processed in spatial planning. The comparison also aims at suggesting ways which, despite existing structural and systemic differences, may facilitate or improve existing approaches in all three case study areas.

2.3 Research methods

For gaining empirical data, researchers may choose between several different methods, both qualitative and quantitative. They should select the main method according to the general orientation of their research work. A distinction is made between four main groups of methods: observation, survey, experiment and thematic analysis (see Figure 6). In the following first the analytical framework will be explained, then the chosen research methods will be presented.

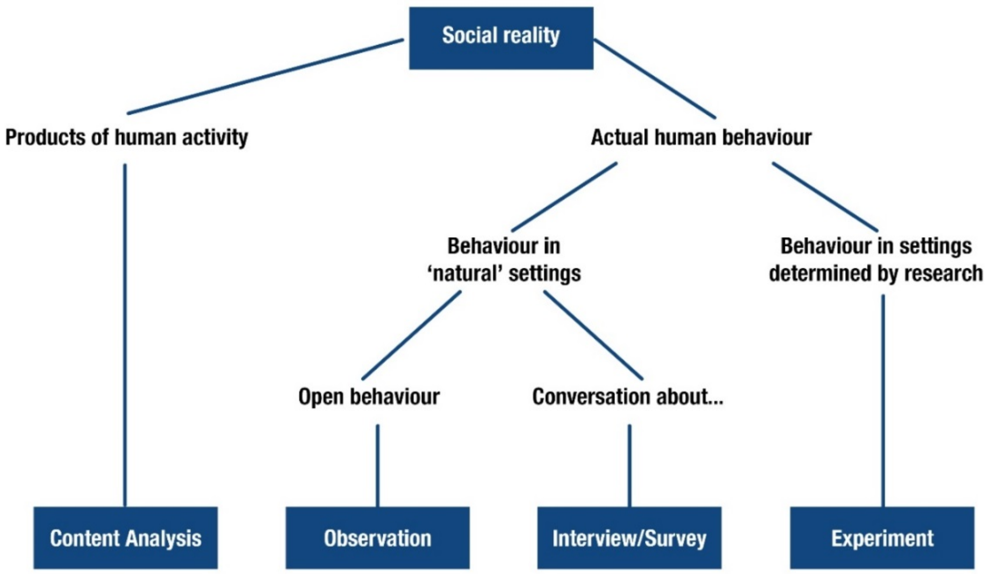

Figure 6 Subject areas and methods of empirical social research (Source: recreated from Atteslander, 2008, p. 49, own translation)

Analytical framework

Cross-country comparisons need adequate methods of investigation in order to ensure a structured comparative analysis. Therefore, an analytical framework is required which links existing theory with research questions and empirical analysis and which guides the analysis and makes sure that comparative research is conducted in a systematic and comprehendible way. The term systematic in this case means that (Easton, 1965; Lijphart, 1971; Dogan, 1990 cited in Kantor and Savitch, 2005, p. 136):

- A framework guides the analysis, providing examinable propositions for comparative examination;
- Comparisons should be realised by using common categories or variables that are measurable;
- Comparisons should continuously be carried out throughout the research work.

Especially when addressing different planning systems and dealing with different planning cultures (see Chapter 4.1), which are difficult to perceive, it is important to make use of a systematic comparative framework that helps to draw useful and preferably general conclusions (Steinhauer, 2011, p. 484). Using legal and administrative families for such cross-country comparisons can be justified, since they yield the basic framework for the operation of planning systems. But it is just as important to look at their operation in practice (Nadin and Stead, 2008, p. 38).

In order to apply a structured analysis of planning systems and cultures that ensures the consideration of both the general planning framework and what happens in planning practice, the analytical framework developed by Steinhauer (2011) was used and adjusted to match the characteristics of this study[13]. Steinhauer (2011, pp. 489–491) adopts Knieling and Othengrafen's (2009, p. 59) concept of differentiating between three dimensions ("societal environment", "planning environment" and "planning artefacts"), but changed their denomination and focus. Steinhauer's first dimension, called "national setting", is a more comprehensive dimension dealing with general aspects of a country, reflecting the importance of external conditions and circumstances[14]. It involves elements such as geographical characteristics, political, administrative and institutional settings and historical development, i.e. facts that are visible and can be gathered through desktop research. It also includes aspects such as accepted social norms and values, e.g. perceptions about the role of nature. These latter aspects, however, are rather invisible and hard to gather (Steinhauer, 2011, p. 491).

The other two dimensions "planning structure" and "planning practice" deal in more detail with the planning system and are based on Giddens' (1984) two elements: structure (planning structure) and agency (planning practice). They focus more specifically on planning, are strongly interrelated and underline the importance of interaction between structures, individual perceptions and actions (Steinhauer, 2011, p. 490). Steinhauer (2011, p. 491) describes "planning structure" as a dimension that deals with institutionalised elements. It addresses aspects such as planning legislation and planning instruments and concentrates on the administrative framework of a planning system. Relevant policies and sectors are determined as part of this dimension. These aspects can be recognised through desktop research, thus they are clearly visible. The dimension "planning practice" focuses on daily, operational planning practices, i.e. routines and actual performances of spatial planning apart from formal legislation and looks at how decision-making processes take place. Since these are all rather informal, invisible procedures and aspects, information cannot be collected through desktop research but should instead be gathered through an empirical study by carrying out focused interviews (Steinhauer, 2011, p. 491).

For this research, these three dimensions were adopted and employed for analysing spatial planning frameworks and practices in the three case study sites (see Figure 7). In order to understand the "national setting" and the "planning structure" of the three countries in which the case study sites are located, a general analysis of administrative structures, spatial planning systems (institutions, legislation and

[13] Steinhauer developed this enhanced analytical framework by applying the culturised planning model suggested by Knieling and Othengrafen (2009b) and complementing it with Giddens' theory of structuration (Giddens, 1984). Since the culturised model was supposed to just provide a first theoretical basis for studying planning cultures in a more structured way (Knieling and Othengrafen, 2009a), but does not constitute a thorough model for a systematic comparative analysis due to inconsistencies and vagueness (Steinhauer, 2011, p. 489), adjusting of the model was necessary.

[14] The analytical framework described by Steinhauer ((2011, p. 489) refers to the national level, but can also be applied to studies at other levels.

instruments) and geographically-related characteristics especially in terms of exposure to natural hazards in the case study areas was carried out via desktop research (see Chapter 6). Furthermore, a literature review focused on how natural hazards are dealt with in spatial planning and SEA with regard to the legal basis and existing instruments. Information on general perceptions, overall accepted social norms and shared values (dimension "national setting") is harder to gather. The present study is not directed towards examining social behaviour and beliefs on a broader level, however. Information on soft factors (perception, opinions etc.) is therefore only gathered within the context of the actual spatial planning practice (third dimension). Only main structural aspects are analysed within the first dimension (see Chapter 8 and 9). In order to get more insights into the operational planning practice within the case study sites, focused, semi-structured interviews were carried out. More precisely these interviews were conducted to understand decision-making processes in practice, i.e. how decisions are influenced and made, and how risk information is used to inform these decisions.

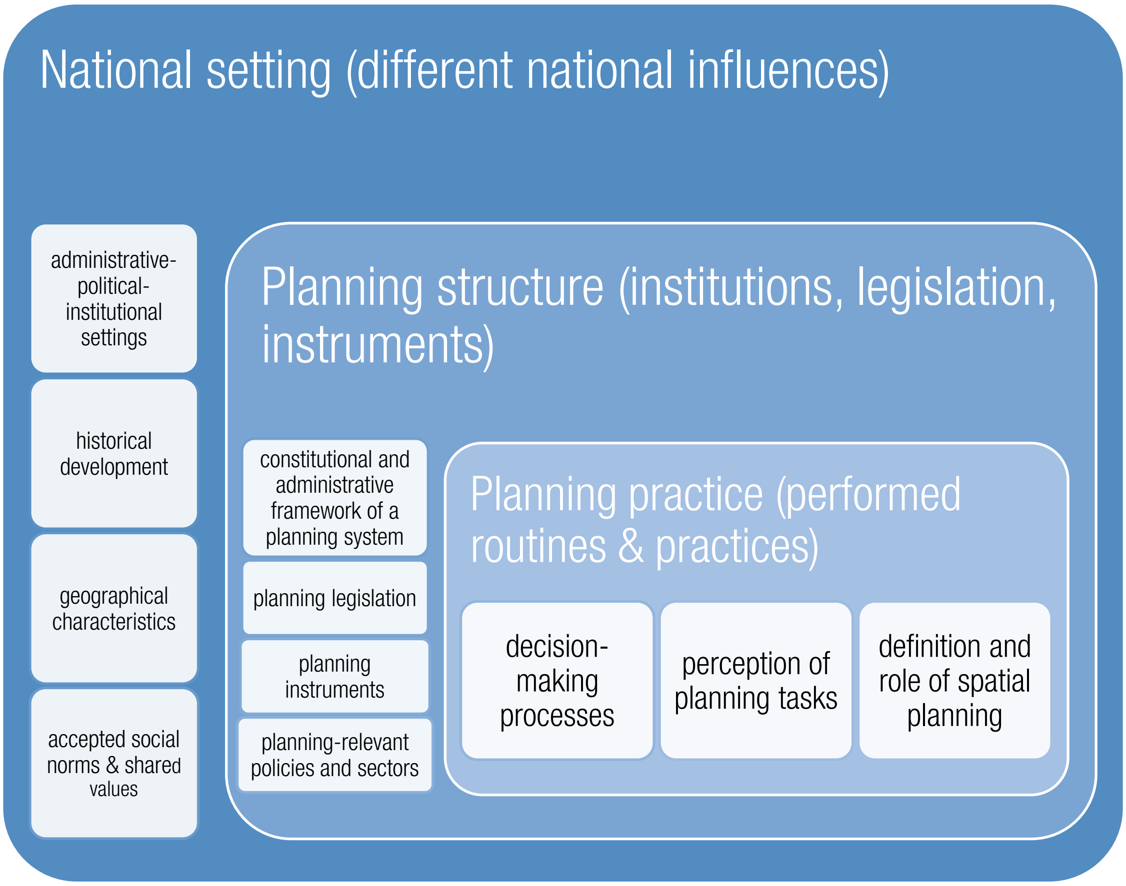

Figure 7 Analytical framework (Source: adapted from Steinhauer, 2011)

Following this analytical framework, the study is grounded on a thorough secondary, or desktop, research by collecting and outlining facts which are important for the topic at hand. Primary research – and data collection – was carried out during two fieldwork periods through informal discussion rounds and expert interviews (see Figure 8). Meuser and Nagel (1991, 2002) introduced and applied expert interviews as a specific form of semi-structured interviews which were designed to explore expert knowledge. Hence, they focus on the knowledge of experts in a particular field.

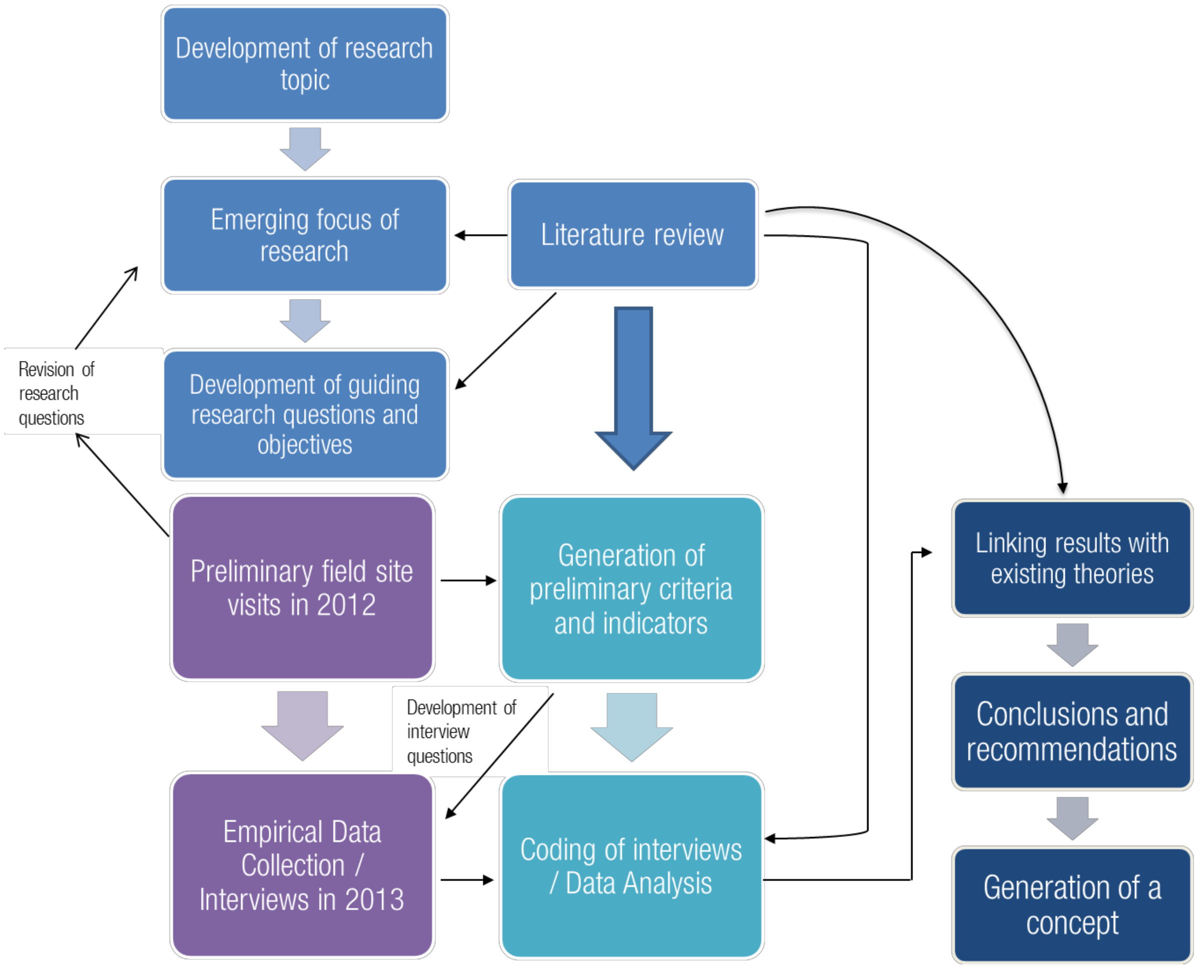

Figure 8 Research process (Source: own illustration)

Desktop research

Desktop research provided an essential overview over issues that have to be dealt with during the analysis and field work. It comprised already existing studies and information sources in the form of (project) reports, scientific papers, books, but also policy documents, legislative texts (EU Directives, national codes, national and regional laws and legislative decrees etc.), spatial plans and maps as well as environmental reports and other text documents. This input data proved to be particularly useful to learn about current planning practices in the respective case study areas and to gain an overview about current efforts regarding the reduction of risks through spatial planning as well as the current handling of SEA in this context.

Expert interviews

During the fieldwork, data was collected by applying techniques of qualitative research, more precisely by conducting informal discussion rounds and semi-structured interviews with experts. Fieldwork was conducted in two stages: The first round of field site visits was realised for the following purposes: a) becoming familiar with the case study area and the local conditions, b) establishing initial contacts with the main stakeholders and potential interview partners, c) organising informal discussion rounds in order to get more background information about the study areas as well as about existing risk management structures and mechanisms from a practical point of view. During the second stage, semi-structured expert interviews were conducted with experts met during the first field site visits as well as additional ones to supplement the analysis[15].

A semi-structured interview makes use of an interview guide, i.e. a pre-prepared list of open questions which form the basic structure of the interview (Gläser and Laudel, 2008, p. 111). Accordingly, an interview guide was prepared before conducting the interviews in the case study sites. It included and listed the questions or propositions that were going to be raised or discussed with the selected experts[16] (see Appendix 1). Such an interview guide allows the interviewer to gain more information, if required. Besides, the interviewer can also explain questions and provide help and guidance to his interviewees (Patton, 2002, pp. 343–344; Walsh and Wigens, 2003, p. 98). By applying the same interview guide to the same group of stakeholders, by following a standardised interview procedure and focusing on the same content, a common and comparative approach was guaranteed[17]. A semi-structured interview is considered adequate when the interview addresses several, different topics depending on the goal of the study, or the inquiry respectively, and if single, definable information is to be collected (Gläser and Laudel, 2008, p. 111).

For this present study, questions were raised during the interviews to understand aspects related to the use of risk information in spatial planning and SEA. The topic of dealing with risk information in spatial planning and SEA is rather broad, for it involves different actors, instruments and methods. Hence, the topic was divided into the following sub-categories:

a) the planning process, i.e. the way how risk information is used and dealt with while producing local spatial plans;
b) the planners as experts who apply the information about risks;
c) the risk information as such, i.e. the risk-related contents that are communicated to the planners;
d) the communication process which encompasses the planning process and the provision and use of risk information.

The inquiry required questions which addressed all of these aspects. The interview guide was therefore compiled by using a preliminary set of indicators that had been elaborated on the basis of a literature study and insights gained from the first round of field site visits. Both literature study and field site visits served to develop a theoretical background and to receive an impression about which aspects are important to consider. These aspects were then transformed into indicators. Accordingly, the preliminary set of indicators included targets, criteria and indicators that reflected ideas and assumptions of how risk information should be used (see Chapter 7). This means that the selected indicators reflected an idealised

[15] In first instance, individual interviews with representatives of different target groups were planned in order to better capture and understand personal opinions and experiences without being influenced by others. Yet, in few cases interview partners requested a group interview and asked colleagues to join. Due to the fact that those interviewed in groups of two or three all represented the same target group, and that in the end it was rather a question of complementing than contradicting each other, group interviews were considered just as valuable.

[16] Patton (2002, p. 343) describes the interview guide as a guide that *"provides topics or subject areas within which the interviewer is free to explore, probe, and ask questions that will elucidate and illuminate that particular subject"*. This is why on the one hand it can be considered as a sort of "tutorial" and on the other hand it still leaves enough room for flexibility by not demanding questions to be asked in a strict chronological order.

[17] This means that selected interview partners all represented certain categories of stakeholders/interviewee groups in order to ensure comparability. The study was carried out in the same fields and sectors in all three case study sites.

state or case and characterised a good way of dealing with risk information according to current scientific evidence and advice. These criteria and indicators in turn were then used to develop questions for the interview guide. The answers were expected to give an indication on the degree to which certain targets and desired conditions were met.

Individuals considered as experts are all those persons that have special knowledge and high skills in a certain domain (Gläser and Laudel, 2008, p. 11) and that have a privileged access to information (Meuser and Nagel, 1991, p. 443, 2009, p. 24). It is the researcher that defines who is an expert and who is not (Meuser and Nagel, 2009, p. 18). This judgement depends on the problem, topic and aim of the research. In this study, following the definition of Meuser and Nagel (1991, p. 443), an expert is defined as a person that is responsible for or influences problem-solving and that has privileged access to information about stakeholder groups or decision-making processes related to risk reduction matters in spatial planning and SEA. Bogner and Menz (2009, p. 46) distinguish three types of expert interviews: exploratory, systematising, and theory-generating. In the present case conducted interviews can be assigned to the systematising type of expert interviews, which focuses *"on knowledge of action and experience, which has been derived from practice, is reflexively accessible, and can be spontaneously communicated"* (Bogner and Menz, 2009, pp. 46–47). This description applies to the interviews conducted for this study in that they were oriented towards gaining access to knowledge and experience referring to the practical application of risk information in spatial planning and SEA and the various aspects (e.g. types of risk information used, procedures of dealing with risk information, problems and difficulties related to the use of risk information, ways of communicating risk information etc.) related to it. It is not the person itself that is subject of the analysis. Instead, experts are part of the field of action that defines the research topic (Meuser and Nagel, 1991, pp. 442–443). Hence, expert knowledge is in the core of the investigation. Expert knowledge in this study can be described as operational and not contextual knowledge.

Different stakeholder groups that are connected to activities in the field of risk reduction can be identified. Selecting experts for the interviews required narrowing down the field of action to those stakeholder groups which are expected to give essential and vital information regarding the object of investigation. The most important stakeholders addressed for the focused interviews were spatial planners (working in consulting agencies) or representatives of local and regional planning bodies. These actors were considered important experts as they possess both specific knowledge in spatial planning matters as well as expertise and experience in dealing with risk information in their daily work and planning practice. Further actors were involved in the expert interviews due to their roles in dealing with risk information in spatial planning and their expert knowledge, experiences and opinions have been included:

- Sectoral planners (in particular representatives from Water Boards, Geological Surveys and Environmental Protection Agencies) as providers of risk information and expert opinions on natural hazards as well as supervisory authorities in the planning process;
- Representatives from local level governments.

The empirical material used in this study is gathered from a total amount of 30 expert interviews. 26 interviews were conducted in the case study areas between April 2013 and September 2013 as part of the second fieldwork period (see above): Six in the Polish study area, seven in the Italian study area and 13 in the French study area. Additionally, two more interviews in the Italian study area were conducted as part of a student project at TU Dortmund University in March 2014. Information given by the experts in these two interviews was also used for the present study as secondary data[18]. Finally, two interviews were conducted in September 2015 with experts in the field of Strategic Environmental Assessment. These two experts were confronted with the elaborated concept for integrating risk assessment and management into Strategic Environmental Assessment and were asked to comment on the concept and to offer feedback, both support and critique. The experts were not selected for their affiliation with any of the case study sites, but for their expert knowledge in SEA application. For the concept is not context-specific for any or all of the three case study sites – or for the countries Poland, France and Italy respectively – it was not considered necessary to interview experts from all three countries. In fact, interviews were conducted with one SEA expert from Poland and one SEA expert from Germany.

Most of these interviews were carried out orally and face to face. There were few exceptions: One interview in the French case study was completed via Skype. As the last part of the interview could not be completed – due to time constraints of the interviewee – the last few questions were answered in written form via e-mail. Another interview in the Italian case study was also completed in a written form via e-mail[19]. Finally, the last two interviews with the SEA experts were completed via Skype and by phone.

Prior to the field work, interview requests were sent to selected experts to inform about intent and context in which the interviews are embedded. Specific interview dates were fixed by phone with the help of the project partners in the case study areas. However, some of the requested experts refused to be interviewed, which is why not all intended and desired interviews could be realised[20]. Some interviews were arranged on short notice on-site after interview partners suggested personal contacts who should also be addressed and involved in the inquiry. Most of these recommendations proved beneficial.

Whenever possible, interviews were recorded digitally after the interviewee’s consent, so that every detail and all the information given were saved. Only in one case there was no permission granted to record the interview. Here, notes were taken by hand[21]. Native speakers provided for translation in most of the cases so that misunderstandings could be solved right away. Two interviews (one in the Italian case study site and one in the French case study site) were conducted in the interviewee’s language without translation by a native speaker. If the interviewee was fluent in English, the interview was conducted in English, not

[18] The student project “Planning for disaster? Planning and disaster risk management in the urban space of the Italian Alps” was realised at the Faculty of Spatial Planning of TU Dortmund University between October 2013 and July 2014. An excursion took place in March 2014 during which Bachelor students of Spatial Planning conducted interviews with experts as part of their project work. Some of the interviewed experts were also relevant for the present research, which is why interview transcripts prepared by the students for these two interviews were first checked for correctness and completeness (recording was available) and then processed personally for further use.

[19] Most interviews were conducted by two researchers (myself and a project fellow), each with a separate interview guide and proper research topics and inquiry intents. Consequently, constant harmonisation was required and the order of questions asked had to be individually adjusted and coordinated.

[20] In the Italian case study it proved particularly difficult to motivate spatial planners to participate in the inquiry. Most of them hinted at the fact, that they have nothing to do with risk information and would therefore not be adequate discussion partners. Instead, they suggested to interview geologists, as they are the experts who deal with and use risk information.

[21] Taking notes entails the risk that important information might get lost, while a recording could involve confidentiality problems. Confidentiality issues were addressed by clearly stating what the information is needed for and how the results are going to be analysed, handled and published. Experience has shown that interviewees often forgot about the recording device after a while, which is why reticence did not appear to be a problem in most cases.

requiring translation from native speakers. Recorded interviews were later transcribed, in order to be able to work with the transcript as a text document.

The interview transcripts were then used for an in-depth analysis. An evaluation of transcripts, and hence of the given responses, needs to be done with respect to research question and research aims. Usually respondents give too much information, not all of which is important or useful for the purpose of the research (Walsh and Wigens, 2003, p. 98). Therefore, it is necessary to filter the information and to determine what is essential. There is no rule about how to carry out a qualitative data analysis. However, there are well-recognised approaches, most of them including "coding" as their main feature, and broad guidelines on how to deal with qualitative data (Bryman, 2008, p. 538). In this research, data analysis was accomplished through qualitative content analysis ("Qualitative Inhaltsanalyse") as advanced by Philipp Mayring since the 1980s[22]. This analytical approach is a systematic, theory-guided approach to text analysis which makes use of a theoretically deduced category system that is applied to the collected data (Gläser and Laudel, 2008, p. 198; Mayring, 2000). According to Mayring (2014, p. 40) this category system *"constitutes the central instrument of analysis"* and working with such a system *"is an important contribution to the comparability of findings and the evaluation of analysis reliability"*. Two approaches are central in this context: inductive category development and deductive category application[23] (Mayring, 2000).

Data analysis was broadly guided by Mayring's explanations, but was slightly adjusted as follows: In a first step, the preliminary set of indicators that also served as a basis for the interview guide (see above) was used to develop a category system. However, a first, partial analysis had already been done during the expert interviews. In some situations it was necessary to follow up specific topics and arguments and carry the discussion a bit further. Likewise, during the course of the second fieldwork period some aspects turned out to be irrelevant and were not (necessarily) further pursued. In such situations a preliminary interpretation is helpful in order to pre-sort information and to draw the attention to the most important topics. A thorough and systematic analysis of the collected data was accomplished after returning from the second fieldwork period. This means that, in a second step, the text material (i.e. interview transcripts) was checked and coded by using the deductively generated categories. In this way, categories were revised and adjusted and new categories could be inductively developed. Accordingly, first categories followed the structure of the interview guide and were then changed and supplemented with new, inductive categories during the process of analysing and coding collected data. This basically complies with what Mayring (2000) calls "feedback loops".

Coding helps to reduce the large amount of collected data down to the most important statements. Miles et al. (2014, pp. 71–72) describe codes as *"labels that assign symbolic meaning to the descriptive or inferential information during a study"*, which *"usually are attached to data 'chunks' of varying size […]"*. Coding is accomplished by reviewing the transcripts of an interview and by assigning labels to matching

[22] According to Gläser and Laudel (2008, p. 198) there is no international equivalent for the German term "Qualitative Inhaltsanalyse". The English term "content analysis" is used for quantitative analysis of qualitative data only. This study makes use of the translation of the German term into English, i.e. "qualitative content analysis".

[23] The procedures of qualitative content analysis will not be further outlined here. More detailed information on qualitative content analysis and a distinct description of inductive category development and deductive category application is given in Mayring (2000; 2014).

contents and parts of the text which seem to be relevant and which allow conclusions or give useful information that will help answer the research questions (Bryman, 2008, p. 552). Today, various computer programmes are available that help to organise the data and support the coding process. Qualitative data analysis software can take over important and labour-intensive manual work[24] (Bryman, 2008, p. 565; Creswell, 2014, p. 195; Miles et al., 2014, p. 46). For the present research the software MAXQDA was used in order to generate codes that matched the developed categories and which were then assigned to matching text passages or sentences in the analysed documents. Not only the interview transcripts have been inserted into the programme, but also EU documents such as EU Directives and EU Communications which served as another basis for deriving indicators[25]. During the coding process of the single interview transcripts and EU documents – and actually already during the transcription of interviews – new indicators became apparent and required adding new codes. In the same way preliminary indicators – and codes – which previously seemed appropriate proved to be impractical or irrelevant and thus called for deletion. While the coding process continued, some case-related particularities emerged. Further topics emerged as important, but were not suitable to be turned into an indicator. After the coding process, data interpretation followed as a final step in data analysis in order to determine the lessons learned. According to Creswell (2014, p. 200) these lessons can take several forms: For example, it could be a conclusion (or conclusions) derived from comparing results with theoretical background information, either confirming or differing from past information. It could also be new questions that arise and that could be addressed in future research. One goal lies in the systematisation of generalisations and interpretive frames (Meuser and Nagel, 1991, p. 462). Here, EU documents in the form of EU Directives were used to define a target state. As mentioned in Chapter 2.1, a distinction has to be made between an information level and a value level. EU Directives represent premises with normative statements which have to be connected to the information level. Thus, EU Directives provide the value level, which is why risk reduction practices in EU Member States should contribute to reaching these objectives – derived from the fact that EU Member States need to implement EU Directives into national law.

[24] Computer software only assists in analysing data; it does not complete the analysis itself so that the final interpretation is still left as a task for the researcher. For more information about uses of computer software in qualitative studies see Miles et al. (2014, pp. 46–50).

[25] As explained in Chapter 2.1 EU documents were used for developing indicators in order to have a politically justified basis, which is valid for all three case study sites, as regulations were set up at European level and certain rules are to follow EU-wide.

Part II: Theoretical principles for the analysis

3. Natural hazards and risks

The UNISDR (2015, p. 9) acknowledges in its Sendai Framework for Disaster Risk Reduction that since the adoption of the HFA in 2005 *"progress has been achieved in reducing disaster risk at local, national, regional and global levels by countries and other relevant stakeholders, leading to a decrease in mortality in the case of some hazards"*. However, at the same time disasters have continued to occur and cause devastating damages in that more than 1.5 billion people worldwide have been affected by disasters in different ways (see Figure 9) (UNISDR, 2015, p. 10). A large majority of disasters occurs as hydro-meteorological events. Even though there is a growing understanding of the physical processes behind the occurrence of natural hazards and the regime of a disaster, *"there are still many challenges related to hazards science, and particularly, in the reduction of uncertainties in forecasting of hazard events, local resolution of models, and prediction lead time, among others"* (ICSU and ISSC, 2015, p. 4).

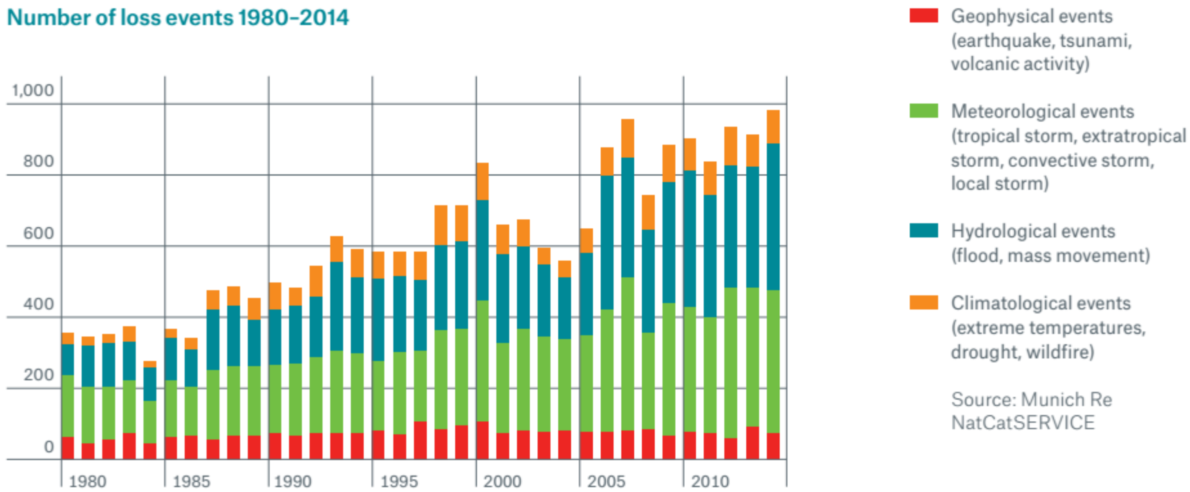

Figure 9 Number of loss events of various types of natural hazards and extreme weather events between 1980 and 2014 (Source: Munich Re, 2015, p. 48)

However, climatic changes and disaster risk do not necessarily negatively influence or affect mankind or its livelihoods. Disasters have always occurred in the past and humans have developed their proper way to prepare for and respond in case of a disaster for many centuries. This is why humans have a certain understanding and knowledge as to how adapt to disaster risk and avoid the occurrence of a disaster in the first place. Especially the more developed countries have implemented adaptation strategies and measures that help protect their settlements – in particular urban or urbanised areas – from disasters. As a consequence, such measures often create a false sense of security. Both technical or structural and non-structural measures have increased a feeling of not being exposed or susceptible towards disasters[26]. Despite the fact that technology advances and human know-how is improving, it is *"urgent and critical to anticipate, plan for and reduce disaster risk in order to more effectively protect persons, communities and countries, their livelihoods, health, cultural heritage, socioeconomic assets and ecosystems, and thus strengthen their resilience"* (UNISDR, 2015, p. 10).

[26] Grassl (1999, p. 23), for instance, argues that we live in a fool's paradise. In fact, our society is more vulnerable than we believe it is.

This chapter introduces ways and means of dealing with disaster risk, with a particular focus on natural hazards. Due to the multi-disciplinary character of disaster risk and related research areas, different disciplines have developed their own understanding of disaster-related terms and thus apply different definitions (Thywissen, 2006, p. 449). Providing various established explanations and definitions in chapter 3.1.1 and 3.1.2 is considered necessary in order to create a common understanding for their use within this thesis and to avoid confusion. This chapter also introduces different risk concepts in natural and social sciences in order to explain the principles and derivation of the terms and to illuminate the understanding of disaster risk and its elements in spatial planning (see Chapter 3.1.3).

Chapter 3.2 then deals with a more detailed description of the risk governance approach. Many of today's risk issues are complex, uncertain and ambiguous. There is a need for a better understanding of disaster risk. In addition, scientific, political, social and economic contexts of risk need to be examined and better understood; and so do the ways how risks are managed (IRGC, 2008, p. 2). Risk management is deeply influenced by public concerns and perceptions. An adequate inclusion of public concerns constitutes an important aspect of good governance[27]. Therefore, knowledge about the concerns that people associate with the causes of risks is fundamental (Klinke and Renn, 2010, pp. 24–25). In this context, Botzen et al. (2013, p. 231) notice that *"individuals may place a considerable value on measures that reduce risk to zero levels instead of only limiting risk partially, which has been called the certainty effect"*. They continue to explain that the existence of a certainty effect may strongly influence adaptation policy. After all, in such cases individuals would ask for adaptation measures that aim to reduce the existing risk to zero (Botzen et al., 2013, p. 231). Accordingly, society often asks for absolute certainty. Although there is no such thing as absolute certainty, adaptation policy needs to take these public concerns into account. This holds also true for risk reduction policies: Public authorities are facing ever-growing public expectations and pressures in terms of reducing risks at the best possible rate. Hence, the IRGC (2008, p. 2) believes that *"improvements in risk governance are essential to taking optimal risk-related decisions and to maximizing public trust in risk management processes, structures and decisions"*. Managing risks in the most ideal way has turned into a vital obligation for many public authorities, especially those exposed to one or more natural hazards. This requires knowledge about the constituting elements of risk governance and adequate measures that are required to reduce the risk. Chapter 3.2 therefore explains the concept of risk governance as well as the single components that lead to an ongoing process of risk governance. As spatial planning constitutes one of the major players in risk governance, an explanation of the entire risk governance process is considered necessary. After all, spatial planning decisively contributes to risk reduction. In this context, spatial planning strongly depends on results of risk assessments, in particular in the form of maps (see Chapter 3.2.2). Decisions about the use of land are an important part of the prevention phase within the so-called disaster risk management cycle (see Chapter 3.2.3). Finally, spatial planners benefit from good risk communication. They apply information that is relevant to the management of risks and therefore are required to well understand the communicated level of risk in order to take good planning decisions (see Chapter 3.2.4).

[27] "Good governance" involves a number of criteria which have been discussed in various contexts (Klinke and Renn 2010, p. 24). According to the CEC (2001a) five principles underpin good governance: openness, participation, accountability, effectiveness and coherence. The IRGC (2008, p. 4) explains that good governance also includes aspects such as *"transparency, effectiveness and efficiency, accountability, strategic focus, sustainability, equity and fairness, respect for the rule of law and the need for the chosen solution to be politically and legally feasible as well as ethically and publicly acceptable"*.

3.1 Clarification of central terms

The terminology of disaster reduction is quite diverse. Due to the different scientific fields, fields of action and actors involved, disaster reduction is addressed in many different disciplines, which all have their specific approaches to the topic. The multi- and trans-disciplinary nature of disaster reduction gave rise to a multitude of definitions for natural hazard related terms used in different disciplines. Sometimes there are different interpretations and meanings for an identical term in various scientific discourses of different professional groups (Banse and Bechmann, 1998, p. 7; Birkmann, 2008, p. 6; Thywissen, 2006, p. 449; Twigg, 2007, p. 2). In fact, *"it seems that no one can agree on the meaning of terms in the disaster risk reduction field"* (Alexander, 2013, p. 2713). Engineers, economists, geologists, social scientists and other actors related to the risk reduction field may understand the same term quite differently. For instance, many different definitions exist for key terms such as "disaster", "hazard", "vulnerability" and "risk" (Brooks, 2003, p. 2; Thywissen, 2006, p. 485; Twigg, 2007, p. 3; Wamsler, 2014, p. 15). This holds also true for scientists and practitioners in spatial and sectoral planning.

Besides that, the disaster risk reduction terminology has to be distinguished from the climate change (adaptation and mitigation) terminology (Twigg, 2007, pp. 2–3). Although the terms are quite similar or even alike, both approaches differ which is why the same terms may have very different meanings. Furthermore, terms in disaster risk reduction are often determined by an international or Anglo-American research community, which makes a translation into many different languages or specific explanations necessary (Birkmann, 2008, p. 6).

Disaster risk terminology keeps developing and will always adapt to shifts in scientific thought by either adjusting old terms or by introducing new ones (Twigg, 2007, p. 3). Many terms used by the disaster risk reduction community have a long and rich history which implies a certain degree of ambiguity (Alexander, 2013, p. 2713). As there is no consensus on a common use of terms or on the respective definitions of equal terms, communication within the wide field of disaster reduction is often made difficult and yields misunderstandings (Banse and Bechmann, 1998, p. 7; Thywissen, 2006, p. 449; Twigg, 2007, p. 2). This situation is often referred to as "Babylonian confusion" (Thywissen, 2006, p. 449). However, breaking all these terms down to one single definition and understanding is neither feasible nor desirable. Still, actors from different backgrounds must develop a mutual understanding of the terms used and they must be able to interrelate them, so that different traditions and disciplines can be integrated and a common framework be constructed in order to comprehensively manage risks (Brooks, 2003, p. 2; Wamsler, 2014, p. 15). Considering different perspectives of various academic and practice fields and disciplines is crucial when trying to explain the definitions of terms. By clarifying the terminology at the beginning of a project or before the development of a strategy and by providing a mutual understanding of differences in definitions, collaboration across different fields can be facilitated.

3.1.1 Hazards and disasters

A main premise when talking about hazards and disasters is clarifying the difference between these two terms. A hazard is described as a *"dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage"* (UNISDR, 2009a, p. 17). Hazards are therefore phenomena which severely affect humans and the environment and lead to great harm. Yet, not every serious hazardous event necessarily causes damages in infrastructure or economy or causes losses of life (Dikau and Pohl, 2007, p. 1031).

Natural hazards are hazards based on natural processes or phenomena. A natural hazard may have different degrees of intensity and severity (Wisner et al., 2004, p. 49), e.g. for a flood in terms of depth and extent of water, speed of water flow etc. It is also characterised by its frequency, probability and location of occurrence. In addition to natural hazards, i.e. hazards of natural origin, technological hazards, i.e. human-induced hazards, play a role in disaster risk reduction. Examples include floods, landslides, rock falls, earthquakes and avalanches for natural hazards as well as industrial pollution or explosions and transport accidents for technological hazards. The latter are not within the scope of this research and they will not be further considered and addressed as part of this study[28].

In contrast to a (natural) hazard, a disaster is a *"serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources"* (UNISDR, 2009a, p. 9). This means that, literally speaking, the term "disaster" can only be used when related to humans, human activities, man-made structures or anthropogenic uses. It can only be referred to as a natural disaster when a natural hazard occurs in developed and populated areas and only when having a certain impact on society (Dikau and Pohl, 2007, p. 1031; Godschalk et al., 1999, p. 4). Therefore, according to Wamsler (2014, p. 19), *"an event can only be called a disaster if it (a) is triggered by the combination of a 'natural' hazard (or several hazards) and vulnerable local conditions, (b) results in a disruption of the functioning of a community or society, and (c) requires external assistance for the subsequent impacts to be adequately dealt with"*. Natural systems such as ecosystems are usually not affected by natural disasters, because natural hazards occur naturally and do not pose any serious threat for ecosystem biodiversity, for instance. Often such systems are able to cope with short impacts caused by a natural hazard[29]. Figure 10 demonstrates the relation between the terms.

Figure 10 The disaster concept (Source: recreated and slightly altered from Wamsler, 2014, p. 20)

[28] Further hazard-related terms exist which more specifically refer to the cause or the origin of a hazard, such as "biological hazard", "geological hazard", "hydro-meteorological hazard" and "socio-natural hazard" (UNISDR, 2009a, p. 17).

[29] However, the damages a natural hazard may cause on the environment can be rather severe, so that they may cause further impacts on human beings. Even if the natural system itself is not posed to a threat and can cope with the damages it experienced, a hazard damaging the environment can still have adverse consequences from a human point of view, like for example extreme storms which damage forests or other habitats, forest fires affecting plant and animal species constituting a livelihood or important source of income for human beings etc. (EEA, 2003, p. 1; Fleischhauer, 2006a, p. 9). This means that a natural hazard that causes environmental damages can turn into a human disaster.

According to the above explanation, disasters are connected to existing social, political and economic environments (Wisner et al., 2004, p. 4). In fact, disasters are basically the product of an interaction between natural hazards and vulnerable conditions and a disaster can only be considered socio-economic and not natural which is why there is actually no such thing as a "natural" disaster (Wamsler, 2014, pp. 4–5). As disasters are always related to their impact on humans, the occurrence of a disaster depends on the level of socio-economic development. Wisner et al. (2004, pp. 4–5) explain in this context that both aspects, natural and social, are equally important and should not be separated from each other.

As Godschalk et al. (1999, p. 4) explain, disasters have grown in number and intensity, since more people and more developments have become exposed to natural hazards and extreme weather events[30]. It can be regarded as counterproductive that those places where people prefer to live are often the places where hazards occur on a more or less regular basis, like for example along sea shores, riverfronts, flood plains or on slopes of volcanoes (Godschalk et al., 1999, p. 4; Wisner et al., 2004, p. 5). Both urban development in such areas and the risk of damage, casualties or injury increase steadily at the same time. Nonetheless much of the impacts of disasters could be avoided if preventive actions were taken to reduce vulnerability to natural hazards. Taking preventive actions becomes even more important when considering the fact that *"there is high confidence that climate change will affect disaster risk not only through changes in the frequency, intensity, and duration of some events […], but also through indirect effects on vulnerability and exposure"* (Cardona et al., 2012, p. 76). The occurrence of a natural hazard cannot be prevented, but its impact on society can be reduced and damages be diminished (Godschalk et al., 1999, p. 4; UNISDR, 2009c, p. 2). Accordingly, *"while the hazards generally cannot be influenced, the magnitude and frequency of disasters can be significantly reduced through the application of sound, evidence-based investments in means to reduce the exposure and vulnerability components of risk"* (UNISDR, 2009c, p. 2). This explanation points towards two further terms that require definitions and explaining: "vulnerability" and "risk".

3.1.2 Hazards and risks

The term "hazard" is often confused or used interchangeably with the term "risk". Yet, it is today widely accepted within the disaster risk reduction community that "hazard" is a component of risk and should therefore not be confused with the term risk itself (Cardona et al., 2012, p. 69). From a sociological point of view, a distinction is made between hazard as external attribution and risk as self-attribution (Weichselgartner, 2001, p. 61). The term "natural hazards" is applied for natural processes. If these natural processes are linked to human or societal decisions, they can be termed natural risks (Weichselgartner, 2001, p. 62). This means that risk always depends on human actions and decisions (McBean, 2010, p. 65) or involves a decision by the person at risk respectively (i.e. deciding whether to take the risk or not) (Thywissen, 2006, p. 450). The role and influence of human beings in this context has also been stressed by the International Council for Science (ICSU) (2008, p. 14), that explains that *"the risk associated with environmental hazards typically depends not only on physical conditions and events but also on human actions, conditions (vulnerability factors, etc.), decisions and culture"* (ICSU, 2008, p. 14). Markau (2003, p. 20) highlights the difference between hazard and risk by noting that a hazard

[30] According to the UNISDR (2012), natural disasters have almost quadrupled between 1975 (around 60 reported cases) and 2012 (310 reported cases) worldwide.

> *"describes natural or anthropogenic-induced unique, sequential or combined events, conditions, processes or actions which may potentially cause damage or loss for the nature or for humans and their goods. Risk additionally implies the probability of a damage and stresses the causal relationship between the damage and a decision"*.[31]

Hence, the (natural) hazard is just the physical event itself and can only be referred to as a (natural) risk if related to human decisions, their possible influence and potential options for risk reduction. A hazard turns into a risk by recognising expected damages and the possibility to influence the occurrence and the extent of effects of an event through subjective decisions (Greiving, 2002, pp. 70–71). This also corresponds to an explanation of the IRGC (2006, p. 19) which states that *"risks always refer to a combination of two components: the likelihood or chance of potential consequences and the severity of consequences of human activities, natural events or a combination of both"*.

According to Eiser et al. (2012, p. 7), people have to make choices when living in environmental conditions which are prone to natural processes that are periodically hazardous[32]. This means in turn that *"projecting risk into the future, will depend, in part, on the choices people make, individually and collectively (through their governments at all levels), and how they implement these choices"* (McBean, 2010, p. 65). These choices usually have not only consequences for themselves, but also for others (Eiser et al., 2012, p. 7) and may imply a hazardous situation for some and an (economic) benefit for others (Markau, 2003, p. 20). Since these consequences are uncertain, "risk" is usually ubiquitous. The ICSU (2008, p. 14) further states that actions and decisions of humans determine whether or not a (natural) hazard will lead to a disastrous event (e.g. construction on a flood plain leading to a disastrous flooding). These explanations point to the crucial role of spatial planning as well as the necessity to (somehow) deal with uncertainties.

In accordance with the above-named explanations, Markau (2003, p. 21) summarises the characteristics of risks as follows:

- Risk presupposes a hazard;
- Risk presupposes uncertainty;
- Risk is based on decisions;
- Risk implies the possibility of both a damage and a benefit.

Now human influence on nature and space adjusted and intensified with time. Mainly due to changing demands on space and according changes of the environment through humans, natural-induced extreme events have changed and thus turned into man-made risks (Markau, 2003, p. 21; Wanczura, 2010, p. 14). According to the ISCU (2008, p. 14) some physical events are directly attributable to human activities, which means they are basically man-made risks, provoked by humans and human activities[33].

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[31] A basic definition of the UNISDR (2009a, p. 25) describes risk as *"the combination of the probability of an event and its negative consequences"*.

[32] Thywissen (2006, p. 451) also points out that risk and possible choices come along with responsibility, which raises the question of morality. She acknowledges, however that *"there can be no direct moral valuation of risk because the level of acceptable risk is highly subjective and highly variable"* (Thywissen, 2006, p. 451).

[33] This is the case, for example, with small- and medium-scale flooding, landslides and drought in rural and urban areas caused or intensified by environmental degradation or human intervention in ecosystems as well as by global climate change (ICSU, 2008, p. 14). In contrast, events that cannot be influenced by human beings include earthquakes and volcanic eruptions (Markau, 2003, p. 21).

Due to the fact that human beings are not only affected by hazards, but also influence them through their own decisions it can be asserted, that certain natural phenomena cannot be considered hazards but rather risks (Greiving, 2002, p. 9; Markau, 2003, p. 21).

Finally, the difference between the terms disaster and risk should be clarified: While both risk and disaster are determined by the factors hazard and vulnerability, risk additionally involves the aspect of probability. The term disaster refers to the event itself which causes a serious disruption, while risk is the latent, ubiquitous probability or likelihood, that an event causes negative consequences, or as Wamsler (2014, p. 19) explains: *"Disasters are the outcome of (continuously) present conditions of risk"*.

The UNISDR (2009a, pp. 9–10) defines disaster risk as *"the potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period"*. In fact, disaster risk is usually understood as an interaction between natural or technological hazards and vulnerability/vulnerable conditions, which is why this research work will follow this basic definition of risk[34]. Nevertheless, some authors, like Crichton (1999) with his risk triangle, refer to three different components as separate features (hazard, exposure and vulnerability), while yet others distinguish between four categories: "hazard", "exposure", "vulnerability" as well as "capacity and measures"[35] (Birkmann, 2006, p. 23).

While the term "hazard" has been explained above, the term "vulnerability" now needs to be defined in more detail. Just like the previous terms, vulnerabililty is a very complex and multifaceted concept (Wamsler, 2014, p. 25). Evidence for the complexity of the vulnerability concept is given by existing scientific literature, which encompasses more than 25 different definitions[36] (Birkmann, 2006, p. 11), leading to differing concepts and manifold conceptual frameworks. Originally, the vulnerability concept stems from the social sciences and was introduced as a response to hazard-oriented approaches focusing on technological solutions. Instead, natural hazards should rather be viewed as a result of human actions (Hilhorst and Bankoff, 2004, pp. 1–2). As explained above, the definition of disasters involves a human element. This is why the concept of vulnerability was brought forward in order to look at the ways in which people are put at risk:

> *"Since the 1980s, the dominance of technical interventions focused on predicting hazards or modifying their impact have been increasingly challenged by this alternative approach, which seeks to combine the risk that people and communities are exposed to with their social, economic and cultural abilities to cope with the damages incurred"* (Hilhorst and Bankoff, 2004, p. 2).

A general and basic definition is again provided by the UNISDR (2009a, p. 30) which defines vulnerability as the *"characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard"*. While the UNISDR definition focuses on the susceptibility, other authors

[34] This understanding of risk is in line with both the one expressed by Birkmann (2008, p. 10) and the one applied by the ARMONIA consortium in the research project "Applied Multi- Risk Mapping of Natural Hazards for Impact Assessment" (see Fleischhauer, 2006a, p. 10), whose elaborations also focus on the perspective of spatial planning on natural hazards, vulnerability and risks and therefore chose planning-related definitions for these terms.

[35] Capacity and measures involve physical planning, social capacity, economic capacity and management and seem to be closely related to the term coping capacity (Birkmann, 2006, p. 23).

[36] See Thywissen (2006) for an overview of different definitions, not only for the term vulnerability, but for the core terminology of disaster risk reduction.

describe vulnerability by focusing on other elements or factors. The IRGC (2006, p. 27) highlights the factor of exposure by stating that *"vulnerability describes the various degrees of the target to experience harm or damage as a result of the exposure (for example: immune system of target population, vulnerable groups, structural deficiencies in buildings, etc.).*" Blaikie et al. (1994, p. 9) in turn focus on the element of "capacity" or "ability" by defining vulnerability as *"the characteristics of a person or a group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard"*. Many research approaches focus on three aspects of vulnerability and involve susceptibility, exposure and coping capacity (see Figure 11) (Birkmann, 2008, p. 7). This latter perception results from the fact that the potential of a community or system to suffer harm or loss depends on the degree of sensitivity of a community or system to damaging effects, the occurrence of a hazard and its characteristics, as well as the capacity to cope with its impacts[37]. This means that it is not only important to look at what makes elements susceptible to potential impacts of hazards in physical, social and economic terms. Equally important is to look at the characteristics of the hazard in terms of temporal and spatial aspects as well as the communities' or systems' capacity to cope with a potentially damaging event in terms of predicting, preparing for, resisting and recovering from the hazard[38].

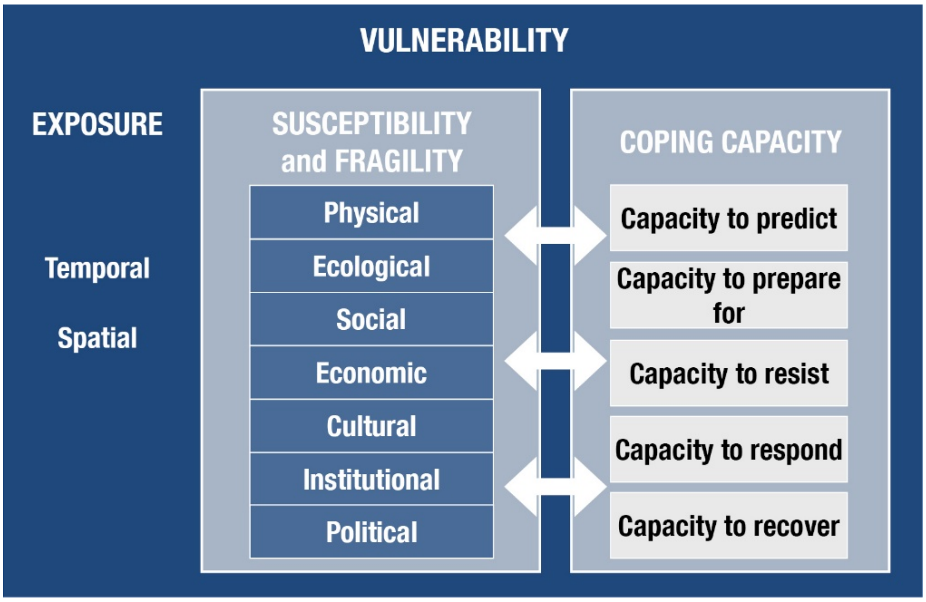

Figure 11 Components of vulnerability (Source: recreated and slightly altered from MOVE, 2010, p. 6)

A comprehensive definition for vulnerability which accounts for all three of these aspects was provided by the ESPON Hazards project in 2003. It defined vulnerability as

[37] According to this idea the so-called "BBC" framework, based on work by Bogardi, Birkmann and Cardona, differentiates between the three aspects "exposure and physical vulnerability", "social and economic fragilities" and "lack of resilience or ability to cope and recovering" (Birkmann, 2006, pp. 35–36). A distinction is hence made between "harder" physical aspects, "softer" social and economic factors and intrinsic aspects related to "coping".

[38] Birkmann (2006, p. 38) acknowledges in this context that *"although one can argue that exposure is often hazard-related, the total exclusion from vulnerability assessment could render this analysis politically irrelevant. If vulnerability is understood as those conditions that increase the susceptibility of a community to the impact of hazards, it also depends on the spatial dimension, by which the degree of exposure of the society or local community to the hazard or phenomena is referred to"*. Exposure is therefore mainly a characteristic related to the hazard, but at least partially a characteristic of vulnerability (Birkmann, 2006, p. 36).

> *"the degree of fragility of a person, a group, a community or an area towards defined hazards. Vulnerability is a set of conditions and processes resulting from physical, social, economic and environmental factors that increase the susceptibility of a community to the impact of hazards. Vulnerability also encompasses the idea of response and coping, since it is determined by the potential of a community to react and withstand a disaster"*[39] (Kumpulainen, 2006, p. 66).

This definition is also in line with the idea of Wamsler (2014, p. 25) that two factors influence the degree of vulnerability:

1. location-specific conditions (quality of building, population density, degree of environmental degradation etc.), referring to the exposure and susceptibility aspects of vulnerability;
2. presence of people's and institution's reactions in terms of response to and recovery from disasters, referring to the coping capacity aspect of vulnerability.

According to the definition of vulnerability of the ESPON Hazard project (see above), various aspects of vulnerability and vulnerability types exist which arise from different physical, social, economic and environmental factors[40]. Some authors add further factors such as political, cultural and institutional as determinant factors of vulnerability (Kumpulainen, 2006, p. 66; MOVE, 2010, p. 4; Twigg, 2007, p. 2) (see also Figure 11). Yet, the following types can be considered as main vulnerability types (van Westen et al., 2011, 5):

- **Physical vulnerability**: Refers to the potential for physical impact on the built environment and the public and is analysed per group of constructions that have a similar damage performance. Due to the focus on the intrinsic quality of the structure itself, physical vulnerability does not depend on a specific location;
- **Economic vulnerability**: Refers to the potential impacts of hazards on assets and processes with an economic value (e.g. business interruption);
- **Social vulnerability**: Refers to the potential impacts of a phenomenon on demographic groups, such as the poor, handicapped people, children and elderly people and requires the consideration of risk awareness and coping capacity of these groups, including the institutional structures that are put in place to help them cope with the event;
- **Environmental vulnerability**: Refers to the potential impacts of hazardous events on the (natural) environment.

The project "MOVE - Methods for the Improvement of Vulnerability Assessment in Europe" applied a conceptual framework for vulnerability measurement – based on an understanding of the term vulnerability similar to the one by Wamsler (2014, p. 25) mentioned above – which includes both susceptibility and exposure, but refers to "lack of resilience" instead of coping capacity[41]. Following the MOVE project (2010, p. 5) susceptibility and exposure can be defined as follows:

[39] A similar definition was later also employed by the ARMONIA consortium for their project on multi-risk mapping.

[40] See also UNISDR (2009c, p. 30).

[41] In this study resilience is regarded as the antithesis of vulnerability (see also Twigg, 2007, p. 2), which is why "coping capacity" as a component of vulnerability is considered more appropriate than "lack of resilience".

- **Susceptibility** *"is the predisposition of society and ecosystems to suffer harm resulting from the levels of susceptibilities or fragilities of human settlements and disadvantageous conditions and relative weaknesses related to physical, ecological, social, economic, cultural, and institutional issues."*
- **Exposure** is understood as *"the susceptibility of human settlements and environment to be affected by a dangerous phenomenon due to its location in the area of influence of the phenomenon and to a lack of physical resistance."*

Exposure may also refer to the inventory of elements that are exposed to a potential hazard in an area (Cardona et al., 2012, p. 69). The term "exposure" can therefore also be substituted by "exposed elements". This expression focuses more specifically on particular elements that are exposed to a hazard which can sometimes also be referred to as "**elements at risk**".

Finally, **coping capacity** is *"the ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters"* (UNISDR, 2009a, p. 8). According to this definition, capacities to cope require continuing awareness about risk, financial and human resources as well as good management to prepare for and deal with hazards[42] (UNISDR, 2009a, p. 8).

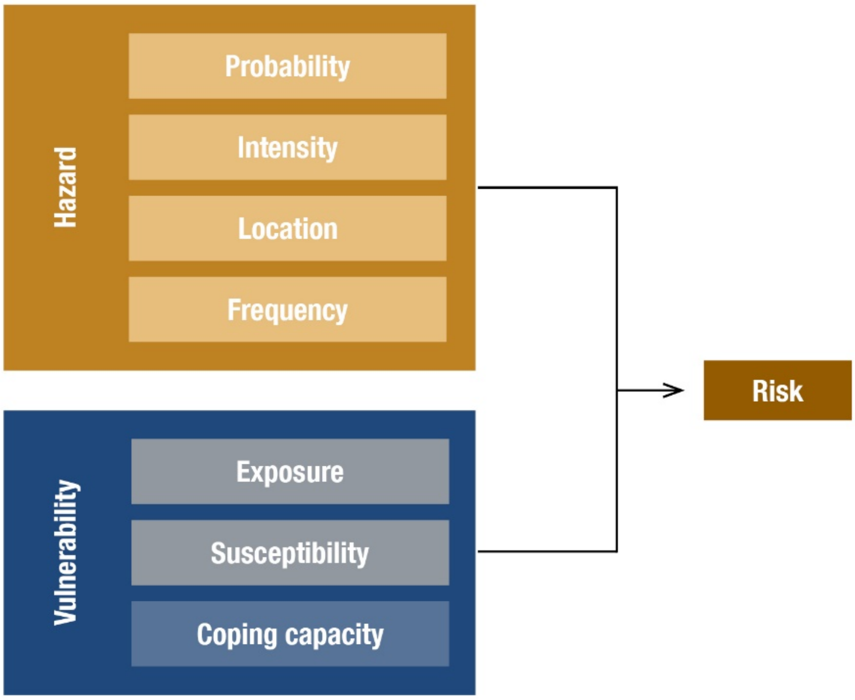

Figure 12 Components of risk (Source: recreated and slightly altered from Fleischhauer, 2004, p. 50, own translation)

To conclude, the above-defined terms are used within this study regarding their meaning and application as follows (see Figure 12):

[42] It is important to point out that coping capacity should not be confused or used interchangeably with "adaptive capacity". While coping capacity is commonly used in research by the disaster risk community, adaptive capacity relates to research by the climate change community and refers here to the ability of a community or system to adapt to climate change and its consequences.

Risk is a product of the probability of damages (or losses) as a consequence from an interaction between natural or technological hazards and potentially vulnerable conditions. The probability of damages arises from the probability of occurrence of a (natural) hazard and its consequences (extent of consequences, intensity of impact, duration etc.). Hazards are potentially damaging events of different origins (both natural and technological), negatively affecting people, goods and the natural environment. Vulnerability is the degree of susceptibility or fragility of elements exposed to hazards in a specific area when also considering their respective capacities to cope with the possible impacts.

3.1.3 Risk concepts in natural and social sciences

Definitions for the term risk are very heterogeneous (Banse and Bechmann, 1998, p. 7; Greiving, 2002, p. 12). This heterogeneity in terminological understanding influences, depending on the definition used, processes of assessing, describing and handling risks (Banse and Bechmann, 1998, p. 7).

Two extreme forms of risk concepts as described by Dikau and Pohl (2007, p. 1033) shall be demonstrated to narrow down the concept for this thesis. The authors distinguish between two perspectives that represent two very different perceptions. The first perceives human beings as active elements. By weighing up chances against risks people consciously decide to take a certain risk in order to achieve predefined goals. As an example, humans may decide to build in flood plains or close to river beds and hence might experience a flooded house at some point. By deciding to build in a flood prone area they take and accept a certain risk. The second perspective perceives risk as the probability of occurrence of an extreme event or natural hazard[43]. It defines risk as the result of an interaction between a hazard and vulnerable conditions and thus involves the possible impacts on goods or human beings as well as the probability of occurrence. To summarise, risk is either considered as an individual or collective choice or decision to behave or act in a way that may result in damages from certain events. Or risk is the probability of an event.

These two perspectives of risk are just two extreme forms. In fact, many different schools of thought or approaches to risk exist and different risk concepts have been classified by various authors and based on different disciplinary perspectives. Likewise, the classification of risk concepts into various, disciplinary views or research approaches is almost just as diverse. While Banse and Bechmann (1998, pp. 29–61) differentiate between eleven disciplinary perspectives, Renn (1992, p. 56) distinguishes seven approaches to the conception and assessment of risk and Scholles (1997, p. 24) lists four different perspectives. Banse and Bechmann (1998, pp. 29–61), for instance, recognise the following approaches which address differing issues of risk:

- the (insurance-) mathematical perspective;
- the natural science and technical perspective;
- the decision theory (rational choice) perspective;
- the psychological perspective;
- the economic perspective;
- the jurisprudential perspective;
- the sociological perspective;

[43] To distinguish a natural hazard from an extreme weather event, the latter can be defined as the *"occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable"* (IPCC, 2012, p. 5).

- the political science perspective;
- the cultural anthropology perspective;
- the socio-theoretical perspective and
- the philosophical and ethical perspective.

Bechmann (1993, 9) classifies three basic orientations or schools of thought, which explain the historical development of risk research :

- **Formal-normative approach:** The main aim of this research perspective consists in developing a universal measure of risk, which was supposed to allow comparing different types of risks (Bechmann, 1993, 9). In response to the controversial discussions, Starr (1969) developed a model which dealt with people's perception of risks and benefits to the end that the risks people had accepted in the past should be determined (Kane, 1992, p. 9). This model sought to answer the question "How safe is safe enough?"[44] (Starr, 1969, p. 1233). By developing a universal measure of risks, risk research intended to achieve a rational clarification about the acceptance of differing risks, depending on the degree of their probability of occurrence and their impacts (see Figure 13). The risk equation taken from the insurance economy was the focus of this perspective. It considers risk as a product of extent of damage and probability of occurrence – and therefore facilitates the calculation of damage potential. Besides, decision theory provided a model for rational decisions, which were supposed to allow the consideration and scaling of damages and benefits (Bechmann, 1993, 9; Weichselgartner, 2001, p. 25).

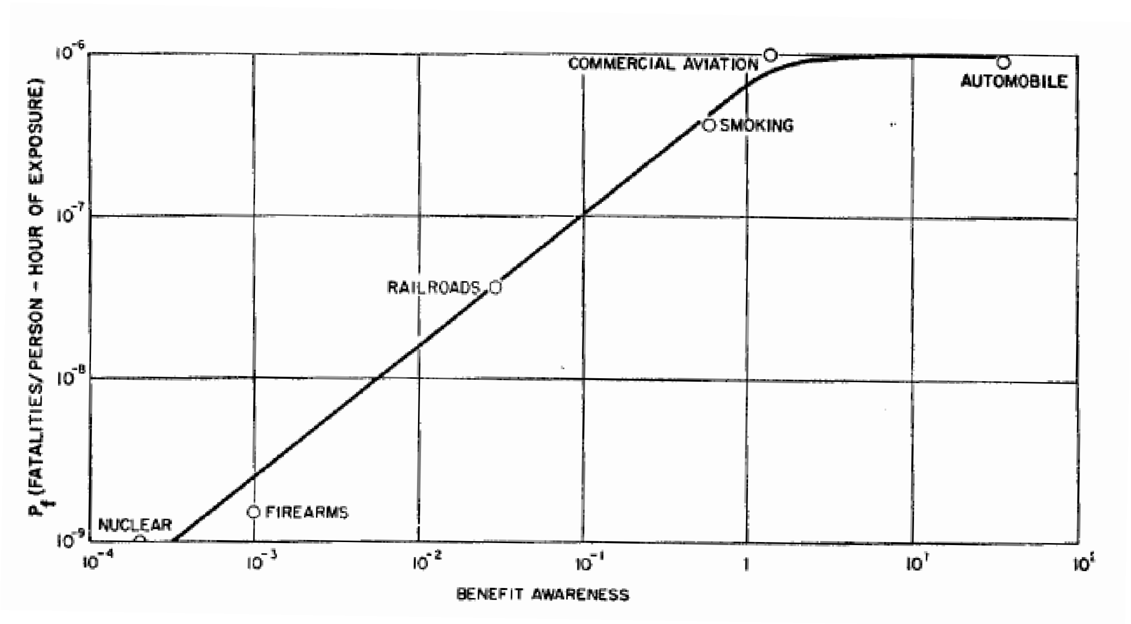

Figure 13 Accepted risk plotted relative to benefit awareness (Source: Starr, 1969, p. 1236)

Critics of this perspective see deficiencies of this approach in its lack of empirical evidence in terms of probability of occurrence and damaging effect. A further shortcoming can be seen in the lack of public trust and acceptance for analytical risks. Loss of trust in analytical sciences as well

[44] Markau (2003, p. 26), however, points out that until today there is no explicit answer to the question "How safe is safe enough?".

as a growing request and desire of the public to influence future development resulted in a necessary integration of psychological, social and cultural aspects into risk research (Markau, 2003, p. 26).

- **Psychological-cognitive approach:** While the formal-normative approach focused on “objective risk”, the psychological-cognitive approach addresses the actual (individual) decision behaviour and therefore focuses on “subjective risk”. Inquiries serve to collect empirical data about decisions in order to examine influencing factors and attitudes towards risks and to analyse how humans assess existing risks in a specific situation (Bechmann, 1993, 12). Interdisciplinary dialogues still address the differentiation between subjective and objective risk. While Bechmann (1993, 12) acknowledges that an “objective risk” only exists when there is sufficient data for a solid statistical analysis, Markau (2003, p. 27) feels that it is doubtful there are objective risks at all.
  This approach was criticised for its negligence of important social and political influencing factors (Markau, 2003, p. 27) as well as its inability to provide evaluations of risk which are supported by the population (Bechmann, 1993, 14).
- **Cultural-sociological approach:** This approach addresses factors that make people conceive a certain opinion on existing, technical risks. Thus, it is not the subjective decision itself which is the centre of attention, but identifying the reason for the emergence of controversies. The distribution of people’s opinions serves to describe and determine conflicts within a society as well as roots of conflict potential (Fleischhauer, 2004, p. 51). Perception and attitude towards risks depend on the public opinion. It is also important to look at the purpose of technology. This purpose in turn depends on general attitudes towards underlying values (Bechmann, 1993, pp. XV–XVI). According to Markau (2003, p. 28), this approach will become more essential and popular in the future due to the increasing importance given to public acceptance of decisions. However, when dealing with risks in spatial planning, Greiving (2002, p. 28) suggests that considering decision processes conforms with the understanding of planning to organise problem-solving and related decisions in an efficient and rational way. This perspective matches the first approach which employs a decision-related use of the term risk (see below).

The different concepts of risk or their respective risk perception depend on different individual interests (Markau, 2003, p. 25) and differentiate in the way in which adverse effects of certain actions are assessed and evaluated (Greiving, 2002, pp. 11–12). These different interests and perspectives in turn require a trans-disciplinary dialogue (Markau, 2003, p. 26), so that conflicts can be avoided and communication be facilitated. In order to grasp definitions specific to spatial planning, the term risk needs to be further examined. A clear differentiation within the risk context has to be made as well as a specific integration into the spatial planning related context. It is worth noting that spatial planning requires a spatial perspective and a planning-related definition, as it cannot be simply classified into one of the above-mentioned approaches[45]. In contrast to other disciplines, spatial planning focuses on a pre-defined space instead of a specific sector or topic. While sectoral planning focuses on particular sectors, objects or environmental media, spatial planning is integrative and comprehensive due to its spatial approach. This

[45] For more detailed information on the different perspectives and approaches see Banse and Bechmann (1998), Renn (1992) or Scholles (1997).

means that a focus on single (natural) hazards is not sufficient[46] (Fleischhauer, 2004, p. 163; Greiving, 2006a, p. 76).

An existing DIN-Norm (DIN 31000:2009, Risk management – Principles and guidelines), which provides principles, a framework and a process for managing risks, defines risk as a product of extent of damage and probability of occurrence (International Organization for Standardization, 2009). Such a definition of risk, however, is primarily supported by the natural science and technical perspective as well as the insurance perspective (Greiving, 2002, p. 12). The former perspective deals with technical failures, natural hazards and damaging effects of the environment on human health, thus being considered as (technical) safety research (Banse and Bechmann, 1998, p. 30). It also addresses uncertainties related to analyses or prognoses of effects (Scholles, 1997, p. 24). For the latter perspective risk signifies the uncertainty of future situations and events. Also, the actual damage plays an important role[47] (Banse and Bechmann, 1998, p. 29). Furthermore it focuses on the calculability of risk (Scholles, 1997, p. 24). This is why Renn (1992, p. 56) refers to this perspective as "actuarial approach" that uses statistical predictions.

According to Greiving (2002, pp. 72–73) and Birkmann (2008, p. 9), dealing with risk in spatial planning is mainly influenced by the natural science and technical perspective as well as the decision theory perspective. The decision theory perspective attempts to set up criteria for rational actions which the respective actor applies (or should apply), in order to reach a satisfying result (Banse and Bechmann, 1998, p. 34). Greiving (2002, pp. 72–73) explains that a mere focus on hazards and damages following the natural science and technical perspective does not meet the purpose of spatial planning. One of the tasks of spatial planning consists in addressing the implementation of predefined goals spatially in a way that allows societal actors to achieve their preferred goals. This purpose or task of spatial planning involves choices and decisions, which is why the natural science and technical components of risk – i.e. probability of occurrence and extent of damage – have to be complemented by a component closely related to decisions themselves. After all, spatial planning may directly and indirectly influence the occurrence and the extent of a disastrous event through planning decisions (see above). Therefore, in addition to the aspect of calculability, a planning-related definition of risk has to include the aspect of verifiability with regard to planning decisions taken[48] (Fleischhauer, 2004, p. 48). This is the perception that is also applied within this research work.

A future increase in extreme weather events and a more frequent occurrence of natural hazards are very likely. The risk in certain areas is expected to increase due to an ever growing urban development and a growing housing demand. Both components of risk – hazard and vulnerability – are likely to increase as a result of projected climatic changes. Efforts should be made to promote disaster risk reduction by reducing the vulnerability towards damaging events since the occurrence of a hazard cannot be fully prevented. Reducing vulnerability can be achieved by avoiding additional exposure to natural hazards, by reducing the susceptibility of elements at risk and by increasing the capacity to cope with natural hazards. The next

[46] Therefore, according to Greiving (2006a, p. 76), a multi-hazard risk approach is needed: *"All relevant hazards that threaten a certain area as well as the vulnerability of this area have to be considered instead of an area of science (sectoral, like in many natural sciences)."*

[47] As a consequence *"the expectation of a damage in the insurance business is defined as the product of probability and extent of damage [...]"* (Banse and Bechmann, 1998, p. 30).

[48] Markau (2003, p. 22) notes that the existence of a risk necessitates the decision to expose oneself to a potentially harming or damaging situation. Such a decision allows exerting a certain degree of control about the situation and wielding influence.

chapter will therefore explain the concept of risk governance, which encompasses ways to deal with existing risks (reduce or minimise risks) and to avoid an increase in risk.

3.2 Dealing with disaster risks in Europe

Reducing or avoiding disaster risks has turned into a global goal, especially since the adoption of the Hyogo Framework for Action (HFA) in 2005. A legal basis is needed to effectively implement measures to reduce and avoid risks. National frameworks should be established to set standards for how to deal with natural risks that then need to be followed nationwide and that provide a legitimate basis for further decision-making processes. Such a regulatory and legal framework is essential, as it determines *"the relationship, roles and responsibilities of the actors and co-ordination mechanisms such as markets, incentives or self-imposed norms"* (IRGC, 2006, p. 22). Llosa and Zodrow (2011, p. 1) further explain that *"these laws may dictate – or encourage – policies, practices, processes, the assignment of authorities and responsibilities to individuals and/or institutions, and the creation of institutions or mechanisms for coordination or collaborative action among institutions"*. Pelling and Holloway (2006, p. 7) point out that a national legislation on disaster risk can be used to provide penalties and incentives in order to follow rules under compulsion, e.g. by enforcing standards in construction and land use. Legislation can also serve to empower existing actors or to set up new entities with new responsibilities. As a consequence, a national legislation can promote risk reduction and support a resilient community development. This requires the establishment of according standards and norms and of an efficient risk governance framework including the integration and coordination of all actors involved. Moreover, a legal basis for dealing with disaster risk also determines ways to analyse risks and produce risk information as well as how to use this information in spatial planning.

Today the majority of countries have introduced some form of risk-related legislation or are currently within a process of enactment (UNDP, 2007, iv; UNISDR, 2013, p. 11). However, once elaborated, disaster risk legislation is yet subject to continuous amendments. New information on the impacts of climate change as well as advancements in hazard and risk modelling may make it necessary to continuously adjust and update legislation in order to enable adequate hazard and risk assessments and to ensure adaptive responses (Cardona et al., 2012; Llosa and Zodrow, 2011, p. 1; UNDP, 2007, xiv). At the European level, there is no common, comprehensive framework for risk reduction. Instead, risk reduction is managed through sectoral directives, such as the Seveso Directive and the Flood Risk Directive (Llosa and Zodrow, 2011, p. 3). Furthermore, both the political-administrative system as well as the legal framework significantly determine how risk assessments should be carried out and how to use this information in the planning process. As a consequence, due to the lack of an overarching EU framework and due to prevalent differences in national legislative and administrative systems, national approaches of assessing disaster risks differ throughout the EU.

Not only are adequate national policies and a legal basis needed in order to achieve risk reduction and a more resilient society. In addition, an overarching framework that effectively implements such policies and laws into practice and ensures the pursuing and achieving of respective objectives is crucial. The UNISDR (2013, p. 11) recognised that the establishment of legal and policy frameworks provides a structure for disaster risk reduction (DRR). It does, however, not always lead to immediate results in form of effective action. Laws and policies are an essential prerequisite that establish a basis for dealing with natural hazards. However, an actual, successful implementation also depends on other factors such as the coordination of actors involved as well as a potential reconciliation between a diversity of roles, goals and activities (IRGC, 2006, p. 11). The contemporary shift away from a traditionally top-down oriented approach to multi-level governance systems characterised by an involvement of various actors requires new ways of coordination and cooperation. Forms of governance have experienced popularity in the last decade, because governance intends to *"enlarge the perspective on policy, politics, and policies by acknowledging that government is not the only actor in managing and organizing societal and political solutions"* (Renn et al., 2011, pp. 232–233).

3.2.1 Risk governance

As compared to a traditional top-down approach ('government'), governance is characterised by involving different types of actors and applying alternative – or new – ways of governing and coordinating (Just et al., 2006, p. 1). Governance describes often complex interplays between different actors and the coordination of societal issues and planning processes (Benz, 2004, pp. 12–13; Dietz, 2007, p. 162). According to Benz (2005, pp. 406–407), the main features of governance processes in contrast to 'government' consist in:

- Connecting governing and self-governing: i.e. the collaboration of actors to reach common objectives complements the control executed by governmental institutions;
- Targeting an integrated policy through strategic coordination;
- Promoting coordination through cooperation between different actors and organisations;
- Representing a combination of governing (top-down), incentives, competitions and negotiations;
- Comprising both formal and informal elements.

Risk governance is a concept that tries to enhance the disaster resiliency of a society (Fleischhauer, 2006a, p. 10) and includes *"the totality of actors, rules, conventions, processes, and mechanisms concerned with how relevant risk information is collected, analysed and communicated and management decisions are taken"* (IRGC, 2006, p. 22). Accordingly, risk governance encompasses several aspects of risk. The concept of risk governance is introduced because it is of vital importance for dealing with risks and preparing for disasters. It touches on aspects related to dealing with risk information in spatial planning in the sense that it involves the essential element of risk assessment, which is a prerequisite for producing risk information. In addition, it is also concerned with risk-related decision-making which comprises several actors and thus requires coordination among different interests and concerns[49] (IRGC, 2006, p. 11). First, this implies the need for a collaborative approach between governmental and private actors. Natural hazards pose risks to society beyond what single authorities can deal with. Instead, multiple stakeholders need to coordinate their activities (IRGC, 2006, p. 22). Second, decisions concerning natural risks and risk reduction constitute value judgements and therefore require acceptance of all actors involved in order to ensure legitimacy of decisions. This holds particularly true for decisions made under uncertain probabilities of occurrence and uncertain extents of an event (Biermann, 2007, pp. 433–434; van Asselt, 2005, p. 129), as the social acceptance of responses to risk associated with uncertainty is critical (Renn et al., 2011, p. 237). Consequently, communication plays an essential role as well. It does

[49] In fact, problem-solving and decision-making capacities of single actors are restricted, which is why coordinated efforts are needed that involve and bring together a variety of actors concerned by the topic one way or the other (IRGC, 2006, p. 11).

not only involve mere information about risk, but also involvement and participation of a wide range of different actors and stakeholders[50]. Finally, it is important to mention that risk governance also has to consider contextual factors like institutional characteristics such as the legal framework as well as the cultural aspects, e.g. differing risk perceptions (IRGC, 2006, p. 22).

To summarise, three elements of risk governance can be recognised: risk assessment (including the assessment of hazards and vulnerability), risk management and risk communication (communication of assessment and management activities). Combining all three elements leads to an ongoing process of risk governance, the "risk governance cycle" (see Figure 14) (Fleischhauer, 2006a, p. 10). Risk management in turn is again characterised by different phases of management (prevention, preparedness, response, recovery), which can be depicted in their proper "disaster risk management cycle". Appropriate activities and measures in all phases of the disaster risk management cycle promote vulnerability reduction, greater preparedness, better warnings and more effective response. Two of the stages (prevention and preparedness) relate to a period before an event occurs, while recovery and response transpire after an event (Paul, 2011, p. 157).

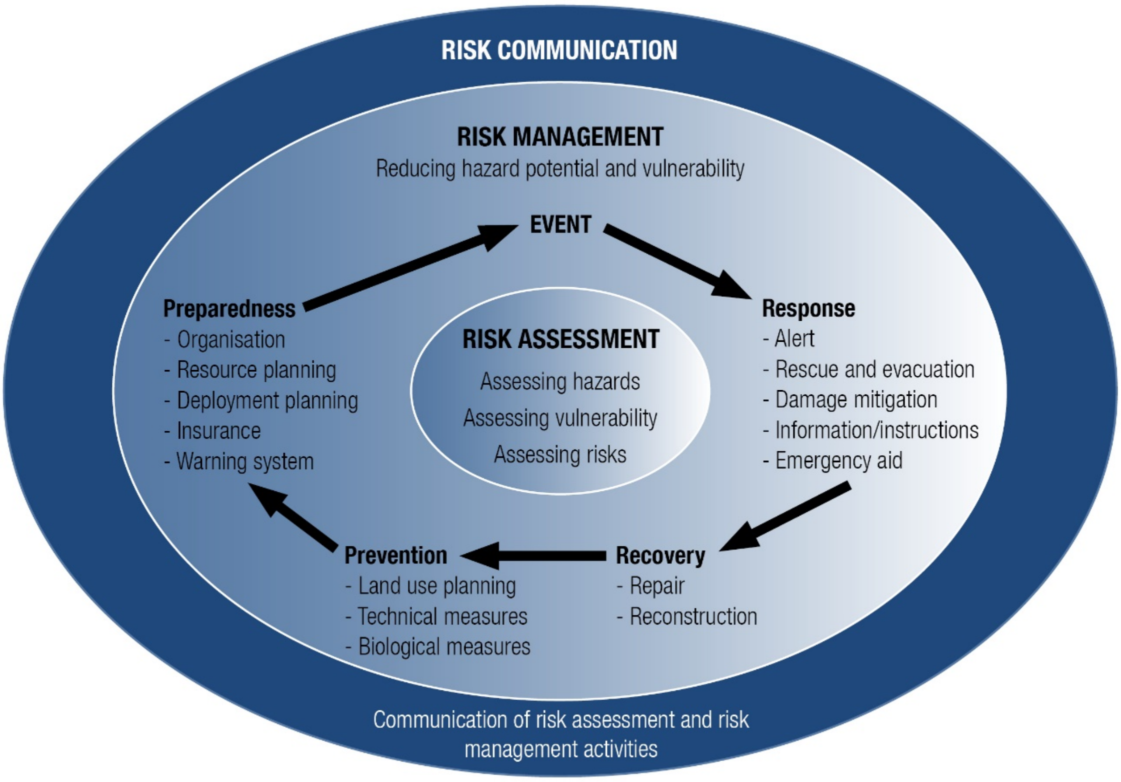

Figure 14 Risk governance and the disaster risk management cycle (Source: recreated and slightly altered from Fleischhauer, 2006a, p. 11)

[50] The term „stakeholder" involves any individual, group of individuals or organisation that has a legitimate interest (stake) in the issue at hand, those who are possibly affected – directly or indirectly – by decisions, actions, plans or policies (Baede et al., 2007, p. 87). The term „actor" refers to individuals or entities that serve as agents in decision-making. According to Scharpf (1997, p. 41) these individuals or entities *"are actually involved in the policy process"* and their *"choices will ultimately determine the outcome"*. While there are overlaps between the terms and while an actor is usually also a stakeholder, a stakeholder is not necessarily an actor.

Prevention can be understood as the limitation of negative impacts and damages caused by hazards and disasters well before the actual disaster event occurs[51]. It involves actions taken and decisions made to reduce the threat that can be either directed towards reducing the hazard or the vulnerability. It can incorporate both structural or non-structural measures (Alexander, 2002, p. 5; Godschalk et al., 1999, p. 5). Structural measures aim at strengthening buildings and infrastructures and refer to building protective constructions, employing building codes or making use of engineering works. Non-structural measures involve spatial planning related measures (e.g., directing new development away from hazard exposed areas or maintaining protective structures such as forests or sand dunes) and evacuation plans. Preparedness involves knowledge and capacities as well activities and decisions taken by governments, organisations, communities and individuals, in order to effectively anticipate, respond to, and recover from hazardous or devastating impacts. Response means the provision of emergency aid and services during or right after an event to reduce the loss of lives and further health impacts and focuses on immediate and short-term support. Recovery includes decisions and activities which aim at restoring and improving facilities and living conditions of the affected population after a disaster has occurred.

Spatial planning can significantly contribute to reducing the vulnerability of a society to natural hazards. This can be achieved by taking adequate measures that are based on a reliable evidence base, i.e. on reliable risk assessments, and that are complemented by an appropriate communication strategy (Fleischhauer, 2006a, p. 10). Spatial planning has competencies in all phases of the disaster risk management cycle. However, its main role lies in the prevention of risks and actions taken during the recovery phase. Due to the overall significance of risk assessments for this research topic, the individual components of risk assessment will now be further outlined. The risk management phase is not the centre of attention of this study, which is why this component of risk governance will not be described in detail. Finally, the importance of risk communication related to the use of risk information in spatial planning and SEA will be shortly presented.

3.2.2 Risk assessment

The assessment of risk is of vital importance for determining appropriate risk reduction strategies. This has been highlighted by the HFA which explains, that

> *"the starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters that most societies face, and of the ways in which hazards and vulnerabilities are changing in the short and long term, followed by action taken on the basis of that knowledge"* (UNISDR, 2005, p. 7).

Moreover, the UNISDR (2015, p. 16) underlined in its subsequent Sendai Framework that in order to achieve a better understanding of disaster risk (Priority 1 of the Sendai Framework) it is important

[51] It is important to point out, that the term "prevention" is often used interchangeably with the term "mitigation" in DRR research, although in fact they have different meanings. The IRGC (2006, p. 80), for instance, provides two distinct definitions by stating that risk prevention refers to *"measures to stop a risk being realised*", while risk mitigation refers to "*measures to reduce the impact of a realised risk"*. Often, the complete avoidance of losses or damages by taking prevention measures is not feasible, which is why usually it rather needs to be spoken of mitigation measures. Spatial planning, however, has instruments at hand that indeed aim to prevent disasters. Besides, the term "mitigation" is used differently in climate change research. For convenience and to avoid confusion, this study therefore makes use of the term "prevention" to describe both aspects (prevention and mitigation in disaster risk research).

> *"to enhance the development and dissemination of science-based methodologies and tools to record and share disaster losses and relevant disaggregated data and statistics, as well as to strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems".*

Knowledge about the level of risk is a prerequisite before taking political decisions and appropriate action. As Greiving (2002, p. 38) explains, risk assessment is a type of applied policy analysis as it involves several elements of evaluation. It is not just a simple assessment based on natural scientific approaches. Instead, risk assessments are also based on policy- and socially-influenced subjective and projected appraisals (i.e. risk evaluation) with the aim to create an evidence base for political decisions. Despite the inclusion of risk evaluations, risk assessment primarily constitutes a scientifically-led process which is based on empiric data and scientific findings, while risk management is based on economically, technically and politically oriented reflections, which form the basis for weighing up processes and decisions for risk management measures (Wanczura, 2010, p. 59). It is therefore crucial to separate risk assessment from risk management and to distinguish between a scientific, factual assessment of risks on the one hand and normative decisions for managing risks on the other hand.

Risk assessments produce an estimation of the risk by showing the probability distribution of expected impacts (IRGC, 2006, p. 26). Overall, risk assessment can be defined as

> *"a methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend"* (UNISDR, 2009a, p. 17).

To sum up, results of risk assessments are therefore statements about probabilities or frequencies as well as intensities/magnitudes or consequences of potentially damaging effects (Hollenstein, 1996, p. 22).

Risk assessments differ and they depend on the respective source of risk they are addressing. This study follows the understanding of risk assessment as outlined by the IUGS (1997, p. 12) which regards risk assessment as a process of risk analysis and risk evaluation (see Figure 15). Risk analysis intends to

> *"estimate the risk to individuals or populations, property, or the environment, from hazards. The process of risk analysis usually consists of hazard identification, hazard assessment, elements at risk/exposure analysis, vulnerability assessment and risk estimation"* (van Westen et al., 2011, p. 7).

Risk evaluation is then the step

> *"at which values and judgements enter the decision process, explicitly or implicitly, by including consideration of the importance of the estimated risks and the associated social, environmental, and economic consequences, in order to identify a range of alternatives for managing the risks"*[52] (van Westen et al., 2011, p. 7).

[52] The IRGC (2006, p. 27) names three core components of risk assessment which basically comply with those of the IUGS (1997): a) the identification and estimation of hazard; b) the assessment of exposure and/or vulnerability, c) an estimation of risk combining the likelihood and the severity of the targeted consequences based on the identified hazardous characteristics and the exposure/vulnerability assessment.

Finally, both the analytical risk and the socially-accepted or tolerated risk are the basis for risk management and for selecting strategies and measures of risk reduction (Hollenstein, 1996, p. 24; Markau, 2003, p. 70).

Figure 15 Stages of risk assessment (Source: recreated from van Westen et al., 2011)

Many risks are systemic and cannot be captured by a simple cause-response model or be calculated as a function of probability of occurrence and consequences[53] (Renn et al., 2011, p. 234). Systemic risks are usually characterised by a high degree of complexity, uncertainty and ambiguity (OECD, 2003). These three characteristics constitute major challenges for risk assessment (IRGC, 2006, p. 29). Complexity, uncertainty and ambiguity do not refer to the intrinsic characteristics of hazards or risks themselves but result from a lack of knowledge – or quality of knowledge – about risks in their entirety (IRGC, 2006, p. 29; Klinke and Renn, 2006). The IRGC (2006, p. 29) acknowledges that the validation of results of risk assessments is insofar particularly difficult as in order to prove that characteristics of analysed risks were correctly assessed one would need to wait indefinitely. In cases where the relationship between cause and effects becomes difficult to discern and where effects are difficult to interpret, the validation of risk assessment outcomes constitutes a major problem. Consequently, sophisticated scientific investigations are needed to characterise available knowledge regarding complexity, remaining uncertainties and ambiguities (GACGC, 2000, pp. 194–195; IRGC, 2006, p. 29). The following paragraphs will closer examine difficulties related to complexity, uncertainty and ambiguity, because of their significance for carrying out sound risk assessments. Moreover, as spatial planning is concerned with the future use of land, it is directly concerned with handling complexity, uncertainty and ambiguity, which is why a basic understanding of these challenges is needed.

[53] Renn et al. (2011, p. 234) explain that *"the term 'systemic' describes the extent to which a risk is embedded in the larger contexts of societal processes*" and that systemic risks require *"a more holistic approach to hazard identification, risk assessment, and risk management, because investigating systemic risks goes beyond the usual agent-consequence analysis"*.

Complexity *"refers to the difficulty of identifying and quantifying causal links between a multitude of potential causal agents and specific observed effects"* (IRGC, 2006, p. 29). Complex systems imply that essential aspects of the overall system cannot be grasped and understood by an analysis of its separate parts (GACGC, 2000, p. 194). Interactive effects among these agents (synergism and antagonisms) as well as long delay periods between the cause and the effect do not allow for a well-defined functional relationship between a cause and an effect to assess the probabilities of damage (IRGC, 2006, pp. 29–30; Klinke and Renn, 2006; Renn et al., 2011, p. 234; Renn and Klinke, 2013, p. 2038). Due to this complexity, a full assessment of all possible interactions that would be required for an exhaustive risk calculation is not attainable. This is particularly relevant for modelling low probability events that do not dispose of any data based on past experience or historical time series (Greiving, 2002, p. 43). In case of complex risk problems, Klinke and Renn (2006) suggest that deliberation among experts is required. They therefore advise *"to bring the best expertise together and regulate on the basis of the state-of-the-art knowledge in risk assessment"* (Klinke and Renn, 2002, p. 1086). While the involvement of public concerns and perceptions is not advisable in this case, assessment methods applied by scientists such as cost-effectiveness methods are deemed appropriate instruments to cope with complex phenomena. Such an "epistemological discourse" aims to most adequately and distinctly describe and explain problems related to risk in a preferably homogenous and consistent manner (Klinke and Renn, 2006). As a consequence, experts in risk assessment play a significant role when it comes to complexity in risk situations.

The second characteristic, uncertainty, *"relates to the limitedness or even absence of scientific knowledge (data, information) that makes it difficult to exactly assess the probability and possible outcomes of undesired effects"* (Renn et al., 2011, p. 234). As data availability is sometimes scarce, some results in risk assessment will be based on assumptions and estimations[54]. This means that deterministic findings cannot be made, as not even experts and scientists are able to fully determine probabilities and damage potential. Besides, both intensity and frequency usually need to be assessed by using estimations (Greiving, 2002, p. 42). In this context the German Advisory Council on Global Change (GACGC) (2000, p. 38) explains that risk assessments can only represent approximations of the objective hazard due to the uncertainty about the occurrence of a future event. Again this causes difficulties in assessing low probability events, as the objective hazard can only be known after the actual event has occurred.

Dealing with natural hazards is always subject to uncertainty. It is caused by different factors, such as statistical and natural variations, measurement errors, non-existing data, ignorance and missing knowledge (Greiving, 2002, p. 42; Klinke and Renn, 2002, p. 1085). Klinke and Renn (2002, p. 1086) acknowledge that acquiring additional knowledge may help to reduce uncertainty. However, due to the nature of the hazard, knowledge about exact probabilities is often not available or not attainable. Furthermore, scientific data and information about natural hazards can only be a first step in risk evaluation. Thus, if additional knowledge cannot reduce the level of uncertainty, or if immediate action is required without having yet obtained additional knowledge, the so-called "precaution-based risk management" (Klinke and Renn 2002) should be applied. This management approach is characterised by developing better ways to tolerate and accept uncertainties. A crucial point can be seen in finding an

[54] This is the reason why it is important to make assumptions, proxies used and estimates used explicit and to communicate any problems related to data (CEC, 2010, p. 13).

adequate and broadly accepted balance between too much precaution – by implementing strong measures of precaution – and too little precaution. However, unfortunately there is no scientific solution to this problem (Klinke and Renn 2006). Therefore, Klinke and Renn (2011, p. 241) hint at the necessity to involve stakeholders and public interest groups for enabling a reflective process that allows expressing and weighing up concerns, economic powers and social preferences.

Finally, ambiguity relates to *"different legitimate viewpoints from which to evaluate whether there are or could be adverse effects and whether these risks are tolerable or even acceptable"*, which is why it *"refers to the existence of multiple values"* (Renn et al., 2011, p. 235). These different viewpoints, beliefs and values require the involvement of those who express them. As a consequence, discourse processes and management tools are needed in order to make these wider concerns tangible for managing existing and future risks (Klinke and Renn, 2002, p. 1087). Where ambiguity is present, deliberative processes such as participatory discourses help to resolve differences in values and viewpoints. They are an adequate means to find solutions that are compatible with various interests and concerns of all the people affected (Klinke and Renn, 2006). After all, the ultimate objective of risk management in the face of ambiguities is reaching a consensus between those who consider the risk acceptable and those who rate the risk as intolerable (see below) (Klinke and Renn, 2002, p. 1087).

For these three major characteristics of risk pose specific challenges for risk assessment, they also entail consequences for spatial planning. Knowledge about complex systems we live in will always be incomplete and a degree of uncertainty in predicting and modelling future changes in general and natural hazards in particular will therefore always remain. This fact leads to the necessity to discover ways how to best cope with developments that cannot be predicted (Berkes, 2007, p. 285). Uncertainty in particular constitutes a major challenge for spatial planning. Therefore, strategies are required how to deal with and communicate uncertainties in spatial planning.

Risk analysis

According to the GACGC (2000, p. 38), risk analysis

> *"is the attempt to determine qualitatively and, as far as possible, quantitatively by means of scientific methods and as accurately as possible the probabilities of occurrence of concrete damage or the probability function of the magnitude of damage".*

In other words, risk analysis provides information about extent and probability of expected damages and addresses the question: What is the likelihood that something happens to what extent? (Hollenstein, 1996, p. 21; Markau, 2003, p. 70).

Risk analyses are supposed to define, as objectively as possible, the expected damage potential (GACGC, 2000, p. 38). Due to the fact that risk analysis deals with an objective ascertainment of facts, not with normative goals and values, the determination of these aspects should be achieved by applying scientific methods, mainly natural science and mathematical methods (Hollenstein, 1996, p. 22). These methods can be based on observations of physical processes as well as risk modelling, prognoses and scenario development (GACGC, 2000, p. 38). They may involve subjective estimations (e.g. for a specific parameter with no historical records), but they may not involve subjective valuations (e.g. concerning the legitimacy of a condition). The definition of the term "damage" itself, however, already constitutes an evaluation which can only be made in a normative and not in an objective way (Greiving, 2002, pp. 40–42). Nevertheless, attention should be paid at primarily focusing on empirical and mathematically calculable data during risk analysis and to only involve risk perceptions when evaluating the risk.

The identification of hazards is the starting point for analysing risks. The process consists of both, identifying and characterising potential natural hazards. Within this step the particular types of hazards and their processes (e.g. types of flood, landslide, rock fall processes) as well as their spatial patterns are identified. The investigation intends to identify all those hazardous events that might occur within a confined area. Natural hazards can usually be identified quite easily: many processes are quickly recognisable due to experiences with former events, existing records or indirect hints, such as high water marks (Hollenstein, 1996, p. 59; Markau, 2003, p. 73). Findings are based on an examination of the topographical, geomorphological, hydrological and natural conditions of an area. Such information is needed to determine the likelihood of occurrence of a hazardous event, as specific conditions of an area (e.g. in terms of relief, soil characteristics and mean annual precipitation) influence the triggering of a hazard (e.g. a flood or a landslide). In addition to recognising the possibility of adverse effects, hazard identification also consists of assessing the strength of cause-effect relationships (IRGC, 2006, p. 29).

After identifying a hazard, it has to be assessed in terms of its specific characteristics. Hazard assessment is

> *"the process by which the probable future occurrence of a dangerous phenomenon, of determined intensity, in a particular place and within a defined time period, is determined. It provides information on the estimated return period and the geographical location of probable events"* (MOVE, 2011a, p. 6).

Accordingly, hazard assessment deals with a) the probability of occurrence, b) the intensity (or magnitude) of the event, c) a particular area concerned and d) a specific period of time. The probability of occurrence of a natural hazard declines with its intensity. This means: the higher the damage potential, the lower the frequency. While potentially damaging effects, e.g. in terms of damages or losses of life or goods, can be measured, there is no clear method for determining the probability of occurrence (GACGC, 2000, p. 37). The probability of occurrence gives information about the relative frequency in which an event under constant conditions in a long period of time is expected to happen (GACGC, 2000, p. 38). Probabilities of occurrence or frequencies are estimated by analysing historical data and records of past events[55]. A distinction can be made between statistical and probabilistic methods: A statistical analysis can determine the intensity and frequency of events based on experiences of past event variability. Such an approach is primarily applied for frequently occurring events or if the event is merely an extreme value of a continuously observable parameter (Hollenstein, 1996, p. 60). Should a large amount of data be available, the level of uncertainty can be low (Markau, 2003, p. 74). A probability assessment aims to define the intensity and probability of events based on parameters of various system elements. Knowledge about the system and its elements is therefore a necessary precondition for probabilistic assessments. Usually, due to the complexity of natural systems, probabilistic assessments require great expenses. The main benefit of this approach is that assessments are independent of past events. This means that information on

[55] For landslide processes, for instance, using historical data is certainly useful. It should be added, however, that historical data for landslide events are always incomplete information, as they mainly cover larger scale events and do not necessarily consider events with smaller magnitudes (Greiving et al., 2013, p. 3).

intensity and probability can be provided even before an actual damage occurs (Markau, 2003, p. 75). Probabilities and frequencies can be expressed as return periods, which constitute the time interval during which an event of a predefined intensity occurs once.

After the hazards are assessed, they are typically presented in a hazard map[56] (Burby et al., 2000, p. 102). The first hazard maps were merely based on an analysis of past events. This means they illustrated and depicted those areas which have been affected by a hazard in the past, e.g. the spatial extent of a flood event. Today, more specific hazard maps can be produced and provided. Based on prognoses and scenarios, estimations can be made concerning the potential occurrence and spatial extent of a damaging event. Such estimations can be made for different return periods. This is the case for the development of flood hazard maps as required by the EU Flood Risk Directive (FRD) (CEC, 2007b), which asks for the provision of hazard maps for three return periods. According to the directive, hazard maps need to be prepared which show the extent and expected water depth in three scenarios (or return periods): an extreme event scenario (e.g. a return period of 300 years), a medium probability scenario (a return period of 100 years) and a high probability scenario (e.g. a return period of 50 years). Such maps make it possible to account for events even with a very low probability (extreme events). Making decisions only on the basis of information about past events does not necessarily take into account the possibility of extreme events. This is why new types of hazard maps can be of particular interest and importance for spatial planning and planning-related decisions.

After analysing the hazard, related exposure and vulnerability need to be assessed. Exposure is understood as the *"contact of the hazardous agent with the target (individuals, ecosystems, buildings, etc.)"* (IRGC, 2006, p. 27). Exposure basically indicates the degree to which respective elements at risk are exposed to a certain hazard (van Westen et al., 2011, p. 1). Exposure assessment therefore focuses on an analysis of the number of elements at risk that are overlapping with a hazard scenario in a particular area (Greiving et al., 2013, p. 11). Elements at risk are *"the population, properties, economic activities, including public services, or any other defined values exposed to hazards in a given area"* (van Westen et al., 2011, p. 4). Elements at risk can be classified and their respective amount be characterised in different ways (e.g. number of buildings, people, the economic value of an asset).

Vulnerability assessment is closely connected to exposure or elements at risk assessment, as vulnerability describes the degree of a parameter to experience damage or loss as a result of exposure (IRGC, 2006, p. 27). Despite differences in understanding, interpreting and defining vulnerability, common to the term is that vulnerability is considered (van Westen et al., 2011, p. 5):

- Multi-dimensional (e.g. different factors such as physical, social, economic, environmental, institutional, and human, define vulnerability);
- Dynamic (the degree of vulnerability is dynamic and changes over time);
- Scale-dependent (vulnerability can be related to different scales and to different spatial resolutions);
- Site-specific (vulnerability is specific to one particular factor and is therefore dependent on the respective site, which is why each area might need a separate approach).

[56] Hazard mapping is important for spatial planning, especially at the local level, as maps inform local decision-making. The purpose and use of hazard maps for spatial planning will be explained in detail in Chapter 4.2.

When focusing on the exposure and susceptibility of structures, vulnerability assessment involves the analysis of the source of hazard and its characteristics (probability, intensity, extent) as well as the exposure of human structures and their characteristics. Therefore, the degree of vulnerability depends on the current status quo of human settlements and infrastructures (Markau, 2003, p. 77). Analysing vulnerability consists of two main steps (Markau, 2003, p. 77):

- **Valuation or value assessment**: Within this step the damage potential of elements at risk is inventoried and evaluated.
- **Damage assessment**: Based on the value assessment, this step involves an assessment of the expected damage for different event scenarios, considering different, existing mitigation measures.

Just like hazards can be presented on a hazard map, vulnerability assessments can be illustrated on a vulnerability map or elements at risk map, respectively. Vulnerability maps show human settlements or other man-made structures such as buildings, infrastructure or further physical elements. They may also present other sensitive or vulnerable elements (e.g. elements that are important to a community due to economic, social or ecological reasons). Hence, they intend to describe the vulnerability of an area towards a defined natural hazard (or several hazards). It has to be underlined, that a vulnerability map more or less only presents static information about a given vulnerability at a certain point of time (Greiving, 2006b, p. 186).

Risk estimation is the last component of risk analysis. It can be both quantitative, such as the probability distribution of adverse effects, and qualitative (e.g. a scenario construction)[57] (IRGC, 2006, p. 79). Hazard and risk analyses often aim to assess the level of threat from certain hazard types as accurately as possible by obtaining *"an objective, reproducible, justifiable and meaningful measure of risk"* (Glade et al., 2005, p. 9). This last step aggregates the results of hazard identification, hazard, exposure and vulnerability assessment and indicates for each degree of severity (risk impacts) a probability of occurrence (see Figure 16) (IRGC, 2006, p. 14). The integration of hazard analysis and impact analysis thus allows a calculation of the risk. For illustrating and conclusively evaluating the results, the information needs to be aggregated and presented in a comprehensible manner. The most popular way of presenting risk is by overlaying the hazard map with an elements at risk map in a Geographic Information System (GIS), thus illustrating the interaction between the hazard component and the elements at risk in an understandable way (van Westen et al., 2011, p. 4). While hazard maps indicate natural hazards by illustrating e.g. the extent and probability (return period) of a flood event, risk maps involve a quantification of the risk in terms of judgemental elements (e.g. the expected damage) (Greiving, 2002, p. 41; Markau, 2003, p. 88). Greiving et al. (2013, p. 11) further explain that for flood hazards, single flood extent maps for different return periods can be overlaid in a GIS with the elements at risk. Such an approach allows calculation of the number of elements at risk – or assets – affected in the area during the specific hazard scenario. For landslide hazards the hazard map is combined with the analysed elements at risk. Mapping elements at risk will help to construct a data base for finally evaluating the vulnerability of the assessed elements at risk for certain hazards (van Westen et al., 2011, p. 4).

[57] For more information on qualitative and quantitative risk estimation see Glade et al. (2005, pp. 27–29).

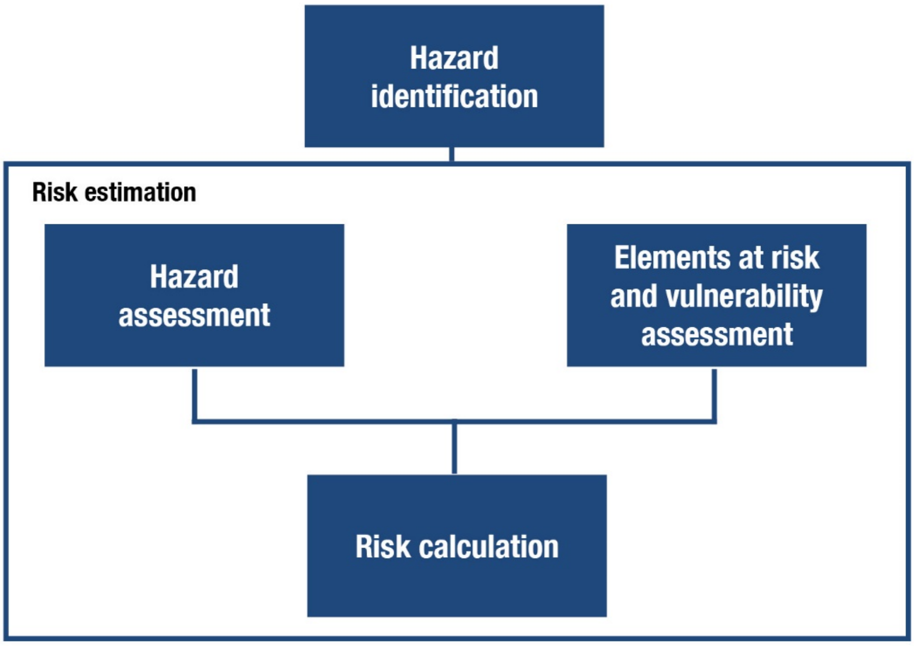

Figure 16 Process of risk estimation (Source: recreated and altered from Glade et al., 2005, p. 10)

Risk evaluation

Finally, risk evaluation comprises the result of risk analysis and risk perception. It can be defined as the process of determining *"the value-based components of making a judgement on risk"* (IRGC, 2006, p. 80) or *"the importance and relevance (significance) of the results of risk analysis with reference to the social and physical context within which they occur"* (Glade et al., 2005, p. 35). In other words, it aims to determine whether a given risk is tolerable, acceptable or intolerable. This means that risk assessment also includes whether a society accepts the outcome of the risk estimation, especially with respect to the current economic, social, political, cultural, technical and environmental premises and values (van Westen et al., 2011, 7-4-7-5). As a consequence, the consideration and analysis of the prevailing risk perception as shared by the majority of society is a prerequisite.

A so-called traffic light model presents a comparison of probability versus impacts, whereas three areas can be distinguished: acceptable (green area), tolerable (yellow area) and intolerable (red area) (see Figure 17) (Renn and Klinke, 2013, pp. 2044–2045). According to the IRGC (2006, p. 14)

> *"a risk deemed 'acceptable' is usually limited in terms of negative consequences so that it is taken on without risk reduction or mitigation measures being envisaged. A risk deemed 'tolerable' links undertaking an activity – which is considered worthwhile for the value-added or benefit it provides – with specific measures to diminish and limit the likely adverse consequences."*

Following this explanation of "acceptable" and "tolerable" a risk is "intolerable" when its negative consequences are detrimental to the extent that they cannot be accepted and unconditional reduction is required. Only if an exceptionally high future growth in benefit is to be expected, intolerable risks can turn into tolerable risks (GACGC, 2000, p. 218).

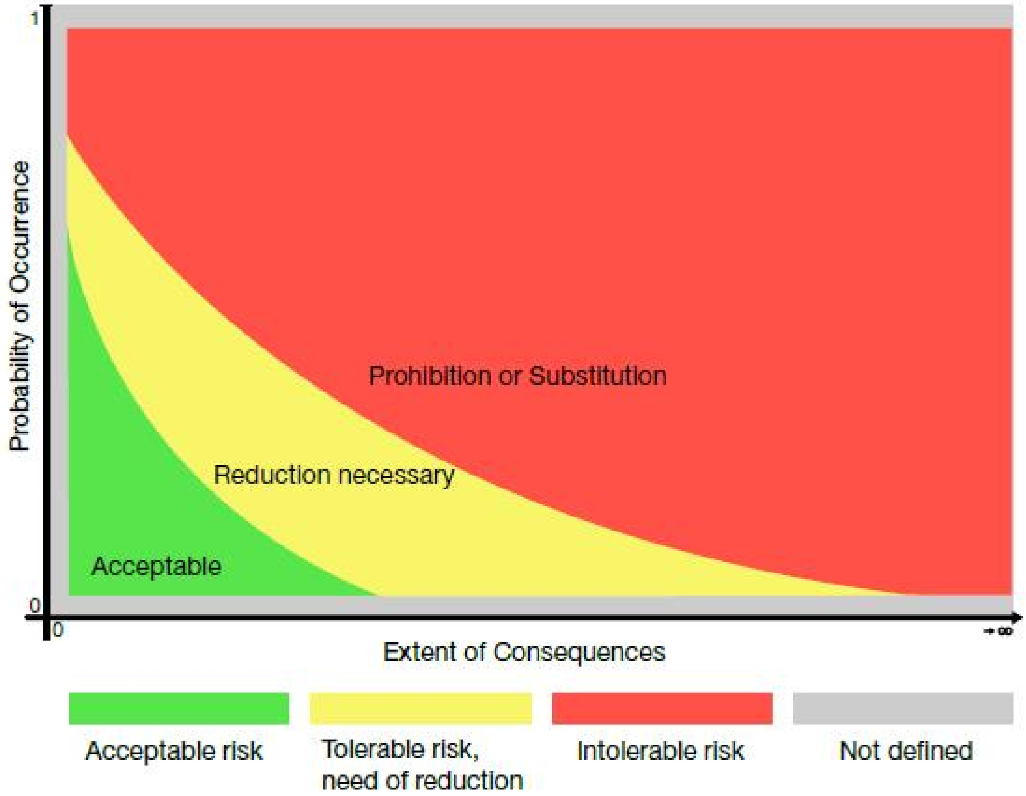

Figure 17 Acceptable, tolerable and intolerable risks illustrating the traffic light model (Source: IRGC, 2006, p. 37)

While risk analysis has already been explained in detail, the term "risk perception" now needs to be further defined. Risk perception is *"the outcome of the processing, assimilation and evaluation of personal experiences or information about risk by individuals or groups in society"* (IRGC, 2006, p. 80). It can be considered as *"an individual's interpretation or impression based on an understanding of a particular threat that may potentially cause loss of life or property"* (Bradford et al., 2012, p. 2300). It includes both a subjective feeling and a further, subjective judgement (Greiving and Fleischhauer, 2006, p. 114). Both feelings and judgements usually vary between individuals or groups of individuals as personal attitudes are dependent on many different factors, such as knowledge, experience, education, values and emotions[58]. They are strongly influenced by psychological, sociological and cultural aspects and views and may also be depending on the nature of the risk itself (Glade et al., 2005, p. 29). Therefore, an individual's perception of risk is also affected by how the community, society or a socio-cultural milieu deals with specific types of risks in general. Accordingly, a clear variation of risk perception in different cultural contexts can be perceived (Greiving and Fleischhauer, 2006, p. 114). It is therefore not only the level of risk itself that determines whether it is considered acceptable or not. In addition, it depends on individual or cultural standards and value judgements how people rate and respond to risks (GACGC, 2000, p. 29). Since individuals (or the public), institutions and the scientific community perceive risk differently, it is important that those responsible for developing risk management strategies and plans understand how a) the public views risks and b) those applying the provided information as evidence base deal with and employ this information.

[58] Furthermore, factors such as the familiarity with a risk, abilities and ways to control the risk or its consequences, proximity to the risk in space and time or scale of the risk influence an individual's perception (Greiving and Fleischhauer, 2006, p. 114).

Perceptions of risk cannot be left aside when dealing with community development. Even the scientific community subscribes to the view that scientific objectivity cannot provide for purposeful decision-making on risk issues (De Marchi and Ravetz, 1999, p. 744). In fact, risk perception forms policy and legislation and can therefore be incorporated in certain norms and practices (Greiving and Fleischhauer, 2006, p. 114). Risk perception also shapes mitigation and risk reduction measures, as the unacceptability of a current level of risk requires the implementation of risk reduction measures. A special aspect that needs to be considered in this context is the problem of uncertainty. Due to the fact that uncertainty inevitably enters into decisions on risk, the purely scientific side of risk assessment needs to be completed by said subjective feelings and judgements. Increasingly uncertain environments ask for an enhanced communication and dialogue with other actors within society. Building trust for the management of risk is a key issue when facing uncertainty towards an increased complexity. This will also help avoid forcing scientists into a position as decision-makers (De Marchi and Ravetz, 1999, pp. 743–744).

If information about individual preferences and values is available, risk managers can extrapolate from risk perception to risk evaluation. This requires, however, empirical studies in the form of inquiries or alike (Greiving, 2002, p. 48). In addition to risk perception, risk evaluation may also involve communication about risk and risk comparison. These aspects are needed in order to be able to develop an adequate form of response (Glade et al., 2005, p. 35). However, evaluating and determining whether risk is acceptable or tolerable often remains a real challenge. Renn and Klinke (2013, p. 2045), for instance, hint at the difficulties related to the classification of a given risk.

Risk perception and the results of risk evaluation respectively play a crucial role for the adoption of risk reduction measures in the risk management process. Due to the fact that human activities and decisions can influence exposure and vulnerability, the judgement of risks as acceptable, tolerable or intolerable entails the implementation of certain protective measures (both structural and non-structural). Accordingly, risk evaluation may influence the consequent risk management strategy and decisions on whether and which risk reduction measures should be taken.

3.2.3 Risk management

Risk management is an essential part of risk governance and can be defined as a *"systematic approach and practice of managing uncertainty to minimize potential harm and loss"* (UNISDR, 2009a, p. 26). It can be considered an ongoing process which involves the implementation of strategies, actions and measures to control and reduce intolerable risks[59]. This means in turn that public or private entities utilise and apply resources with the objective to reduce the occurrence of disasters, their negative effects and the overall threats imposed by extreme events (Paul, 2011, p. 105). Risk management can be considered an iterative process which requires constant evaluation, monitoring and adjustment by all actors involved.

[59] A more general explanation of risk management is given by Hollenstein (1996, pp. 20–21) who argues that risk management involves strategies and measures which identify a certain need for action, determine according goals, develop solutions and implement as well as monitor and evaluate respective measures.

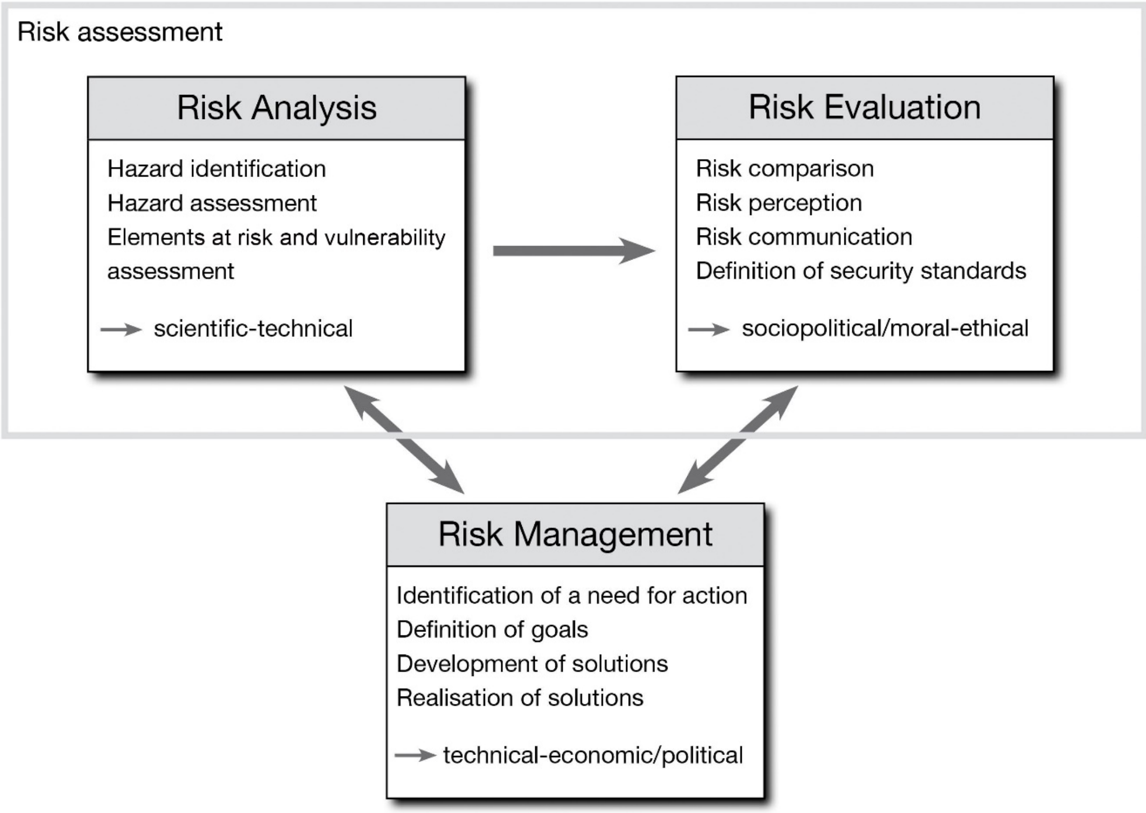

Figure 18 Relationship and linkages between risk analysis, risk evaluation, risk assessment and risk management (Source: recreated and slightly altered from Hollenstein, 1996, p. 22, own translation)

As outlined by the IRGC (2006, p. 40), risk management uses the information gained from the risk assessment process to assess, evaluate and select risk management options (see Figure 18). When facing an acceptable situation, costs for implementing risk reduction measures might exceed potential damages or losses. This situation occurs, *"when the incremental risk from a hazard to an individual is not significant compared to others* [*sic*] *risks to which a person is exposed in everyday life"* (Greiving et al., 2013, p. 14). This means that acceptable situations do not require action in the form of protective measures (or only if they are taken on a voluntary basis). When a tolerable situation exists, risk reduction needs to be accomplished by effecting reasonable resource investments, for example by managing risk within the ALARP ("as low as reasonably practicable") principle (Greiving et al., 2013, p. 14; IRGC, 2006, p. 40). This principle states *"that risks, lower than the limit of tolerability, are tolerable only if risk reduction is impracticable or if its cost is grossly in disproportion (depending on the level of risk) to the improvement gained"* (van Westen et al., 2011, 7–8). In the case of an intolerable situation, risk reduction measures need to be implemented that either help to reduce the vulnerability or to limit the exposure. Accordingly, the perception of whether a risk is perceived as acceptable, tolerable or intolerable significantly determines whether and what kind of risk management strategy should be followed.

3.2.4 Risk communication

Communication can be based on either formal or informal processes. Formal communication processes are predetermined ways of communication that use predefined channels, happen among predefined actors and are usually characterised by one-way communication only. Formal communication is also usually standardised or even legally defined. Informal communication is not necessarily defined and it is usually based on voluntary forms of interaction. It is not standardised and can also happen unplanned. Both formal and informal communication processes are needed in risk governance. While formal communication provides for a minimum degree of interaction between certain actors, informal communication is an important prerequisite for efficient cooperation and in further consequence for a more successful decision-making. Cooperation, however, depends on coordination[60]. Some degree of coordination is needed in organising spatial planning processes, since spatial planning always has to consider different concerns and interests. In a coordinated process, stakeholders often deal with conflicts. In risk management conflicts arise when there are different interests regarding the use of land, for instance. Coordinated processes therefore organise activities in a way that makes use of efforts most effectively in order to achieve jointly determined goals (Fuks et al., 2008, p. 149). Communication between the stakeholders can be regarded as the main element that generates commitments managed by coordination and enables cooperation (see Figure 19).

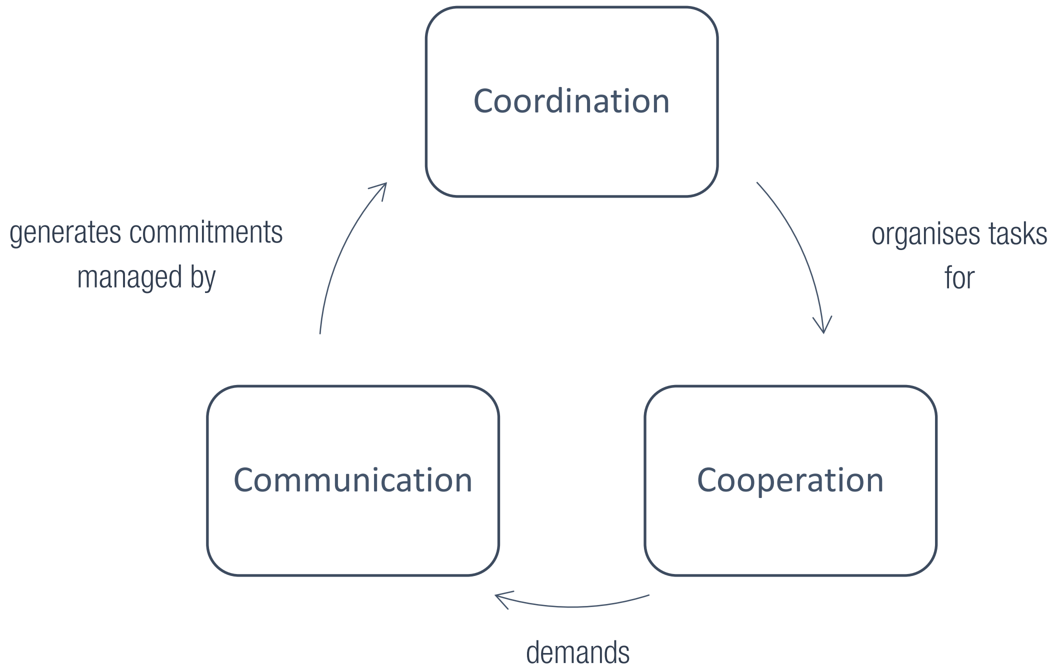

Figure 19 Model of communication and cooperation (Source: adapted from Fuks et al., 2008, p. 149)

Risk communication is required throughout the whole risk governance process, from setting the stage via risk assessment and management activities to the monitoring of management impacts. The IRGC (2006, p. 54) argues, that *"effective communication has to be at the core of any successful activity to assess and manage risks"*. Risk communication is the *"process of communication between all stakeholders involved in a risk governance process"* (MOVE, 2011a, p. 11). It ensures the alignment of those actors that are

[60] Cooperation refers to the joint operation of certain stakeholders in a shared space (Fuks et al., 2008, p. 149) and primarily focuses on the alignment of interests. Coordination can be defined as *"the deliberate and orderly alignment or adjustment of partners' actions to achieve jointly determined goals"* and typically involves *"the specification and operation of information-sharing, decision-making, and feedback mechanisms […]"* (Gulati et al., 2012, p. 542) to reach desired outcomes in most effective ways. While cooperation involves an alignment of interests and focuses on an agreement of goals, coordination focuses on effective alignment and adjustment of actions and individual contributions and highlights the specific ways to solve the problem at hand (Gulati et al., 2012, p. 532).

occupied with assessing and managing risks, including scientists, politicians and the public (Fleischhauer, 2006a, p. 10). Risk communication presents mechanisms and different interests. It also conveys information that is relevant for the management of risks (Hollenstein, 1996, p. 123). Risk communication is not limited to a one-way information transfer from experts to decision-makers, i.e. from information providers to information users. In addition to information provision, risk communication also involves all communication streams between and within the various groups of stakeholders (MOVE, 2011a, p. 11), including the wider public[61]. This way, all stakeholder groups are expected to participate to both deciding on measures and acting accordingly. Such a two-way communication process is supposed to build mutual trust, in particular between decision-makers and the public[62]. Risk communication therefore aims to ensure that stakeholders understand the rationale behind risk assessments and risk management decisions to the end of making informed choices about the respective matter at hand (IRGC, 2006, pp. 54–55). To summarise, risk communication can be understood *"as both a one-way transfer of hazard and risk related information and their management, and as a two-way exchange of related information, knowledge, attitudes and/or values"* (Höppner et al., 2010, p. 7). Renn (2008) summarises risk communication requirements by underlining that means of communication should help all actors involved in risk assessment and management to understand the issue at hand. It should also be made clear how they can be involved and how they can possibly participate and contribute – depending on their responsibilities and competencies. In addition, risk communication should ensure that stakeholders which are not directly contributing to risk assessment and management are sufficiently informed and, if necessary, engaged.

Risk communication mainly aims to raise awareness, adjust behaviour of the stakeholders, improve knowledge and relationships (e.g. by building trust), enable a mutual dialogue and issue warnings (Höppner et al., 2010, p. 16). It also helps to reduce tensions between different hierarchical levels and to make reactions towards administrative measures and decisions more easily predictable (Hollenstein, 1996, p. 125). A crucial element is the communication of uncertainty. Decision-makers constantly deal with uncertainties and have to take decisions under uncertainty every day. Accordingly, in order to be able to handle uncertainty in risk management strategies, it is necessary to communicate uncertainties in the first place. Petersen (2002, p. 13) points out that *"facing this dilemma of uncertainty communication, we must try […] to find uncertainty expressions which both match scientific practice and can be understood by lay people"*. However, communicating uncertainty is difficult and there are often large differences between scientists, policy makers and the general public in understanding and interpreting risk and uncertainty (Larsen et al., 2013, p. 144).

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[61] Initially, risk communication used to communicate results of risk assessments to the public. Communication therefore simply aimed to bridge the tension between public perception and expert judgement. However, this original objective of communicating information about risks to the public and educating them about consequences of disasters has changed. The reason for this modification is that the public did not ask to be educated, but they rather insisted in implementing alternative risk management practices (IRGC, 2006, p. 54).

[62] Höppner et al. (2010, p. 37) explain that *"trust is considered a crucial element because it determines the credibility of a message and its source and because it might affect the receiver's willingness to engage in communication"*. By communicating uncertainties in risk information, trust can be built between experts and decision-makers and between decision-makers and the public.

The IPCC (2007, p. 143) suggests that participatory processes help to establish a dialogue between all stakeholders and in particular between experts and lay persons. By applying participatory approaches, experts can explain the uncertainties to policy makers and the public and avoid misinterpretations. Simultaneously, policy makers can highlight their decision-making criteria. This is important because understanding the audience or addressees is crucial in order to define the correct level of specificity of the information about uncertainty (CEC and EEA, 2016). This way, both experts and policy makers can work together to develop a successful risk management strategy. Most importantly, experts need to be open about uncertainty of the information provided, but they also need to communicate the consequences that are related to uncertainty. Lack of transparency in communicating these issues may hinder effective risk management, as decisions are made under false assumptions. Hill et al. (2013, p. 1) highlight the need *"for the transparent quantification of risk and uncertainty so that informed choices can be made, both to reduce the risks associated with natural hazards, and to evaluate different mitigation strategies"*. Even when only limited knowledge about the potential consequences exists, this uncertainty in predicting consequences needs to be communicated. After all, decisions to manage risks have to be made despite such limited knowledge. Therefore, it is vital that scientific uncertainty is transparently assessed when scientists contribute to decision-making and that results are openly reported and made available to all interested parties (Hill et al., 2013, p. 1). In order to ensure that both strengths and weaknesses of the communicated risk information is transparent and comprehensible, stakeholders need to care for an honest communication between information providers and users (CEC and EEA, 2016). A key task and at the same time main challenge in communicating uncertainties consists in making risk information and uncertainty comprehensible for information users.

Risk can be communicated in different ways: oral, textual and visual. The selected form of communication thereby needs to represent the nature of the respective risk at hand, their context and potential effects in terms of causing societal concern (IRGC, 2006, p. 55; Klinke and Renn, 2010, p. 22). Charrière et al. (2013) observed that maps are usually the most used means for visually presenting risk. However, visualisations may also cause false alarms or a false sense of security: hazard events may either never occur or be weaker than predicted; or they may also be a lot stronger than predicted. Hill et al. (2013, p. 6) argue that such results may be interpreted by the general public or lay persons as scientific 'failures' and hence lead to mistrust and incredibility of future decisions. Communicating risk – and the uncertainties related to it – therefore constitutes a real challenge for experts. It hence requires thorough and thoughtful reflections about the ways and means to accomplish risk communication, in order to reach the respective audience or addressee in the most effective manner.

3.3 Summary

In Chapter 3 the following insights were gained that are particularly relevant for the topic of this research work and the following elaborations:

For this study focuses on the ways risks are analysed in different national frameworks and cultural contexts and used in spatial planning processes, it should be kept in mind that risk analysis constitutes a scientifically led process while risk perception enters the risk assessment process via evaluating the risk. This is particularly important when comparing risk assessment approaches in different national contexts. Due to differences in social and cultural values and viewpoints, risk analyses and risk perception differ and countries choose different ways how to deal with the risk information they are producing. Since individuals, institutions, planning practitioners and the scientific community perceive risk differently, it is important to consider how planning practitioners deal with and employ the provided risk information as an evidence base. Differences in risk assessments will consequently lead to differences in prevailing risk management strategies. In the context of the present study it is therefore necessary to understand how risks are assessed and communicated to spatial planning practitioners, including existing or non-existing standards for planning practices at the local planning level, as well as how well this information is understood. This also includes investigating the respective roles of sectoral planning authorities as information providers and spatial planners as information users and their interlinkages and existing communication structures. In this respect it is also important to determine ways of how to deal with and communicate uncertainties in spatial planning. Thus, different ways of communicating risk will be examined, with a particular focus on different types of maps. After all, a key task in communicating uncertainties consists in making risk information and uncertainty comprehensible for information users. Existing hazards and risk maps will therefore be presented, their single elements further examined and their application described.

Due to their evaluative factors, risk assessments are not purely scientific and objective, but involve subjective judgements. Still, risk assessment needs to be perceived separate from risk management, since the former encompasses a factual assessment of risks while the latter yields normative decisions based on economically, technically and politically oriented aspects for managing risks. Nevertheless, risk assessments are the basis for risk management measures, which is why the consideration of how the public perceive risk and an evaluation whether risk is accepted or tolerated is crucial. Analysing, understanding and considering the prevailing risk perception of the public is a prerequisite, as risk management is deeply influenced by public concerns and perceptions. There can be no purely scientific solution for broadly accepted strategies for risk reduction. Moreover, uncertain environments require an enhanced dialogue among different stakeholders. Many different stakeholders therefore need to be involved. Sufficient public involvement will help build trust and ensuring acceptance for planning decisions which are key issues when facing uncertainty.

4. Spatial planning and disaster risks

Hazards pose threats for the population, both directly and indirectly. This usually requires some kind of reaction either by tolerating or amending existing risks. Spatial planning can be one aspect or means of toleration or amendment, as it comprises decisions of whether and how spaces will be used (Greiving and Fleischhauer, 2006, p. 110). The CEMAT (2007, p. 25) defines spatial planning as *"the methods used by the public sector to influence the distribution of people and activities in spaces at various scales as well as the location of the various infrastructures, recreation and nature areas"*. According to this definition, spatial planning can contribute to the change or toleration of risks by influencing exposure and susceptibility of people, infrastructures and livelihoods towards natural hazards. Burby et al. (2000, p. 99) argue that spatial planning can even be *"the single most promising approach for bringing about sustainable hazard mitigation"*. Thus, spatial planning can play a vital role in disaster risk reduction due to its competencies in managing the use of space.

In general, policy has to be well-informed in order to be able to prepare reasonable political decisions (Schülein and Reitze, 2005, p. 224). This means that the applied information needs to meet certain requirements with regard to its quality, especially in terms of reliability and validity. This holds also true for decisions regarding future land uses and the management of risks. This is exactly the problem. Subjects such as the future development of space, climate change, socio-economic change and natural hazards are always tainted with great uncertainties (see Chapter 3.2.2). Any decision-making process has to deal with uncertainty, which increases in proportion to the complexity and the timescale (European Commission, 2013, p. 13). While spatial planning is by definition associated with uncertainties (Lyle, 1999, p. 131), present climate change projections show large uncertainties due to inadequate models, missing or erroneous data, ambiguously defined concepts, the difficulty of projecting human behaviour, inappropriate spatial resolution etc. (IPCC, 2005, p. 1; Kunreuther et al., 2014, p. 155). Projecting the vulnerability of future settlements or infrastructures towards disasters as well as the probability of their occurrence and the magnitude of future natural hazards is just as difficult. In other words, the occurrence, severity and extent of a natural hazard can hardly be predicted, thus making it difficult to anticipate to what degree future land use and urban development will be affected. Consequently, spatial planning faces great challenges in overcoming and dealing with problems of uncertainty. It needs an adequate evidence-base to inform decision-making, so that reasonable decisions about future land uses can be made and – more importantly – justified towards the public. Hence, the question about how spatial planning can best deal with information about risks in the face of uncertainty is justified.

A guiding principle of spatial planning is the precautionary regulation of (land) uses and actions, which both try to protect new and existing developments and avoid conflicts caused by divergent spatial demands. Each decision regarding land use may imply adverse effects. These effects can never be entirely predicted or assessed in advance. By consciously dealing with this uncertainty and by weighing up opportunities and threats of decisions, risk management in spatial planning promotes a precautionary use of land. Additionally, risk management with its comprehensive, interdisciplinary elements has a high relevance for fostering the public good. Summarised, these are good reasons to make risk management an integrative field of action for spatial planning (Birkmann et al., 2011, p. 2). However, risk information needs to be made available in an adequate way or form in order to be applicable in spatial planning, especially at the local level.

Knowledge about the characteristics of different planning systems and cultures is required in order to be able to understand differences in applying risk information and managing risks in spatial planning as well as the rationale behind the different ways of dealing with risks. Chapter 4.1 therefore introduces fundamentals concerning planning systems and planning cultures in Europe. Special attention will be given to the planning systems in France, Italy and Poland.

As spatial planning has considerable competencies in determining the use of space, it significantly matters when it comes to dealing with hazards, both natural and technological. Likewise, results of risk assessments constitute an important evidence base for spatial planning, in particular when they are legally binding. Assessment results that are visualised in the form of maps, for instance, are essential inputs for planning processes. Planning decisions require a certain level of transparency, which can be guaranteed by using according maps based on scientific expertise. After all, planning decisions must be legitimate and justifiable in order to be accepted by the public. Chapter 4.2 will focus in more detail on the integration of risk assessment and risk management into spatial planning. In particular, it will refer to respective requirements and demands on information and evidence bases.

As an integrative field of action for spatial planning, risk assessment and management are also well-suited for an integration into the SEA procedure. In fact, SEA provides a suitable procedural framework for implementing the whole risk governance approach (Greiving, 2002; Greiving and Fleischhauer, 2006; Greiving and Mayer, 2009; Birkmann et al., 2011). Although SEA usually forms part of the planning procedure, the role of SEA in risk assessment and management will be elaborated in a separate chapter (see Chapter 5).

4.1 Planning systems and planning cultures in Europe

Due to the comparative case study approach, particular attention has to be paid to national and, in some cases, regional contexts. Each country in Europe is characterised by a specific cultural and socio-economic background. In fact, there is no general definition of spatial planning, because of differences in cultures, traditions, attitudes, beliefs or values between countries (Biesbroek et al., 2009, p. 234). Further differences exist especially with regard to historical, political or legal aspects, e.g. legal frameworks and concepts of justice, as well as in structures of governance and government. This is why urban and regional planning systems and approaches have evolved in different settings, influenced by the institutional context (Friedmann, 2005b, p. 29; Knieling and Othengrafen, 2009c, p. xxiv). Common to different spatial planning systems and approaches is that spatial planning is usually seen as a holistic approach that determines spatial developments while acknowledging interrelations and consequences of spatial planning measures in the long run (Biesbroek et al., 2009, p. 234). Spatial planning hence *"coordinates the different relevant socio-economic objectives and desires, for example, the development of transportation systems, local economy and housing, and objectives with a strong environmental component, such as nature development, water management and agriculture"* (Biesbroek et al., 2009, p. 234).

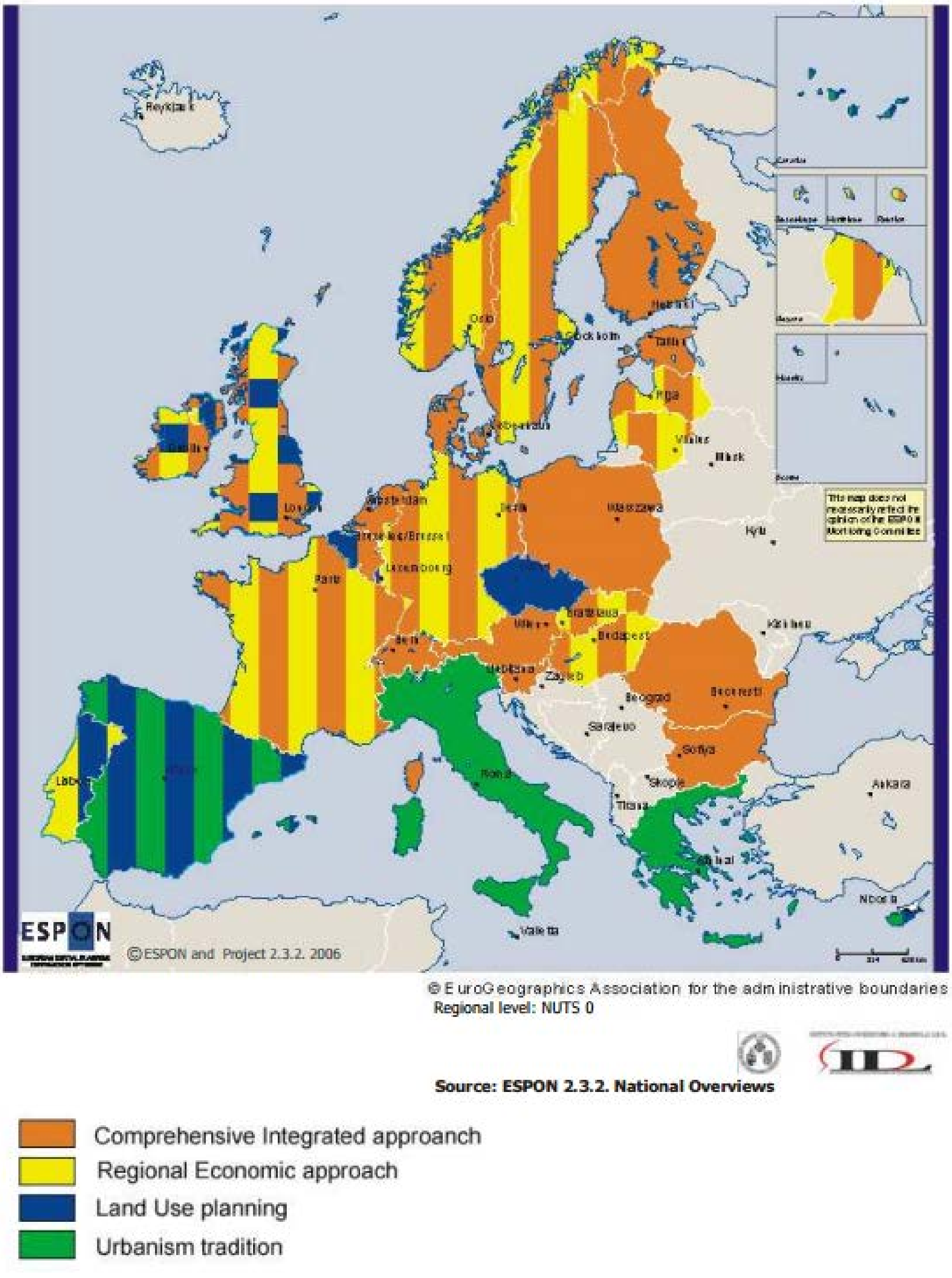

Figure 20 Trends and traditions of spatial planning in Europe (Source: Farinós Dasi et al., 2007, p. 40)

For this study, spatial planning systems can be understood as *"the ensemble of territorial governance arrangements that seek to shape patterns of spatial development in particular places"* (Nadin and Stead, 2008, p. 35). According to the European Communities (1997, p. 22), the ways in which planning is conducted and practice complies with planning policies significantly differ across the European Union. The diversity of spatial planning systems and practices is evident and planning systems keep evolving and changing because of the constant emergence of new reforms (Stead and Cotella, 2011, p. 13). Despite existing differences, planning systems come more and more under the influence of other factors such as international (global) treaties and European integration through EU legislation and sectoral policies (Dühr et al., 2007, p. 291), which provide some sort of approximation. This and the fact that intensified EU-wide cooperation between planners has led to a prosperous exchange of experiences and practices, which in turn promoted a certain degree of harmonisation (Nadin and Stead, 2008, pp. 35–36), favour a comparative analysis of spatial planning approaches. This holds especially true in the context of a global issue such as dealing with climate-induced natural hazards that every country in the EU is somehow concerned with.

Several classifications of the European planning systems are available. Newman and Thornley (1996, p. 27) recognise different legal and administrative styles which form a typology known as legal "families". The "EU Compendium of Spatial Planning Systems and Policies" of 1997 (European Communities, 1997, pp. 36–37), being one of the first comparative research studies directed towards the various planning systems in 15 EU Member States, distinguishes four main planning traditions. The EU Compendium involved an examination of the traditions of spatial planning, its context and principles as well as emerging trends and the impact of the EU (European Communities, 1997, pp. 33–49). Figure 20 shows an upgrade of the classification originally carried out by the EU Compendium for the EU 15 Member States by extending the study by 14 countries (Farinós Dasi et al., 2007, p. 39).

As shown in Figure 20, the Compendium identified four trends or approaches of spatial planning, i.e. four planning traditions in Europe:

- Regional economic planning approach
- Comprehensive integrated approach
- Land use planning (or management)
- Urbanism tradition

These four approaches, their characteristics and the corresponding Member States are further outlined in Table 1. However, these planning traditions are not static. By borrowing and mixing elements with the other approaches, traditions constantly change (Farinós Dasi et al., 2007, p. 41). One major downside of the study is the focus on formal and institutional structures. It does not include any "soft factors" such as habits and values. A second shortcoming of the study is that the Compendium was not able to explain urban and regional planning practices in every country of the EU. In many cases it was restricted to a simple illustration, without explaining specific spatial developments[63] (Knieling and Othengrafen, 2009a, pp. 45–47).

[63] This strongly relates to the first point of criticism, since the inability of explaining specific spatial developments is associated with the disregard of certain cultural elements (tangible and intangible) and traditions (Knieling and Othengrafen, 2009a, p. 47).

Table 1 Four trends or traditions of spatial planning approaches in EU Member States (Source: author's compilation based on European Communities, 1997, pp. 36–37)

Trends/ Traditions	Regional economic planning	Comprehensive integrated	Landuse management	Urbanism tradition
Characteristics	• Spatial planning follows and concentrates on social and economic objectives • Spatial planning aims to reduce disparities between different regions • Central government plays vital role in the application of public investments	• Existence of a systematic and formal spatial planning hierarchy of plans • Focus on spatial development • Horizontal and vertical integration of policies	• Typically deals with controlling land use changes at strategic and local levels • Local administrations manage most planning work • National level controls system and sets goals	• Strong architectural focus • Laws and regulations without a coherent system • Control through zoning and legal codes
EU Member States	France, Portugal	The Netherlands, Germany, Austria, Poland	UK, Ireland, Belgium	Mediterranean countries (e.g. Italy and Greece)

The new EU Member States had to meet some requirements before applying for funding through the EU. In this context Poland, for instance, changed its administrative system by establishing a regional level. Although rapid developments can be observed, adjustments are not yet completed in the new Member States. A trend towards the adoption of the comprehensive integrated approach, the regional economic development approach and the land use management approach can be observed[64]. This stems from the fact that the new Member States orient themselves towards the old Member States by adopting elements that are typical of the regional economic, the comprehensive integrated or the land use management tradition (Farinós Dasi et al., 2007, p. 119).

Newman and Thornley (1996) carried out a similar study on European planning systems and explored variations as well as similarities. They focused their research on the identification of the different legal styles as well as the administrative structures, especially concerning the way in which the administrative system influences the relationship between planning at national and local level[65]. After analysing these legal and administrative structures, they developed a division of countries, i.e. the legal and administrative "families" of Europe. Each "family" is characterised by particular similarities within the planning approaches of different countries, which implies that there are also considerable differences in the planning approaches between the different "families" (Newman and Thornley, 1996, pp. 27–28). According to Newman and Thornley (1996, p. 30), European countries can be divided into the following

[64] The regional economic development approach, which originated in France, is quite significant and well represented across the EU. This is proven by an increasing establishment of regional levels in Member States due to the functioning of EU Structural Funds through the regional level (Farinós Dasi et al., 2007, p. 136).

[65] Nadin and Stead ((2008, p. 38) note that using the legal style and administrative structures to demonstrate differences among planning systems has evident validity. It should, however, be pointed out that this approach *"tends to over-emphasize the formal system of planning in principle as opposed to the realty of its operation in practice"* (Nadin and Stead, 2008, p. 38).

five categories or "families" (see Figure 21): British, Napoleonic, Germanic, Scandinavian and East European. The present study examines case studies in three European countries, which represent two of the legal and administrative families: Napoleonic (France and Italy) and Eastern European (Poland).

Figure 21 The legal and administrative "families" of Europe (Source: recreated from Knieling and Othengrafen, 2009a, p. 47)

The Napoleonic family encompasses the largest number of countries. It is characterised by quite a noticeable amount of internal variation[66]. Within the planning systems of the Napoleonic family *"there is a tendency to prepare a national code of planning regulations and to create a hierarchy of plans based upon a zoning approach"* (Newman and Thornley, 1996, p. 72). Decentralisation and the allocation of more responsibilities towards the regional level are typical developments within this family. Yet a strong hierarchical power relationship can be observed between the central government and the municipalities (Janin Rivolin, 2012, p. 75). While France represents a more systemised version of a planning system, where the range of organisations, instruments and possibilities for flexibility are quite clear, in Italy a greater variety causes more fragmentation and complexity (Newman and Thornley, 1996, p. 72).

[66] The reason for the great size of the Napoleonic family can be traced back to the military expansion in the 19th century under Napoleon. Even after regaining independence, the countries kept the central elements of the French Code and the specific national codes of each country were mainly deduced from the French one. Nonetheless there are differences in the respective codes so that a legal unity could not persist (Newman and Thornley, 1996, p. 32).

France used to have a highly centralised planning system until the early 1980s. During the decentralisation process, planning power has been shared with local authorities (Newman and Thornley, 1996, p. 45), but also governing capacity at the regional level has been strengthened (Oxley et al., 2009, p. 22). Although today local communities can directly elect their mayors, there are still strong associations with the central government and the state still has central control over lower tiers of government through its regional and departmental prefects[67]. Accordingly, the local government contains local representation, but strong central controls persist[68] (Newman and Thornley, 1996, p. 33). The French "aménagement du territoire", which can be translated as "regional development planning", distributes the power between the national, regional and the local levels. Physical planning is undertaken at local level and belongs to the competence of communes. It is regulated by the "Code de l'Urbanisme" (Urban Planning Code) (European Communities, 2000, pp. 19–20) and the main planning instrument at the local scale is the "Plan Local d'Urbanisme" (PLU)[69].

In Italy, a progressive regionalisation took place since the 1970s. While the national government is responsible for the planning law, power in general has been shared with regional governments, which has caused considerable complexity. As a result, Italy's planning system is fragmented and decision-making processes are difficult to grasp (Westphal et al., 2003, p. 6). The Italian planning law (Legge 17 agosto 1942, n. 1150, "Legge urbanistica") was established in 1942 and, despite various amendments, is still in force today. The main planning authority is the municipality. Planning activities at the local level are implemented by means of a local spatial plan and concentrate on the concept of zoning (European Commission, 2000, p. 17). Architects play a main role in the Italian planning system (Janin Rivolin, 2012, p. 75). Accordingly, the system is characterised by *"a strong architectural flavour and concern with urban design, townscape and building control"* as well as by regulations *"undertaken through rigid zoning and codes"* (European Communities, 1997, p. 37).

Planning systems of the Eastern European family are difficult to put into one condensed statement. One reason is their comparably late development (post 1989) (Newman and Thornley, 1996, p. 35). All former socialist countries are categorised as part of this Eastern European family without further distinctions. Such a classification results most likely from a lack of knowledge about the real situation and the fast and diverse developments that took place post 1989 (Bielawska-Roepke, 2009, p. 72). Altrock et al. (2006, p. 3) claim that *"given the highly heterogeneous situation, it makes little sense to speak of 'one Eastern European (planning-)family' […]"*. It seems problematic to define and explain the planning systems as one coherent family, as these countries are still developing their individual approaches. This makes it more difficult to identify commonalities. First, these countries were able to study available approaches in other EU countries and to explore which of them can be applied best. And second, they also adjusted the system to a particular situation in order to make it work. Differences in the degree of decentralisation, geographical size, national context, selected reform paths as well as administrative and fiscal decision-

[67] The administrative systems of France, Italy and Poland will be outlined in Chapter 6.1. A more detailed description of the different levels will be part of this.

[68] The same applies to the regional level. Through the establishment of regional prefects, the central government still has an important role and strongly influences, among others, urban and environmental planning and management (Oxley et al., 2009, p. 22).

[69] The French, Italian and Polish planning system will be outlined in Chapter 6.2. This is why a more detailed description of planning tasks and planning instruments at different levels will follow later.

making structures are some of the reasons why planning has different meanings in the different countries of this family and structures are generally difficult to compare (Altrock et al., 2006, p. 3). Nevertheless, due to the common past as communist countries and their ongoing transition from a former socialist state to democracy, some similarities in the planning systems and common characteristics seem probable (Adams et al., 2011, p. 2; Newman and Thornley, 1996, p. 35). For example, countries like Poland, the Czech Republic and Slovakia all established regional levels and assigned more power to regions and municipalities (Westphal et al., 2003, p. 6). One of the main problems was attributed to the establishment of a market in land and property, which included a long process of restitution of land to its owners (Newman and Thornley, 1996, pp. 35–36). A further problem can be seen in the decentralisation of responsibilities that often lacks a concurrent decentralisation of funding and resources (Westphal et al., 2003, p. 6). Since the system was centralised during communist times, controlled by the state and the Communist Party, there has been a tendency to counteract to this centralised system by implementing clearly decentralised approaches. Increasing local participation in decision-making processes is one of the core aims today. In Poland, for instance, politicians aimed to give local authorities more legitimacy. This is why the latest reform in the year 1999 aimed at a more decentralised system.

Apart from the classification of planning systems, two opponent planning system models exist which currently shape the European planning practice. Similarities among different planning systems of EU Member States are comparably high when regarding the local planning level. According to international discourses on planning theory, decisions taken at the local planning level can be either legally binding or they can be non-binding programmatic statements (Greiving and Fleischhauer, 2010, p. 17). The first one is more traditional and more widely represented: *"Throughout Europe – with the well known* [sic] *exception of the United Kingdom – there are two-level planning systems at the local level, consisting of a legally binding zoning of the urban or municipal area"* (Greiving and Fleischhauer, 2010, p. 17). Here, single projects are adjusted to a mutual strategy. This type of planning system is referred to as "conforming" which means that a planning system with a regulatory function is a conforming planning system (Janin Rivolin, 2008, p. 167; Larsson, 2006). Several forms of these kinds of planning systems exist in Europe. The second planning system model is less institutionalised and promotes non-binding spatial policy programmes which "perform" a mutual strategy. This type is called "performing planning". Diverging processes and changes in historical development and cultural-based reasons explain the diffusion and perpetuation of conforming planning. Current demands for territorial governance justify a preference for performing planning, however (Janin Rivolin, 2008, p. 167). The limits of conforming planning become clear when regarding the increasing societal complexity or the globalisation process and its consequences for the planning practice. As Janin Rivolin (2008, p. 168) acknowledges, they point towards *"the difficulty of plan implementation in the context of reconciling multi-level collective strategies to a growing plurality of local and individual projects of spatial development"*.

Most European countries, the UK being an exception, apply conforming planning with legally binding plans at the local level. However, as already mentioned, developing ("performing") planning systems are actually regarded as more suitable. The main advantage of a developing planning system is its flexibility, while at the same time rigidity is a shortcoming of the conforming planning system (Janin Rivolin, 2008, p. 178). This fact might be of interest in regard to future impacts of climate change and the change in occurrence and intensity of future natural hazards. A regulative, rigid planning system might not be able to adjust to the anticipated changes. Moreover, Fleischhauer et al. (2012, p. 2788) point out that risk management strategies and subsequent measures are designed based on an existing legal framework. Accordingly, *"the setting of legally binding and spatially specific objectives (e.g. to keep an area free of further settlement development) presumes that there are laws enabling the enactment and enforcement of such spatial objectives"* (Fleischhauer et al., 2012, p. 2788). Therefore, it will be interesting to investigate how the national planning systems in question deal with disaster risk and how they integrate risk assessments into the planning procedure by referring to existing laws. Respective differences in planning systems need to be taken into account.

Planning objectives, norms, methods and instruments are always related to specific cultural contexts (Othengrafen and Reimer, 2013, p. 1269). Cultural values such as traditions, norms and perceptions are thus important elements for framing both national planning systems and regional arrangements within the same Member State. The concept of planning cultures views spatial planning as always connected to particular characteristics and individual circumstances (Steinhauer, 2011, pp. 483–484). "Planning culture" can be defined as *"the ways, both formal and informal, that spatial planning in a given multi-national region, country or city is conceived, institutionalized, and enacted"* (Friedmann, 2005a, p. 184). Hence, it refers to *"the different planning systems and traditions, institutional arrangements of spatial development and the broader context of spatial planning and development"* (Knieling and Othengrafen, 2009c, p. xxiv). It can be regarded as the thorough foundation of spatial planning for it encompasses more than just planning instruments and planning processes[70] (Young, G., 2008, p. 35). In order to better understand planning methods and practices in different countries and to take intercultural differences into account, approaches and processes should be analysed by considering their cultural contexts. Different contextual meanings have to be respected in comparative research, as they strongly influence planning processes[71]. Cross-national research on spatial planning systems and practices should therefore aim to acknowledge the notion of cultural aspects. After all, acknowledging local, regional and especially national differences in planning practices is vital for any universal planning discourse (Friedmann, 2005b, p. 30) – as the one about dealing with risks in spatial planning.

Triandis (1994, p. 35), Fürst (2009, pp. 27–28) and Othengrafen and Reimer (2013, p. 1270) ascertained that in European wide research dealing with differences between planning systems, the topic of planning cultures is hardly represented. Despite the fact that a consideration of cultural aspects could significantly contribute to a comparison of planning systems, such aspects are often neglected. Furthermore, considering cultural aspects can also provide for a more methodologically sound discussion about processes and practices in terms of diverse cultural contexts (Steinhauer, 2011, p. 484). Othengrafen and Reimer (2013, p. 1270) notice that considering perceptions, traditions, values, paradigms and cognitive frames is crucial for understanding urban and regional planning practices[72]. It is, however, quite difficult to analyse the role of culture in spatial planning, since culture is a complex and abstract concept and

[70] In scientific literature the term "planning styles" is also commonly used (Fürst, 2009, p. 23).

[71] Nadin and Stead (2008, pp. 43–44), for instance, notice that the planning system is partly an expression of fundamental values in a society with regard to the rights of citizens, the use of land and aspirations of the government.

[72] This is why the authors express the need for examining *"the complex relations between spatial planning and cultural contexts in a more comprehensive way"* (Othengrafen and Reimer, 2013, p. 1270) and provide a system of criteria for a systematic analysis of spatial planning.

challenging to work with. It can neither be fully described and defined nor entirely conceived and grasped (Gullestrup, 2006, p. 21). In fact, a consensus or commonly agreed definition on a concept of culture is missing (Othengrafen and Reimer, 2013, p. 1272) and *"the scope for considering the cultural forces at play in planning is potentially vast"* (Booth, 2005, p. 260). Nevertheless, as the cultural context seems to have a decisive impact on spatial planning practice, it is necessary for comparative institutional studies to consider the different planning cultures (Othengrafen and Reimer, 2013, p. 1272). Booth (2005, p. 260) explains the need for considering cultural aspects by stating that *"if we may loosely describe planning to be about the nature of place, about the way in which we use land, and about the physical expression of the ordering of society, then it becomes apparent that planning as an activity cannot possibly be divorced – as a rational, technical exercise – from the general cultural traditions that inform it"*. Assessing and determining the cultural contexts of each case study site is therefore considered necessary within the bounds of possibility.

Especially when addressing complex issues such as disaster risks, it is important to consider that not only political, administrative and planning systems of countries affect decision-making on risk reduction. Likewise, cultural aspects play an essential role in this regard. Public perceptions of risk are increasingly considered, as they strongly shape ways of how vulnerability to disasters can be reduced[73] (Krüger et al., 2015). Since spatial planning is one of the main actors in disaster risk reduction, cultural aspects also have to be considered when looking at how risks are dealt with in planning processes. First and foremost, there is a constant and continuous cultural change, i.e. a change of conditions under which planning takes place. Friedmann (2005b, p. 33), for instance, points out that *"in the wealthy countries of North America, western Europe, and the Asia Pacific, the conditions for planning have changed dramatically over the past twenty years*" and that *"these changes have posed new problems for cities and have created heated debates over how our planning practices should adapt to the new conditions in a globalizing world"*. Climate change mitigation and adaptation as well as disaster risk reduction represent only a very small proportion of the new challenges that planning faces today. However, due to the rapidly changing cultural contexts and their variety, there can hardly be a one-size-fits-all approach to the problems and conditions that cities have to deal with. Solutions for dealing with the new problems posed on regions and cities cannot be adopted globally or made universally applicable. Therefore, it is crucial that communication between planners and researchers from different planning systems takes place by acknowledging respective cultural differences (Friedmann, 2005b, p. 43).

Planning cultures reflect local conditions and have developed and adapted over time. While one ordinance or regulation may work well in one country, it may not do likewise in another. Consequently, good practice examples may not necessarily be transferred one-to-one to another country, especially when dealing with decisively different planning systems, e.g. when working across the above-outlined planning families.

In this context, this research work will take account of the fact that there are differences in planning systems and planning cultures. The planning systems are examined by looking at institutionalised aspects: planning law, planning institutions, planning instruments, planning actors and other. The cultural context is integrated by looking at the respective influences of central, regional and local governments, aspects that

[73] Risk is – according to Bankoff et al. (2015, p. 3) – *"a result of societal perceptions, decisions and actions and, therefore, a social construct"*. In order to understand why people or nations deal with risk in one way or the other it is important to relate a certain handling of risks to societal contexts and cultures.

influence decision-making such as objectives and principles that spatial planning aims at, the public's acceptance of plans and its willingness to stick to planning norms, environmental consciousness as well as the role of the planner. Cultural aspects are also taken into account by acknowledging different risk cultures, which in turn have a bearing on spatial planning practices for risk reduction purposes due to their influence on protection measures. Depending on the accepted level of risk, reduction measures need to be either realised or can be neglected. Moreover, public safety and public engagement directly relate to both, the notion of disaster risk reduction and spatial planning. Examples given in Chapter 8.2 will show that various cultural aspects significantly influence the way risks are managed and dealt with and therefore need to be taken into account when analysing approaches of risk reduction in each country.

4.2 The integration of risk assessment and management into spatial planning

Risk reduction can be achieved by either modifying the hazard or by modifying the human vulnerability. In order to achieve the modification of a hazard, for example, measures can be selected that aim at a hazard-resilient design. This includes the involvement of sectoral authorities which promote the implementation of such measures by fostering engineering and building works (Sapountzaki et al., 2011, p. 1446). Vulnerability reduction in turn aims to minimise the susceptibility of society to improve resilience towards future disasters (Wamsler, 2014, p. 36). Vulnerability modification can be achieved by improving the preparedness of a society towards a disaster (Fleischhauer, 2006a, p. 10), e.g. by making use of early warning systems.

Spatial planning is involved in both, hazard modification and vulnerability modification (Sapountzaki et al., 2011, p. 1446). For instance, spatial planning can contribute to reducing the probability of occurrence of an event by favouring options that help reduce adverse impacts, such as retention basins and protective forests. Moreover, by reducing the damage potential, exposure of protective goods towards natural hazards can be diminished (Greiving et al., 2011, p. 274). This is mainly achieved by land use regulations aiming at keeping hazard-prone areas free of development. If an area is particularly exposed to hazards (flood plains, steep slopes etc.), used to lower the impacts of a disaster event (such as retention areas, for instance) or needed to ensure the feasibility of response measures (e.g. evacuation routes or areas), spatial planning can determine that these areas are kept free of development (Greiving, 2006b, p. 188). In addition to influencing the location of new developments, spatial planning may also influence the building design. This way structures may be erected that withstand impacts and that are resilient towards natural disasters (Godschalk et al., 1998, p. 86). Regional and local planning instruments as well as specific building codes and zoning options allow spatial planning to decide on the location, the type and the intensity of a future development. All these examples contribute to an overall risk reduction as well as a higher resilience of the area concerned.

Governments are always advised to plan before they act, especially when planning for disaster risk reduction. There are several benefits which make foresighted planning reasonable and desirable: By considering hazards during the preparation of a local land use plan, both the general public and policymakers can gain important information about any potential future hazards as well as about existing obligations which need to be considered when building in hazard-prone locations. Moreover, by regarding the municipal area as a whole and by taking account of different alternatives, planning can identify the most adequate location for a certain use, or – vice versa – the most appropriate use for a certain plot of land. Consequently, local authorities will recognise that economic development does not necessarily have to be extended into hazardous areas. Often there are other possibilities for gaining benefits. In some cases, it will be more reasonable to determine building restrictions rather than realise development objectives. Finally, by involving all stakeholders in the planning process and allowing them to find a consensus regarding the handling of natural hazards, the role of political decision-makers will be enforced and (more) trust in decision-making will be ensured. This could help advance, justify and legitimise any decisions made in favour of hazard mitigation. Eventually, the willingness of local governments and according decision-makers to foster hazard mitigation is vital for the achievement of a more hazard-resilient community (Burby, 1998b, p. 19). When policymakers are made aware of all benefits related to hazard mitigation planning, the consideration of natural hazards as part of the planning process could be promoted.

When examining the role of spatial planning in a certain domain it is important to differentiate between formal and informal planning instruments. Formal instruments and procedures are part of the scope of the public planning law. They are characterised by formal, predefined procedures and predefined ways of public involvement. The way local spatial plans have to be prepared and the kind of information they have to provide and include is stipulated by law. Results of formal planning processes are usually legally binding for third parties. This legally binding character generates planning certainty for public administrations and allows for legitimised planning activities (Danielzyk, 2005, p. 466). In contrast, informal planning instruments and procedures are not necessarily based on a formal mandate and predefined procedures of the public planning law. Informal planning instruments are flexible both in their range and their application. This means that depending on the situation, different informal instruments may be chosen and adjusted to the respective conditions. In addition, there is no formal way of applying these instruments: There is neither a predetermined procedure nor fixed contents to be considered.

Informal, "soft" tools support and simplify the long process of preparing formal land use plans and should therefore be implemented into or at least inform formal land use plans. Informal instruments usually strongly rely on communication processes and thus promote the involvement of third parties. They are particularly useful for advancing comprehension and mediation (Selle, 2000, p. 98; Sinning, 2003). Planning practice and the administrative-political handling of planning processes increasingly encounter problems of acceptance. This leads to difficulties related to the implementation of political strategies and goals (Schauber, 2003, p. 4). Although informal planning instruments do not have legal effects, they constitute an important means to implement commonly accepted measures, as they are usually based on a process that establishes trust and acceptance. Enabling a dialogue between different actors and stakeholders as well as the will to find commonly accepted solutions are therefore important prerequisites.

It is widely accepted that both formal and informal instruments are needed, at least in German planning practice and research: Formal instruments are required to legally enforce planning decisions and thus provide for a justified, legal and authorised implementation of spatial planning measures. Kilper (2006, p. 144) stresses that complex problems require integrated problem-solving and that they can only be successfully managed when different actors are involved and when different forms of finding and implementing ideas are practiced and promoted. This supports the need for complementary informal instruments. However, due to their lack of regulative power, informal instruments cannot simply substitute formal planning instruments. They are rather directed towards implementing projects and concepts and thus aim to make spatial planning more flexible. This is why spatial planning should preferably consist of both legally defined (formal) development planning and a dialogue- and implementation-oriented way of (informal) planning (Danielzyk, 2005, p. 466).

In the context of disaster risks the application of informal planning instruments is crucial, for there are a couple of weaknesses related to formal instruments which reduce their contribution to disaster risk reduction (Greiving, 2010, p. 29). A main challenge is posed by the difficulty to protect existing building structures from disaster events. Spatial planning has hardly any means to influence existing settlements and infrastructures and protect them from disasters. Formal planning instruments can only influence future land uses. Due to private property rights, most of the required protection measures can only be implemented by property or building owners themselves. Since existing buildings and infrastructures constitute the main damage potential which might be affected in case of a disaster (Greiving, 2010, p. 29), informal planning instruments are crucial in order to inform the public and promote individual precautionary measures. A second difficulty can be seen in handling disaster risk reduction as such. In particular when dealing with problems such as disaster risks, informal, informative, participative and cooperative structures are required (Frommer et al., 2013, p. 136). Often missing public awareness about an increase in frequency and intensity of events hinders respective individual action. Providing information through informal planning helps raise awareness. In addition, future events cannot be fully predicted due to the uncertainty related to climate change. This makes acceptance of political decisions a difficult venture. Informal planning approaches might facilitate decision-making processes and improve public attitudes towards political decisions in issues as uncertain as risk reduction.

Schauber (2003, p. 3) notes that various informal options are available to local authorities to prevent potential risks. However, the actual application of those instruments relies, first of all, on political will. Moreover, municipalities depend on effective and interdisciplinary cooperation and coordination of activities with planning entities at different scales and across sectoral boundaries – both vertical and horizontal – and with neighbouring municipalities. This involves entities responsible for environmental management and nature conservation, water management, agriculture, forestry etc. For instance, when dealing with flood risk management, spatial planning entities can play an important role as coordinating actor, provided there is no legally binding hazard zoning map or plan[74]. Still, cooperation between all actors involved is a prerequisite for an effective management of flood risks. In this regard, informal planning instruments might be particularly helpful in coordinating different interests and objectives to finally accomplish purposeful and successful risk prevention strategies. After all, expert knowledge remains unnoticed if experts fail to communicate their knowledge in communication processes that involve all relevant actors or if they have no chance to do so, respectively (Selle, 1997). The common evaluation of various facts and the communication between different actors are equally important. Discourse-oriented approaches allow finding a consensus, which in turn can be considered an equivalent to legal norms[75] (Greiving, 2010, p. 30). According to these explanations, an informal planning approach consists of two

[74] The role of legally binding hazard zoning instruments will be explained in Chapter 4.2.3

[75] A consensus reflects opinions and attitudes of all actors involved in the process of consensus building. By involving different actors and giving all relevant actors – including the public – the opportunity to express their opinions, political decisions might be more easily understood, accepted and supported.

dimensions (Greiving, 2010, p. 35): first, a communication process between relevant political and administrative actors at different administrative levels, and second, a participatory, discourse-oriented approach between the political-administrative system and the general public.

The influence of formal planning instruments in the context of disaster risk reduction is restricted, so that strengthening and further developing informal instruments can be beneficial with near-certainty. When dealing with events such as river floods, flash floods or heat waves, strategies are needed which can be developed and implemented by combining formal and informal spatial planning (Birkmann, Vollmer et al., 2013, p. 164).

Today humans face many different types of hazards. Spatial planning cannot generally influence and have an impact on all of these, as not all of them are spatially relevant. By allocating different land uses, spatial planning can more or less influence the vulnerability to risks, but only in the case of spatially relevant natural and technological hazards (Greiving and Fleischhauer, 2006, p. 110). Floods and landslides are two of the main spatially relevant natural hazards encountered in the case study sites examined and will be described in Chapter 4.2.1.

Planning can be assigned considerable competences in managing risk. At the same time, it is dependent on outcomes of risk assessment, as such risk information constitutes a primary information source and evidence base. Accordingly, spatial planning has clear links with both assessment and management of spatially relevant environmental risks. Chapter 4.2.2 takes a closer look at these connections. Moreover, a number of difficulties related to dealing with disaster risk in spatial planning will be explained, namely the problems of interplay, fit and scale. Especially these last two problems have considerable consequences for the information needs of spatial planning.

Chapter 4.2.3 deals with the characteristics of risk-informed planning and how it should be organised. Statements are made about differences in dealing with risk information in spatial planning in Europe. For instance, the differentiation in deterministic and probabilistic hazard mapping approaches has consequences for handling risk information in spatial planning. In addition, different planning systems apply different approaches of integrating hazard maps or plans into local spatial plans. These different approaches will be presented and discussed.

4.2.1 Spatial relevance of natural hazards

Europe is susceptible to a wide range of natural hazards, including many with spatial relevance. Diverse geophysical and climatic settings are reasons for the observable differences in susceptibility. This study will only consider flood hazards and mass movements, both of which are spatially relevant. A hazard can be described as spatially relevant, when its occurrence can be ascribed to a certain hazard-exposed area, which is more or less regularly affected by a specific hazard. Spatially relevant hazards only occur locally or regionally, i.e. they have a limited extent. Examples include river flooding, storm surges, landslides and avalanches. In contrast, spatially non-relevant hazards such as flash floods, drought and storms may occur everywhere (Schmidt-Thomé, 2005, p. 15).

Spatial planning is charged with making long-term development decisions for a specific space and therefore has to consider all spatially relevant natural hazards[76]. It cannot be confined to just one or two types of hazards, but has to consider the sum of hazards and vulnerabilities (Fleischhauer, 2006a, pp. 10–11; Greiving et al., 2006, p. 5). Thus, spatial planning must technically adopt a multi-hazard approach in order to address potential future hazards in a spatial context (Greiving, 2002; Schmidt-Thomé, 2005).

Fleischhauer (2006a, p. 11) and Greiving et al. (2006, p. 5) note that integrative approaches that assess hazards in a particular spatial area ('hazards of place') have been developed since the 1970's. Hewitt and Burton (1971, p. 5), for instance, point out after a literature review that *"most work has been on single hazards, whereas the expanded concern demands a more systematic cross-hazard approach"*. The authors already acknowledged the great need for multi-hazard approaches. Subsequently, they formulated the 'all-hazards-at-a-place' research design. However, according to Kappes (2011, p. 8) *"rather little has changed since then in the scientific sector. Also in practice, the joint analysis of multiple hazards is still rare and instead separate computation of single-hazards is commonly performed".* This also holds true for spatial planning: Spatial planning research traditionally focused on single hazards while a more integrated research approach that considers multiple hazards has been carried out by just a few authors (e.g. (Burby, 1998a; Egli, 1996; Greiving, 2002; Schmidt-Thomé, 2005). Nonetheless, Cutters (1996) 'hazards of place' approach is well established in the field of geography today (Fleischhauer, 2006a, p. 11). By returning to Hewitt and Burton's (1971) 'all-hazards-at-a-place' approach, Cutter (1996, pp. 535–536) developed the 'hazards of place model of vulnerability' which *"serves as a useful heuristic in understanding the diverse elements that contribute to our understanding of the vulnerability of places"*. It focuses on the interaction of different elements that all together constitute the vulnerability of a place and its inhabitants, for it is the place that forms the principle component of vulnerability and risk analysis. It can promote both, a single- and a multi-hazards approach, taking account of differing hazard characteristics, diverse contexts (social, political, economic) as well as various methodological approaches (historical, descriptive, probabilistic, empirical) (Cutter, 1996, p. 537).

Often natural hazards are classified into categories depending on their respective causes such as gravitational (e.g. floods, landslides, rock falls, avalanches), marine (e.g. storm surges, tsunamis), climatic (e.g. drought, storms, hurricanes) or tectonic (e.g. earthquakes, volcanic eruptions) (Egli, 1996, p. 22). Such a classification, however, corresponds to a natural science approach which predominantly focuses on the threat caused by a hazard (Fleischhauer, 2004, p. 92) and not on its consequences and damage potential. Greiving (2002, p. 95) points out that when focusing on managing risks and when referring to a particular spatial area, options of influencing causes and consequences of hazards, i.e. probability of occurrence and damage potential, through spatial planning should be comprised in a classification. In this respect, main criteria are the following (Egli, 1996, p. 22; Fleischhauer, 2004, pp. 92–93; Greiving, 2002, p. 95):

- *Site-specificity (spatial dimension of a natural hazard)*: Natural hazards are often site-specific, which means they cannot occur everywhere but only when according climatic, topographical and geological conditions are given.

[76] Whether a hazard can be considered "relevant" depends on the knowledge about the hazard and the prevailing risk perception as well as the main objective of a risk analysis.

- *Seasonal conditions (time reference of a natural hazard)*: Natural hazards underlie seasonal or temporal conditions when they cannot occur at any time, but are bound to seasons (e.g. avalanches) or a particular period of time.
- *Characteristics of occurrence (process relatedness of a natural hazard)*: Natural hazards differ in their spontaneity, i.e. the rapidity of occurrence. This means some hazards occur spontaneously, sudden and perhaps even without prior warning. Other hazards occur slowly and steadily. This means it can be a slow process that leads to a culmination over time.
- *Differentiation (impact area of a natural hazard)*: A differentiation exists if it is possible to clearly define the impact area of a natural hazard (e.g. a flood plain). Often it is rather difficult to define the exact impact area (e.g. in case of a storm).
- *Suggestibility*: In some cases, the probability of occurrence of natural hazards can be reduced by implementing according prevention measures (e.g. rock fall protection nets). Other natural hazards cannot be influenced (e.g. earthquakes and volcanic eruptions).

As Fleischhauer (2004, p. 93) explains, not all of these criteria are relevant in the field of spatial planning. Table 2 classifies the listed criteria according to their relevance for spatial planning.

Table 2 Relevance of natural hazard evaluation criteria for spatial planning (Source: recreated from Fleischhauer, 2004, p. 93 adapted from Egli, 1996, p. 22, own translation)

Evaluation criterion	Relevance for spatial planning
Site-specificity	very high
Differentiation	high
Suggestibility	high
Characteristics of occurrence	medium
Seasonal conditions	low

The table reveals that site-specificity has a very high relevance and can be considered the main criterion for determining the relevance of a natural hazard for spatial planning. Especially gravitational hazards have a high site-specificity and a clear spatial dimension. Therefore, they have a high spatial relevance (Fleischhauer, 2004, p. 94). Both floods and landslides are gravitational hazards and thus have a high spatial relevance. Hence, they have a clear and high relevance for spatial planning. For this study focused on these two types of hazards in particular, they will now be explained in more detail[77].

[77] Nevertheless, the focus and interest of spatial planning should not be on gravitational hazards alone, due to the fact that various interactions exist between gravitational, climatic and other natural hazards. The impact of natural hazards can have significant negative consequences and disrupt efforts for sustainable development. Consequently, in addition to gravitational hazards also climatic, marine (where given) and other natural hazards should generally be considered (Fleischhauer, 2004, p. 94). This research applies a case study approach in which gravitational hazards are of particular importance. Climatic and other hazards will therefore not be studied in further detail.

Floods

Following the definition provided by the European Commission in its Directive on the assessment and management of flood risks (Article 2), "floods" can be understood as *"the temporary covering by water of land not normally covered by water. This shall include floods from rivers, mountain torrents, Mediterranean ephemeral water courses, and floods from the sea in coastal areas, and may exclude floods from sewerage systems"* (CEC, 2007b). Flooding, together with wind-related storms, is considered the most important hazard in Europe in terms of both economic losses or damages and people affected, i.e. in causing loss of human life (CRED, 2009; UNDRO, 1978, p. 1). Flooding does not only occur as a result of hydro-meteorological factors. Since the processes behind floods are quite complex and involve both physical and socio-economic aspects, they are also subject to societal factors. A distinction should be made between hydrologic and damaging floods. Hydrologic floods appear in unpopulated areas where they cannot cause any severe damages. In contrast, a flood risk that turns into a disaster automatically implies damages, which is why a flood disaster only occurs as a result of an interaction between a naturally caused flood and a societal system (Figure 22) (Barredo, 2009, p. 98; EEA, 2010, p. 64). Blaikie (1994, p. 124) underlines, that the percentage of vulnerable population is increasing since the population number rises. Due to the lack of settlement space, municipalities are forced to place an increasing number of people on flood plains or other environmentally valuable land worthy of protection.

Figure 22 Flood in Frydrychowice (Poland) in 2010 (Photos: Instytut Rozwoju Miast (IRM))

Besides being the most widespread natural disaster, flooding also causes a significant loss of life. Casualties can be sustained either immediately through drowning or lethal injury or in the wake of the flood through illness and famine. Previous floods reveal places that might be affected again by a returning flood. As a consequence, potentially affected areas are generally known by experience. This is why in many cases mitigation and adaptation measures can be implemented in advance. However, due to the differences in intensity and return periods, exact forward planning to prevent fatalities sometimes proves difficult. Extreme events such as flash floods or tsunamis, which have long or unknown return periods, are much harder to anticipate (Blaikie et al., 1994, pp. 125–126). A better understanding of flood disasters induces or improves the development of disaster prevention policies: Adequate data and information is therefore crucial to promote an appropriate distribution of resources, mitigation plans, disaster monitoring and assessment (EEA, 2010, p. 65).

Measures and policies for handling flood risk are directed towards the modification and prediction of causes that trigger the flood disaster. This involves strategies which reduce the hazard intensity, different precautionary measures, mitigation of adverse consequences as well as prediction of and preparedness for floods (Blaikie et al., 1994, p. 136). Traditionally, managing the risk of flooding consisted mainly in building structural measures such as retention basins, dikes, channels etc. (Jha et al., 2012, p. 73; Patt and Gonsowski, 2011, p. 159). Today, flood risk management is not only about defence against floods, but it is represented within a more comprehensive approach. The growing role and focus on vulnerability and resilience has caused a shift from a protective approach to flood risk management, including more prevention orientated action (Butler and Pidgeon, 2011; Greiving, 2002, 2003, pp. 167–170). The EEA (2010, pp. 72–73) states that many EU Member States *"are already practising integrated flood risk management, an approach that considers the full disaster cycle — prevention, protection, preparedness, response and recovery – in the management and prevention of flood disasters"*. Despite current efforts in regard to a comprehensive flood risk management, it is necessary to seek further vulnerability reduction in the form of flood protection, since the implementation of an integrated flood risk management approach will be a longer process. In order to reduce potential flood risks, short-term measures are essential. This involves measures such as keeping flood prone areas free of development or increasing and improving flood protection measures like dikes or adaptive measures for buildings (EEA, 2010, p. 73). Spatial planning related measures prove particularly useful and necessary, due to the fact that structural measures may fail and not provide absolute protection.

Floods do not stop at national borders. River floods often affect more than just one country. The Elbe flood in 2013, for example, hit several countries in central Europe such as Hungary, Poland and Germany. Furthermore, floods constitute an EU-wide problem (see above), with most EU countries having experienced partly devastating river floods in the past. Therefore, coordinated action at EU level with regard to flood risks seems advisable and reasonable. This is why the European Union used its coordinative function and, in 2007, established the Directive 2007/60/EC "On the assessment and management of flood risks", in order to enhance the Europe-wide flood protection. The Directive aims at the reduction of adverse consequences and applies to river floods, flash floods and storm surges (CEC, 2007b). It is being implemented in three stages: first by preliminarily assessing the flood risks of each river basin and associated coastal zones (by 2011), then by developing flood hazard maps and flood risks maps for areas with a significant flood risk (by 2013) and finally by producing Flood Risk Management Plans (by 2015). Flood Risk Management Plans (FRMP) shall include specific measures which aim to reduce the risk of flooding as well as take account of the various aspects of flood risk management and further aspects such as costs and effectiveness. They are required to follow a long-term approach, considering also climatic, land use and socio-economic changes in order to comply with the concept of sustainability (CEC, 2007b; EEA, 2010, p. 73).

There is an apparent and obvious role for spatial planning in terms of managing flood risks. This role has to be filled by using clear, proactive measures to reduce disaster risks (Sanderson, 2000, p. 101). As already mentioned, floods are spatial by nature. According to Egli (1996, p. 23) the spatial relevance of floods is given due to the following three evaluation criteria:

- *Site-specific*: Floods have a spatial dimension and only occur in areas where certain geographical characteristics prevail and provoke flood risks (e.g. the topography);

- *Differentiation*: Due to their spatial extent, floods can be spatially defined;
- *Suggestibility*: River floods and flash floods can only be controlled partly. The probability of occurrence can be influenced by structural measures next to the river or in the catchment area, for instance. As there can always be an extreme event when structural measures fail, planning-related measures become highly relevant.

Spatial planning has different options at hand to influence the vulnerability to flood risks. The strongest role of spatial planning can be seen in reducing the susceptibility to damages caused by floods (WMO and GWP, 2008, p. 18), namely through leaving areas free of development and diverting development away from flood-prone areas.

Landslides

Landslides are defined as *"the movement of a mass of rock, earth or debris down a slope"* (Cruden, 1991, p. 28). They constitute a serious threat in most mountainous and rolling landscapes of the world and are usually described by two characteristics: the material and the type of movement. Materials can be rock, debris, mud, soil etc., while types of movement can be falls, slides, flows, topples and spreads (see Figure 23 for examples) (Cruden and Varnes, 1996, 56; 67; Highland, 2004). Natural or physical factors triggering a landslide can be bedrock and soil properties and most importantly heavy or prolonged rainfalls, leading to soil erosion on (steep) slopes. Other causes for landslides include earthquakes, snow melt, volcanic eruptions, flooding and heat waves. In addition, there are also factors related to human activities such as land use changes, water leakage from utilities, dam bursts and others (Blaikie et al., 1994, p. 182; EEA, 2010, p. 81). Anthropogenic climate change and the projected effects and consequences in terms of temperature and precipitation rate changes are expected to influence the occurrence of landslides both in number and extent. As already mentioned, heavy rainfall events are one of the triggering factors for landslides, which is why an increase in the number of debris flows as well as soil erosion and degradation phenomena is very likely (EEA, 2010, p. 82; IPCC, 2012, p. 114).

Figure 23 Left: Landslide in the Fella River Catchment; Right: Rock fall in the Fella River Catchment (Photos: Courtesy of Armando Coianiz)

Fatalities through landslides are mainly caused in situations when heavy or long precipitation triggers a rapid slope movement (EEA, 2010, p. 87), which is hardly predictable and where no quick evacuation or at least an early warning can take place. Economic losses can already be caused by smaller or slower landslides since it is very difficult, if not impossible, to move already existing infrastructure or buildings. Fast moving slides in general rather cause risk to property and to a lesser extent to life. One reason for the comparably low probability of fatalities is that the collapse risk to buildings is only high when they are located on the sliding patches. It is mostly low if buildings are located in the trajectory or the runout zone. Another reason is the low probability of a slide directly hitting a person, as people will usually be able to get into safety in most cases – except when extremely fast slides occur. Such slides might still cause significant costs for clean-ups and repairs (Hollenstein, 2005, p. 291). However, it should be pointed out that landslide-triggered fatalities and economic losses may be greater in many countries than generally realised (Michaels, 2005, p. 313) and publicised. In general, economic losses are more difficult to assess for landslides or debris flows than for other types of natural hazards. There is no comprehensive overview available that covers the overall economic losses in Europe[78]. Although no major damages to ecosystems have been reported to date, landslides may modify the landscape to a certain extent and thus also affect ecosystems. Sediment from landslides could adversely impact marine, coastal or fluvial ecosystems, whereas strong rock falls or debris flows can impact forest and agricultural ecosystems. Still, obtaining information on damaged ecosystems is equally difficult (EEA, 2010, pp. 87–88).

Reduction of landslide risks, as with flood risk reduction, is manageable and desirable. Though, not all factors triggering a landslide can be influenced and thus managed. Triggering factors attributed to human activities such as land cover, the location of a dam and slope excavation constitute approaches for implementing preventive measures. Land use planning and management with policies and regulations regarding the full avoidance of landslide hazard areas or a restricted or prohibited activity on hazard-exposed areas constitute important options for landslide risk prevention (EEA, 2010, p. 90; Highland, 2004). Similarly to floods, mass movements such as landslides and rock falls are site-specific and can be spatially and temporally defined (Fleischhauer, 2004, p. 113). Consequently, planning-related measures that aim to reduce the vulnerability as well as anthropogenic triggering factors are particularly suited for managing landslide risks.

Possible measures in addition to land use planning and management are structural measures (e.g. dams, rock fall nets, ground water drainage) as well as ecological countermeasures (e.g. green engineering, afforestation). Further measures include the elaboration and implementation of emergency plans along with a monitoring network and the relocation of settlements and buildings that are exposed to high risks (EEA, 2010, p. 91). While these measures can or should be implemented by local governments, individuals can also attempt to reduce their exposure and susceptibility to landslides. By educating themselves on past landslide events and by claiming relevant information from planning and engineering departments they can strive for self-protection. In addition, it is possible to obtain the help and support of engineering geologists or civil engineers to assess the hazard and possible impacts on-site (Highland, 2004). In line with flood risk management, landslide risk management should follow an integrated approach, covering the whole disaster risk management cycle, making use of different measures and allowing comprehensive stakeholder participation and integration (EEA, 2010, pp. 90–91).

[78] The reason for the difficulty to assess overall economic losses or costs is that landslides are local phenomena, therefore usually several local authorities, institutions and organisations are involved (e.g. the municipality itself, fire brigades, road authorities, emergency units) (EEA, 2010, p. 88).

In contrast to the efforts undertaken to reduce the risk of flooding, there is no separate European policy for managing or regulating the reduction of landslide risks. There are only related EU policies which refer to the protection of soils (e.g. Soil Thematic Strategy, proposal for Soil Framework Directive). Furthermore, some additional principles and guidelines can be derived from international/global arrangements (e.g. the Sendai Framework). However, some EU countries, including France, Italy and Poland, have incorporated the requirement for landslide hazard maps and landslide risk maps into their spatial planning legislation (Fleischhauer et al., 2006).

According to the EEA (2010, p. 91), regardless of an existing legal framework for dealing with landslide risks in spatial planning, a more integrated risk management approach has generally proven to be more successful in reducing landslide risks than a former, defensive mitigation approach. The EEA (2010, p. 91) further highlights, that within the integrated risk management *"it is particularly important to gather knowledge on the hazard (records of past events, hazard maps showing the current situation, etc.) and the related risks at a local level, fully involving local stakeholders in the process"*, as landslides usually only have a local impact.

4.2.2 Spatial planning, risk assessment and risk management

According to Greiving and Fleischhauer (2006, p. 115), risk assessment and management are an integrated part of the planning process. In the decision process about spatial plans, risk assessment and management follow three lines of argument, illustrated in Figure 24:

- Scientific basis
- Political decisions
- Implementation process

The first aspect, the scientific basis, refers to adequate and sufficient data (primarily in the form of hazard and risk maps) which is needed to form a scientifically founded information base (Greiving and Fleischhauer, 2006, p. 115). Hence, this aspect exclusively focuses on the scientific accuracy and correctness of data and assessment methods. It seems to be widely accepted that policy decision-making, including decisions about local planning, must be based on scientific knowledge. After all, scientific evidence is useful in the definition of policies as well as in the evaluation of policy choices. It also plays an essential role for ensuring transparency in decision-making. Local administrators wish to be able to explain their choices in front of the public and policy-makers to ensure support and credibility for local plans, for instance. Science and technology can therefore make major contributions to risk reduction (European Commission, 2008, p. 15; UNISDR, 2009c, p. iv; van Stigt et al., 2015, p. 174).

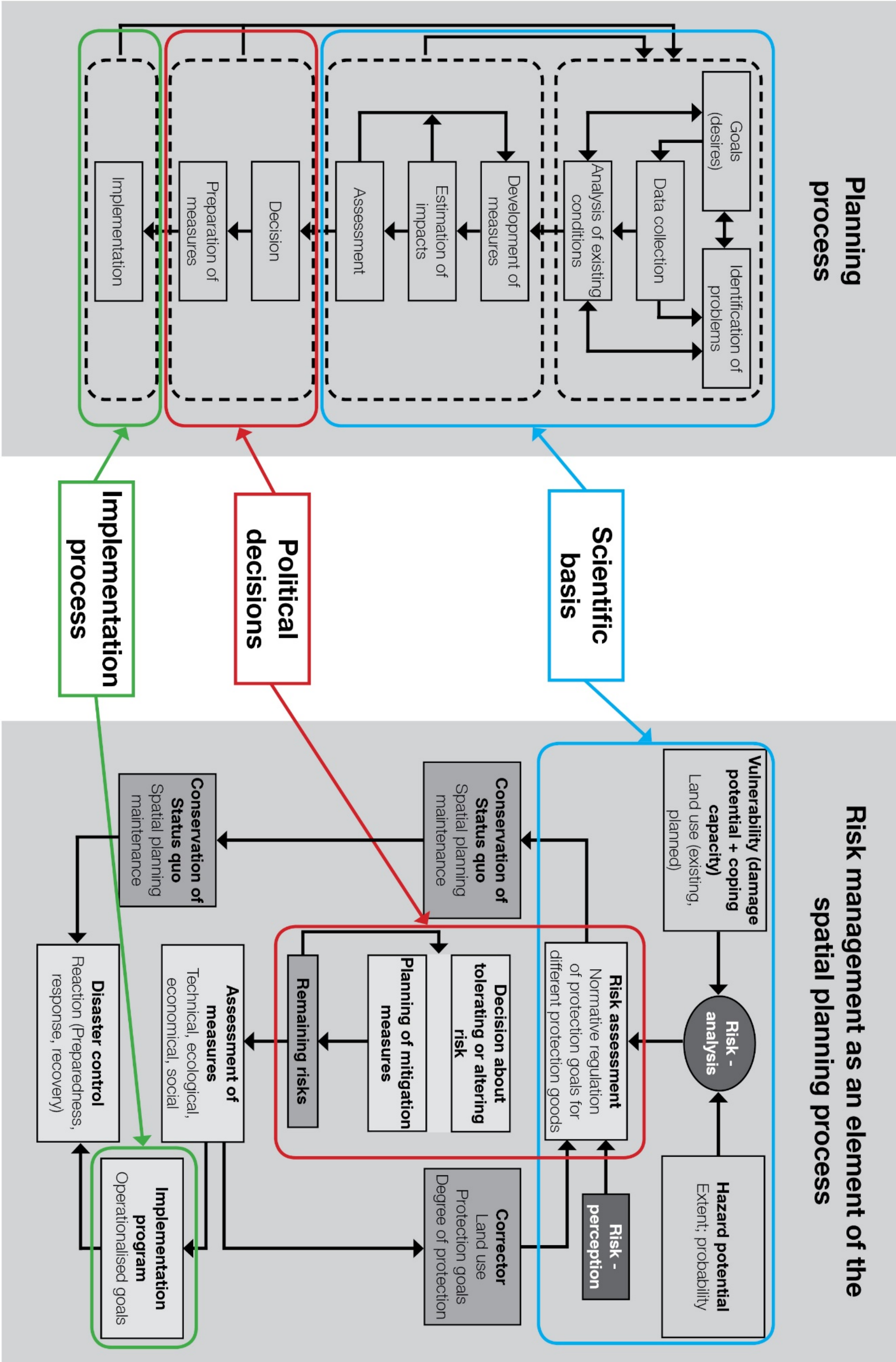

Figure 24 Risk assessment and management as planning process (Source: Greiving and Fleischhauer, 2006, p. 116)

The importance of science for risk reduction has been highlighted by a Scientific and Technical Committee of the UNISDR, which demands *"better mechanisms for integrating science and technology into policy processes"* (UNISDR, 2009c, pp. vi–vii). In this respect,

> *"disaster risk reduction requires strategic planning and implementation as well as technical and scientific expertise. It sits at the interface of policymaking, engineering and scientific research and requires a close and continuous exchange among these fields in order to provide effective and durable solutions"* (UNISDR, 2009c, p. vii).

In this context, the committee suggests that sharing and disseminating scientific information should be given high priority. Ensuring translation of scientific information into methods that can readily be involved into policies is a key aspect to purposeful policy and decision-making. This will help facilitate the adoption of regulations and the implementation of plans related to disaster risk reduction (UNISDR, 2009c, p. vii).

The second aspect deals with the question of whether and how the scientific basis has been taken into account and if not, why (Greiving and Fleischhauer, 2006, p. 115)? It scrutinises the political decision making process. In this context, Burby (1998b, p. 16) points towards difficulties related to the comprehension and interpretation of the scientific basis by stating that *"the science of identifying hazards and designing to reduce their adverse impacts has far outrun the ability of local governments to put this new knowledge into practice."* In order to carry out an effective land management, local governments not only depend on appropriate and reliable information about potential hazards, i.e. their spatial occurrence and magnitude, but also on information that is comprehensible and understandable for lay persons. Burby (1998b, pp. 14–19) also mentions the problem of a lack of political will to carry out risk reduction measures for the protection against natural disasters. Local governments often do not pay enough attention to natural hazards when managing development and they sometimes even ignore the probability of losses and damages in the event of a disaster. There are more important and exigent problems than the protection against possible future hazards, which might never even occur. Existing problems such as unemployment, an aging population, in- and out-migration, education etc. have a higher priority and need attention first. In several cases attention is only drawn to natural hazards after a disaster occurs. This means that first of all local governments need to have the political will to apply hazard-resistant methods in the pre-disaster phase, which is why damage and loss potential of hazards need to be made more explicit.

It should also be pointed out that there is some criticism to the usefulness of science for policy-making. Holmes and Clark (2008, p. 702), for instance, found – based on studies in the EU – that *"current practice in using science to inform policy-making has not yet caught up with guidance"*. While scientific information and knowledge may definitely serve to achieve or enhance political support for a local plan, it would certainly be an oversimplification to assert that science can directly be translated into policy and plans (Holmes and Clark, 2008; van Stigt et al., 2015, p. 168). Kørnøv and Thissen (2000, p. 195) even found that research in policy science assigns political power play and compromise-making a more important role than scientific evidence. Although the crucial role of scientific information is indisputable, there are still difficulties attached to the use of this information in policy and decision-making. This is why the mere provision of scientific expert knowledge and information should not be regarded as the sole solution to promote prevention-oriented spatial planning.

Finally, the implementation process points towards the question of how likely decisions are realised and turned into actual measures once their implementation has been decided, or what reasons there are against implementation, respectively (Greiving and Fleischhauer, 2006, p. 115). One reason might be the lack of private sector compliance, which could prevent a successful application of regulatory techniques. Land use and building regulations can only work if they are accepted and employed by the stakeholders they are addressing (e.g. property owners, house owners, investors, builders etc.). As long as the public ignores the regulations set up by the local government, all efforts will be inefficient (Burby, 1998b, p. 17). In this case it is not only important to adopt strict regulations, but at the same time apply non-regulatory techniques such as public information and training.

A holistic approach to risk assessment and management requires the collaboration and coordination of all stakeholders involved. In fact collaboration between different disciplines and sectors should be made a central feature (UNISDR, 2009c, pp. vii–viii). For example, collaboration and coordination are needed to share information and to coordinate different activities. This can help to exploit existing resources in the best possible way. Sapountzaki et al. (2011, p. 1447) recognised a couple of dilemmas, however. Often actors involved in risk management are hardly connected to each other, partly because of a historically fragmented administrative system. Moreover, spatial planning only has a negligible role compared to other actors which results in the fact that funding is fragmented as well. Finally, measures and activities carried out within the disaster management cycle are equally fragmented. Such a fragmentation reproduces situations *"where the respective information, knowledge, and policy actions run in parallel without any linkages, feedback, and mutual interactions"* (Sapountzaki et al., 2011, p. 1447). Obviously, a missing linkage between actors might hinder or harm successful cooperation amongst them. Such conditions prevent synergies and might even lead to duplicated or unreasonable measures and inefficient funding. This might be particularly problematic and unfavourable for municipalities that have no sufficient resources in terms of personnel or finances.

Young (2002) refers to this problem as the "problem of interplay". The problem of interplay can be regarded as a particularly crucial factor for the mitigation of spatial risks (Greiving and Fleischhauer, 2006, p. 112). Institutions should not be regarded as individual arrangements, but rather be seen as part of a wider network, since they interact with other arrangements both vertically and horizontally. Vertical interplay refers to cross-scale interactions or linkages between institutions and entities at different levels of social organisation. Horizontal interplay refers to interactions that happen at the same level of social organisation (Young, 2002, p. 23). The problem of interplay stems from the existence of a great number of different actors. Several distinct motives can guide actors to engage in intentional attempts to link different institutions or authorities at the stages of design and management. These kinds of attempts evolve from a request to enhance the performance of individual systems. Efforts to integrate local and regional arrangements into larger and extensive arrangements (supra-national or global), stem from the belief that the effectiveness of local or regional arrangements will be greater if they are absorbed by a larger arrangement (Young, 2002, p. 25).

When looking at planning-related mitigation measures, the ways in which national planning systems are usually organised need to be considered. Most national planning systems hold a sectoral dimension in addition to a comprehensive spatial planning dimension. This sectoral planning dimension has its own organisational structure, entities and instruments. In the case of spatial and sectoral planning, an internal harmonisation by a common, encompassing, supra-national authority is not possible, due to the differences in purpose and aims between the many authorities concerned. This makes the integration or reconciliation of comprehensive spatial and sectoral planning divisions a challenging task, as their relationship is considered a substantial element for mitigating risks (Greiving and Fleischhauer, 2006, p. 113). Particularly with regard to the management of water resources and flood risk, problems of institutional interplay emerge as they are often applicable to conflicts of interest between water issues and land use (Moss, 2004, p. 86). The need for institutional interaction at different levels and the problem of interplay become apparent when considering the existing regional fragmentation, for instance. Since hazards such as river floods often occur regionally, affecting a larger area which extends over several administrative regions or maybe even different nations, there has to be a comprehensive approach to risk management with intergovernmental co-ordination. Decisions taken by a government in one region always have to consider potential negative impacts and consequences for another region. One of the main problems in managing flood risks is the "policy gap" between water management authorities and spatial planning authorities (Newson, 1997, p. 343). Accordingly, there is an imperative need to closely coordinate land use planning and water management. However, such an extensive co-ordination is not an easy task. While an internal harmonisation of all the different authorities concerned through a common superior authority is not realisable, at the European level options exist to at least guide and influence existing mechanisms to a certain extent, or require new ones, respectively. Although competencies are missing for spatial planning at the European level, the European commission can exert a certain degree of power over the Member States in regard to sectoral planning entities by issuing Directives (Greiving and Fleischhauer, 2006, p. 113). Concerning water management, the EU Water Framework Directive (WFD)[79], for instance, sets down *"a number of procedural obligations which, in practice, are likely to have far-reaching consequences on the way integrated water management – including interplay with land management – is organised"* (Moss, 2004, p. 89). This is why the WFD is likely to bring about an improved institutional interplay – albeit not formally required.

In addition to the problem of interplay, typical planning related problems involve the problems of fit and scale (Greiving and Fleischhauer, 2006, p. 112; Moss, 2004, p. 86). The problem of fit relates to the question of how well attributes of governance shape and comply with ecosystems at different spatial and temporal scales[80] (Galaz et al., 2008, p. 147). It describes the problem of incompatibility of material or natural and institutional structures. It coercively occurs when humans interact with ecosystems and it addresses the fact that *"the effectiveness of environmental and resource regimes or, in other words, the capacity of these arrangements to prevent undesirable environmental changes and to solve environmental problems once they arise is determined in considerable measure by the degree to which they are compatible with the biogeophysical systems with which they interact"* (Young, 2002, p. 55). Cumming et al. (2006) explain in this context that spatial misfits appear when the scale of an ecological process and the scale of the social organisation responsible for management actions are not adequately aligned so that one or more functions of the system are disrupted.

[79] The Water Framework Directive – adopted in December 2000 – aimed to establish a framework for the management and protection of waters.

[80] Dimensions of the problem of fit involve geographical, jurisdictional, or functional fit (Cumming et al., 2006), yet often it is simply referred to as the problem of institutional fit (Bergsten et al., 2014).

The problem of fit can be encountered in several situations. There are multiple examples of mismatches between the geographical extent of an environmental resource and according administrative borders. This means that environmental problems do not always occur within the territorial scope of the authorities affecting its use (Moss, 2012). Spatial planning faces the problem of fit as well in the sense that decisions and assessments made on a sectoral level often do not match the scales of planning decisions and implementations. Mickwitz (2009, p. 60) came to the conclusion that *"while the need for co-ordination and integration across sectors, scales and levels is growing, the capacities to respond are frequently shrinking because of the rigidity of administrative and political borders, […] the strength of sectoral interests and preferences for small-scale solutions"*. Hence, there is a need for better coordinating sectoral and spatial interests and to look for solutions at appropriate scales – irrespective of existing administrative and political borders.

Functional misfits often stem from "gaps" in governance which can be found as a lack of institutional mechanisms to consider links between the socio-economic system, e.g. industries, and the ecosystem. In order to improve the relation, i.e. to reduce the gap and the mismatch, good knowledge of the existing institutions is required as well as an examination of where institutional arrangements do not account appropriately for the ecosystem which they are supposed to manage (Ekstrom and Young, 2009). In fact, the resolution of mismatches necessitates institutional changes at different hierarchical levels (Slootweg and Jones, 2011, p. 267). Due to the various drawbacks of such spatial misfits, scientists and policy-makers aim to create more effective institutional arrangements that fit the geographical extent of the natural resource. This way they try to improve spatial fit by changing the design of institutions.

Just like with the problem of interplay, one common example is the management of water resources around river basins and the allocation of responsibilities towards river basin authorities (Mitchell, 2005, p. 1338; Moss, 2003, p. 86, 2004, p. 85). Due to the fact that floods do not stop at administrative borders and that a flooded area does not necessarily comply with institutional responsibilities of water authorities within one administrative unit, a solution had to be found how to better manage floods that cross administrative borders – at a regional, national or even international scale. This is why the Water Framework Directive introduced river basin authorities and river basin management plans. According to the Directive, EU Member States are required to establish river basin districts. For each of those districts, the responsible river basin authority has to prepare river basin management plans. By pursuing river basin management on the scale of entire river basins, the WFD intended a tool for overcoming problems of spatial fit. This way the EU meant to encourage a more comprehensive and territorially integrated water management approach (Moss, 2004, p. 85).

Finally, the problem of scale is concerned with the different levels at which natural disasters or other phenomena occur in space and time. For instance, it refers to problems of transferability and comparability of conditions and developments both spatially and temporal. One of the challenges involves upscaling from local to sub-national or global developments or comparing short-term and long-term developments. This means that risk management always has to consider processes of change that take different effects at different levels, e.g. either large-scale or small-scale from a spatial point of view. At the same time, institutional arrangements will have to consider the tracking of processes which occur at different temporal scales (inter-annual, decadal, long-term, short-term etc.) (Young, 2002, pp. 27–28).

The concept of scale should not be confused with the problem of interplay. While the problem of interplay refers to the vertical and horizontal interaction of institutional arrangements across different levels of social organisation, the problem of scale does not address institutional linkages. Rather, it is directed towards *“the extent to which institutional arrangements are similar and exhibit comparable processes across levels of social organizations ranging from the local to the global”* (Young, O. R., 2008, p. 26). In relation to spatial planning, this means that the information provided has to match the spatial scale in order to be used at either the local or regional planning level (Wanczura, 2006a, p. 177).

In the context of the above-mentioned example of river basin and flood risk management, such different spatial and temporal scales may represent challenges for a precautionary management of flood risk. Due to these different spatial and temporal scales, management solutions cannot be simply transferred across space and time. Besides, local situations and problems vary. This is why the coordination of flood risk reduction measures is not an easy task, as in each case strategies and measures have to be adjusted to the respective situation.

4.2.3 Risk-informed spatial planning

In a planning process, decision-making and assessment phases are interwoven. However, a separation of these two phases seems appropriate – at least conceptually (Scholles, 2005, p. 97). An information level can be distinguished from a processual level which runs parallel. The former serves to assess and rate the current situation preliminarily, while the latter serves to determine issues to be investigated, involve authorities and the public, negotiate measures and take a final decision (Eberle 1999 cited in Scholles, 2005, p. 97). This subchapter gives a description of the characteristics of decision-making and assessment phases and processes.

Greiving and Fleischhauer (2006, p. 115) explain that *“decision-making as a core element of risk management is a normative, politically influenced strategy of tolerating or altering risks”*. During the decision-making process, the responsible authority determines specific planning goals related to risk management, e.g. certain protection goals for different protection objects. In this respect, it is essential, especially from a cost-benefit point of view, to determine protection goals in relation to the respective protection object[81]. This means that a protection goal should be both effective and efficient. Now, risk information provides the basis which is needed for selecting and prioritising protection goals – or risk reduction measures in general (Jha et al., 2012, p. 17). Since such decisions must be based on reasonable information, the authority needs a thorough evidence base and scientifically valid information which can be used in the decision-making process (Greiving and Fleischhauer, 2006, p. 115). A key task of the urban public sector consists in collecting information and in producing and providing reliable information on hazards and risks (Lall and Deichmann, 2009, p. 27). The ability to make appropriate decisions in relation to municipal risk management is supported by the access to suitable risk-related information. Such information serves as a sound basis for zoning decisions or general land use restrictions, for instance. This means that disaster risk can only be effectively managed and impacts prevented or relieved when a comprehensive collection of information related to these risks is consulted

[81] While it makes sense to protect highly vulnerable facilities and settlement areas – even against hazards or extreme events with a low return period – zones with agricultural use do not necessarily require protection (Greiving and Fleischhauer, 2006, p. 115).

(Jenkins and Poulier, 2006, p. 42). This information should be as reliable, accurate and current as possible in order to be able to reflect the situation as well as possible. In the end, the decision-making process will then lead to a choice of appropriate measures that – once implemented – contribute directly towards achieving the set up goals. A lack of data and information and the inability to interpret it correctly will most likely hamper the decision-making process and result in inappropriate or incorrect decisions being made (Jenkins and Poulier, 2006, p. 42). Even worse would be a decision making completely devoid of information.

Hence, without any access to adequate information or without the ability to understand and process it adequately, it will become rather difficult to prevent and manage disasters. Further determinations for an effective risk management are the organisational structure, data availability etc. It will therefore be important and interesting to find out how and which information is gathered or attained and how information management and processing at the local planning level take place.

There is a general belief or assumption that the provision of thorough, scientifically valid information will lead to a better, more rational and justified decision. However, almost all empirical research shows that actual decision-making processes usually do not follow rational procedures (Kørnøv and Thissen, 2000, pp. 191–192). Moreover, rational procedures *"will not automatically lead to a rational choice — considering imperfect information, multiple objectives the preferences of which are often not clearly established, and the fact that people do not always behave as assumed in rational models for decision-making"* (Kørnøv and Thissen, 2000, p. 192). This holds also true for spatial planning processes, where decisions are not always taken rationally. Even though spatial planning may in general be seen as a rational process, irrational decisions are a direct consequence of incomplete knowledge and a limited ability to grasp an issue as complex as disaster risk reduction in its entirety (Eggenberger and Partidário, 2000, p. 203). In addition, a distinction should be made between objective, science-based knowledge and subjective norms and values of respective decision-makers which influence decisions and might make them less rational. Nevertheless, Kørnøv and Thissen (2000, p. 192) acknowledge that although decision processes do not seem to follow a rational procedure, this does not mean that there should be no attempts to increase rationality. This, in turn, means that there should always be attempts to improve the quality of the information provided to decision-makers and spatial planners respectively.

Even the most thorough and best scientific information available cannot overcome all problems related to uncertainty. Especially when dealing with impacts and consequences of climate change, regional and municipal actors face difficulties since they cannot base planning decisions related to disaster risks on experiences from the past. Instead, such decisions are always future-oriented and can hardly be verified. Spatial planning always relies on causal connections and prognoses of climate effects to develop concepts and measures for adapting to the current situation (Greiving, 2010, p. 30). A lack thereof causes difficulties for decision-makers. Therefore, *"an underlying assumption is that the large uncertainties associated with climate systems, data, and modeling (e.g., parameters, assumptions, and alternative ways to represent physical systems) have impeded the capacity of decision makers to translate expanding knowledge about the climate system into adaptive actions"* (Larson et al., 2015, p. 14764). This is one of the reasons why the management of uncertainties requires collaboration between scientists, spatial planners and decision-makers (including policy makers).

Larson et al. (2015, p. 14766) further explain that *"the degree to which scientific and technical knowledge is successfully applied to decision-making depends on three criteria: salience, credibility, and legitimacy"*. In terms of disaster risk reduction, issues of credibility and legitimacy are particularly important. Credibility refers to the degree to which information is perceived as plausible and adequate and to which knowledge-providing actors are considered trustworthy and reliable. The main problem of valid information consists in the fact that individuals are often unable to rate information as credible or implausible (Cash et al., 2003, pp. 4–5). Herein lies the challenge of participatory decision-making: The translation of expert knowledge and scientific information for decision-makers and lay people – including spatial planners (who are no experts in hazard assessments and in valuating hydro-geological processes). Credibility of actors, knowledge and information is relevant for risk prevention in order to be able to assert decisions on the use of space, for instance. Clark et al. (2002, p. 24) notice that *"credibility is hard to establish in arenas in which considerable uncertainty and scientific disagreement exists, either about facts or causal relationships*". Especially when facing large uncertainties in the face of climate change, credibility depends on a consensus between all parties involved. Legitimacy refers to the unbiasedness of a policy process. The public judges legitimacy based on the way decisions are made and information is produced, processed and disseminated (Cash et al., 2003, p. 5). Credibility and legitimacy of knowledge and information can be improved through close collaboration and cooperation between scientists and decision-makers. A two-way communication process between providers and users of scientific information is crucial for establishing a mutual understanding of the information provided. Moreover, such an iterative engagement is key to building trust between the actors involved. It may also ensure a better understanding of the needs of policy and planning on the one hand and on the other hand emphasise what scientists can provide to assist decision- and policy-making (Larson et al., 2015, p. 14766).

As explained in Chapter 3.2.2, decisions on how to deal with disaster risks are always value judgements, which is why acceptance of such decisions from the public is highly important. It should be acknowledged that decision-making which is solely based on scientific information and knowledge, without considering socio-cultural aspects and the way risks are perceived by the public, causes mistrust and lack of acceptance (Löfstedt 2005 cited in Greiving, 2010, p. 30). Furthermore, decisions that are taken centrally by local governments often appear to be ineffective, because they lack support from those implementing the decisions as well as the public. The involvement of relevant actors is therefore essential for the success of policies (Kørnøv and Thissen, 2000, p. 195). This is why it is not only important to apply informal planning instruments that serve to inform and sensitise the population but which also allow for sufficient public involvement and stakeholder participation.

Participation may improve the policy process by a) an increased richness of information and creativity and b) an increased acceptance of the results of assessments (Guba and Lincoln, 1989; Mayer, 1997 cited in Kørnøv and Thissen, 2000, p. 196). Regarding the management of risks, participation is crucial for the determination of reasonable risk reduction measures. Not only scientific knowledge has to be communicated to end users, but local knowledge, expertise and perception of different stakeholders have to be considered as well in order to complement and improve available knowledge. By enabling the consideration of knowledge and attitudes of different actors, the abundance of information can be increased and measures which conform to public perceptions of risks can be decided upon. As mentioned above, participation can also help to build trust and increase acceptance of decisions. If different stakeholders participate in determining reduction strategies and measures, this may lead to a sense of ownership of the decisions. In the end results can be more easily implemented, as acceptance is an important prerequisite for taking action[82].

After examining challenges of decision-making processes with relation to risk reduction, the assessment phase within planning processes will now be regarded. As mentioned above, assessment and decision-making phases are closely linked. In the assessment phase, the current situation is assessed and valued. Results of assessments feed into the decision-making process and enable decision-makers to prioritise risk reduction measures. Spatial planners stand at the interface between scientists who provide information and the decision-makers. They use science in order to be able to deal with the wide range of complex issues they have to face in planning processes. Spatial planners also inform political decision-making. Although there is a clear link between spatial planning and political decision-making, decision-making processes and political decision-makers as such are not the focus of this research. Since this work is about spatial planning in particular, decision-making and implementation of political decisions are not further treated as part of this study. Instead, this study is about how spatial planners deal with scientific expertise, how they exercise judgement and how they handle uncertainties. In this respect it is also consequent to consider the role of SEA, which can be an ideal instrument to optimise the plan-making process as well as the final plan.

The basis of incorporating risk into spatial planning is the availability of fairly accurate information about possible future disasters (see above). Information on hazards and risks can be gained through assessing the level of risk by applying different assessment methods. Main actors in this field are sectoral planning authorities: Due to their strong competences and their knowledge in one specific sector policy (e.g. water, soil, environment, forest), sectoral planning authorities have the capability to assess natural hazards such as floods, landslides and avalanches in detail. The EU FP6 project ARMONIA revealed that in all the countries examined as part of the project, *"only sectoral planning divisions are responsible for the assessment of risks"* and that *"spatial planning plays no significant role in this context"* (Wanczura, 2006a, p. 175). While spatial planning is not involved in the assessment of hazards or risks as such, it represents one of the main users of the outcomes of such assessments carried out by sectoral planning divisions[83].

The Sendai Framework emphasises that especially at the national and local levels, risk assessments shall be mainstreamed into urban planning or land use policy development and implementation in general (UNISDR, 2015, p. 19). In fact, both spatial planners and decision-makers have to be adequately informed about risk if they aim to ensure sustainable and resilient land use for a disaster-prone area. This involves knowledge about the probability of occurrence of a disaster, the number of (infra)structures that may potentially be damaged as well as the number of people at risk (Deyle et al., 1998, p. 120). Risk assessment is usually part of a more general process which also recognises available capacities to reduce the level of risk and addresses the planning of risk reduction measures (CEC, 2010, p. 8). This means that a successful risk reduction strategy depends on a thorough risk assessment. Accordingly, risk assessment

[82] Amendola (2002, p. 23) underlines the importance of stakeholder participation by demanding a participatory procedure *"in which the different stakeholders are involved early in the risk analysis process to 'characterise' risks, even before they are given a formal assessment"*.

[83] This is one of the reasons why an early and full coordination between all authorities involved (e.g. spatial and sectoral planning authorities) is vital for effective planning processes (Greiving and Fleischhauer, 2006, p. 114).

provides the essential factual basis for making appropriate decisions on land use in spatial planning. Deyle (1998, p. 120) points out that *"knowledge of the risks posed by extreme natural events and an understanding of how such knowledge can influence human behavior are, therefore, central to assessing the potential of land use planning and management strategies for achieving safer, more sustainable communities."* Knowledge of the risks presumes understanding of the information provided. This necessitates that either the information as such is easily understandable by lay persons in the first place or that information providers, i.e. entities carrying out risk assessments, are aware of the respective needs of their addressees.

Spatial planning makes demands towards the way risk information should look. In this respect, a main requirement for using the outputs of risk assessments in spatial planning is that there is a legally binding basis for producing hazard or risk maps, i.e. information which can be cartographically presented on maps. These types of maps constitute an important information base for spatial planning, provided they exist in an appropriate spatial scale in order to avoid problems of fit and scale (CEC, 2010, p. 34; Fleischhauer, 2008, p. 287; Greiving and Fleischhauer, 2006, p. 114; Wanczura, 2006a, p. 177). Spatial plans cover the territorial jurisdiction of a particular planning unit (RCC, 2011, p. 7). According to the problem of scale, risk assessments need to be carried out at the same spatial scale as the level at which this information is used, or else, information will be hard to use at the respective planning level. Furthermore, different planning levels have different options to manage risks, which is why they require a differentiated level of accuracy of information. While at the regional level *"planning has to be understood as a relatively general framework for local as well as sectoral plans and programmes*", at the local level "*more detailed hazard assessment is needed"* (Greiving, 2006b, p. 192). For the regional level, hazard maps are needed that merely depict the potentially affected areas, as regional planning may only designate certain types of land uses. Planning at the local level involves a binding basis for building permits and addresses particular plots of land. As legally binding regulations may require and enforce specific actions and measures on an individual basis, precise hazard-related information is necessary[84] (Greiving, 2006b, p. 192). Each planning instrument requires information specific to these options due to the fact that each tool has specific ways of reducing risks.

[84] This holds true for both preparatory and legally binding land use plans.

Table 3 Overview of the availability and use of flood maps in European countries (Source: Moel et al., 2009, p. 295)

Country	Various			Flood map type***								Characteristics				Use by government						
	Coverage*	Produced by**	Accessible on-line	Historical	Flood extent	Flood depth	Other flood parameters****	Flood danger	Exposure/Coping capacity data	Qualitative risk	Quantitative risk (damage)	# of classes flood extent map	# of classes flood danger map	# of classes flood risk map*****	# of return periods calculated******	Emergency Planning	Spatial Planning (advisory)	Spatial Planning (binding)	Construction	Awareness	Insurance	Flood assessment/management
Flanders (BE)[a,e]	1	R	Y	X	X	X	R				X			C	17						X	X
France[a,f]	1	R	Y	X	X				X	X		1		3	1			X	X	X		
Switzerland[a,g]	1	R	y		X	X		X		X		1	4	V	4	X		X	X			
Netherlands[a]	1	C	Y			X	.V		.	.	.					X				X		X
Great Britain[a,h]	1	C	Y		X			X	X			2	4–7		4		X			X	X	
Romania[b,c,d]	1	C			X				X						S	X		X		X		
Slovakia[c,d]	1	C			X				X						S	X						X
Wallonia (BE)[a]	1	R	Y		–	–		X					3		3							
Hungary[a,b]	1				X	.	.P					2			2	X	X			X		
Ireland[a,c]	1	C	Y	X	X	.	.					3					X			X		X
Lithuania[a]	1	R		X	X											X		X				
Czech Rep.[a]	1	R	Y	X	X							3			3	X				X		
Slovenia[c,d]	1	C			X										4	X						
Estonia[a]	1	C		X																		
Greece[d]	1	C		X																		
Germany[a,i]	2	R	y		X	X		X			X	1–4	4	~ 7	V			X	X	X		
Spain[a,j]	2	R		X	X				X	X		3		5	3	X		X				
Italy[a,k,l]	2	R	y		X				X	X		3		4	3			X				
Finland[m]	2	R	y	X		X			–				5			X	X		X	X		X
Austria[a,n]	2	C			X	–	V	X				3	5		3		X					
Luxembourg[a,o]	2	P	Y		X	X	V	X				4	4		4		X			X		
Poland[a,p]	2	R			X	X						2–8			V	X		X				
Norway[a,q]	2	C			X							1			6	X	X					
Portugal[c,d]	2	L			X											X	X			X		X
Sweden[a,c]	2	C	Y		X				–			2			2	X	X					X
Croatia[a]	3				X				X		X	1			6							
Denmark[a]	3	C			X							1			2							
Latvia[a]	3	C			X							1			V	X	X					

* 1: (almost) entire territory; 2: some regions/ongoing; 3: limited areas/on request. ** C: central government; R: regional government; L: local government; P: project. *** – : information used in background of hazard map; . : will be developed. **** R: rate of rise; V: velocity; P: propagation. ***** C: continuous scale; V: varies depending on region. ****** S: several, exact amount not known but more then one; V: varies, depending on region/request.

[a] Van Alphen and Passchier (2007); [b]Jelinek et al. (2007); [c] EU survey (2004); [d] National Report Kobe Conference (2005); [e] D'Haeseleer et al. (2006); [f] Fleischhauer (2005); [g] Zimmerman et al. (2005); [h] Fay and Walker (2005); [i] Greiving (2005); [j] Cantos (2005); [k] Galderisi and Stanganelli (2005); [l] Menoni (2005); [m] Dubrovin et al. (2006); [n] www.wassernet.at; [o] www.gismosel.lu; [p] Wanczura (2005); [q] Høydal et al. (2000)

As explained in Chapter 3.2.2, maps can have different senses and purposes, comprise diverse contents and address various target groups. Different maps are therefore applied in different phases of the disaster risk management cycle. They often serve to provide for a certain level of transparency and help to inform stakeholders and raise awareness. Moel et al. (2009) provided an overview of the availability and use of various types of flood maps in European countries (Table 3). In general, hazard and risk maps are most commonly used across Europe for different types of hazards. Due to their overall relevance for disaster risk reduction, the different types of cartographic material should be explained in more detail, as they are applied differently by different types of stakeholders and are subject to different kinds of demands regarding the specific information, which is provided by and integrated into the maps[85].

The most basic input for spatial planning related risk management are hazard maps, which are produced by respective responsible, sectoral agencies, i.e. geological surveys for landslides, river basin authorities for flood hazards etc. Hazard maps show areas most likely to be affected by a hazard and thus help to designate areas with settlement restrictions in local land use plans that avoid and prohibit future development on certain areas of land. Especially conforming planning systems have such zoning instruments available (Greiving and Fleischhauer, 2010, p. 55). They also provide information about the intensity with which the hazard will probably occur. In addition to this spatial aspect, it is highly desirable that hazard maps contain information on respective return periods or the frequency of occurrence (RCC, 2011), i.e. a temporal aspect. While usually a hazard can be spatially defined, at least in the cases of floods and landslides, a temporal demarcation proves difficult. Still, as spatial decisions are characterised by a large temporal scale, the temporal aspect should be integrated into the maps accordingly (Greiving, 2002, p. 40). Usually, land use plans regulate the use of space for a period of at least 10 years, which is why hazard maps should ideally take account of a changing climate and integrate projected changes of climatic factors, which in turn can then be considered by land use plans. The problem is that hazard maps are often static maps, which are based on experience with past events and reflect the current situation, but do not necessarily consider future changes. However, despite the difficulties in predicting climatic changes, it should be clarified whether temporal changes can be involved[86] (Greiving, 2002, p. 41).

Maps should be produced for each spatially relevant hazard and made available to according users and applicants. They constitute a particularly important tool in planning processes as they clearly depict what locations are subject to what type of hazards with what intensity. Depending on the hazard level, decisions about future land uses can be taken that do not put people or infrastructures at risk. Consequently, they facilitate the adoption of adequate approaches to mitigate hazards and taking decisions about where to locate critical infrastructure and houses[87]. For planning decisions, the highest hazard level is relevant for enforcing the prohibition of any development, while lower hazard levels may enable certain provisions or regulations for a limited or restricted use of land and the granting of building permissions under certain conditions. Hazard maps are mainly used in planning at the local level, as, with its legally binding land use plans, the local administration can take decisions which are legally binding for everyone [88]. Some countries produce integrated hazard maps. These maps use data on all individual hazards and integrate them into

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[85] In addition to spatial planning authorities, sectoral planning authorities as well as crisis management units may be users of hazard maps. Sectoral planning entities such as river basin authorities use hazard maps in order to plan structural mitigation measures (e.g. dams, elevation of river banks etc.) to protect existing development structures from disasters. Crisis management units use hazard maps in order to elaborate purposeful evacuation plans or to organise the work of rescue services during a crisis situation.

[86] Hollenstein (1996, p. 57), in contrast, holds the view that hazard analysis can renounce a temporal aspect: For one thing, changes of system properties are hardly predictable, for another thing natural systems are not recurrent. Nonetheless, Greiving (2002, p. 42) feels that despite the difficulties in predicting changes of system properties, such changes do happen and they have considerable effects, which is why temporal aspects should preferably be involved.

[87] Unfortunately, since hazard mapping is expensive not all local governments can draw on such elaborate and specific information, which makes the application of risk reduction measures difficult (Burby, 1998b, p. 16).

[88] Previously built-up areas are an exception, as local authorities cannot exempt any power on private property, which is why informal instruments are needed in this case (see Chapter 4.2.2).

one map. This way, one single map shows the combined overall hazard potential for each region (Camenzind-Wildi et al., 2005, p. 15; Greiving et al., 2006, p. 12).

Hazard maps are not always legally binding. In such cases, they are based on scientific knowledge from scientific advisors and only exert influence once implemented into legally binding land use plans. Weighing up different interests and concerns against each other can be considered a basic feature of spatial planning at different scales. Interests can be related to social, economic, ecologic, cultural and other aspects. Insofar it is incumbent upon spatial planning authorities, or the spatial planner as such, to value different aspects as part of the weighingup process. When hazard information provided by sectoral scientists and experts is legally binding, spatial planning is deprived of its proper tasks and the responsibility is shifted towards the scientists providing the hazard information. It is the hazard map that then sets up standards and regulations and imposes land use and building restrictions.

Scientists should, however, not be held responsible for the provision of information and the content of maps. Instead, the political decision-makers are those that take the final decisions. According to a study of the OECD (2015, p. 25) *"experiences in different national juridical systems suggest that, in general, the Government itself is responsible for decisions based on the findings of Government-appointed expert advisory groups"*. This is, however, not necessarily always the case. In this context, the role of scientists and experts needs to be questioned and examined. It has already been stressed that scientific information is the basis of informed policy- and decision-making (OECD, 2015; UNISDR, 2009c; UNISDR, 2015). Those experts should identify hazards who have special expertise in scientific data collection and knowledge development (UNISDR, 2007, p. 37). However, these experts merely provide information on hazards based on hazard assessments that were carried out with best available methods and knowledge. While *"those involved in giving science advice need to embrace their 'ethical' responsibility to perform the task to the best of their ability and in line with agreed procedures and protocols"* (OECD, 2015, p. 7), experts and scientists cannot exert any power of decision and therefore technically cannot be held responsible. After all, risk research should only have an advisory and supporting role for political decision-makers. This is why experts try to defy the growing weight of expectations by clearly distinguishing between an objective-scientific risk analysis and its political assessment (Cogoy, 1993, pp. 145–146). Cogoy (1993, p. 146) points out that *"according to that, risk research provides an objective estimation of the technological risks, while the political system accomplishes the task to perform an assessment of the risk and therefore a decision about its acceptability*" (own translation). In other words, science is responsible for providing data about risks to policy, and the political system is responsible for processing this data in a transparent way and transforming it into legitimate decisions. This means that the production of a map cannot represent an end-point in itself. Actual risk reduction can only take place when the information of the maps is translated into policies and regulations (DeGraff, 2012, p. 53). Now science-based expertise has increasingly been required by government policy actors and been used for political action across a range of actions – including climate change and disaster risk reduction (Böschen and Wehling, 2010, p. 93; OECD, 2015, p. 5). However, a concern can be seen in the practical application: Science is often unable to offer fully reliable and accurate knowledge to achieve a sound policy making in an unambiguous way (Böschen and Wehling, 2010, p. 93). At the same time, due to the increasing need for evidence and advice, risk research faces growing expectations and is increasingly integrated into political justification and legitimisation systems (Cogoy, 1993, p. 146). This might cause problems for advisory processes in the future, as due to the various degrees of uncertainty scientific evidence may be contested. Experts and scientists should therefore explicitly communicate uncertainties and explain them to decision-makers[89] (OECD, 2015, pp. 20–21). Moreover, there is no consistency in risk evaluation and in setting risk reduction standards. This makes dealing with ambiguous and uncertain data even more difficult. Accordingly, the question arises as to how scientific expertise and expert knowledge can still inform and advise decision- and policymaking in the best possible way? This holds also true for spatial planning decisions where the question can be posed as to how expert knowledge about natural hazards can be communicated to local planning authorities and urban planners and then processed in spatial planning processes in an ideal way. It is assumed that there can be no universal solution or answer to this question. Each country has its proper ways of dealing with this problem, based on the respective influence or relevance of different cultures and the different perceptions of risk of the population[90].

In addition to hazard maps, risk maps can be produced which combine hazard and vulnerability. Hence, in contrast to hazard maps they contain information about the possible consequences (e.g. economic damage, number of people affected). This means that risk maps result from a comprehensive risk assessment. They provide a level of transparency and when applied in decision-making processes they enable policy decisions which are prioritised in a way that address the highest risks with the most adequate risk reduction measures (CEC, 2010, p. 9). As outlined in Chapter 3.2.2 risk assessment involves an evaluation of the risk by incorporating the notion of risk perception. Risk maps thus comprise rating elements as they are based on a specific definition of damage that needs to ensue normatively. This is why risk maps constitute the interface between risk assessment and risk management (Wanczura, 2010, p. 64). In spatial planning, hazard maps are most commonly used, however. Accordingly, in many EU Member States only little attention is paid to aspects of vulnerability in spatial planning processes (Wanczura, 2006a, p. 175).

The elaborations above hint at two important characteristics of hazard maps: different binding effects of hazard maps and consequently also differing ways of integrating hazard maps into land use planning. Since there are various examples of mapping methodologies being used in Europe (CEC, 2010, p. 34), their application in spatial planning differs as well. A distinction with regard to mapping methodologies can be made between deterministic and probabilistic approaches. The assessment of inundation areas, for instance, is often carried out through a deterministic approach by means of hydraulic models. These numeric models are first calibrated with reference to a specific historical flood event. Then they are used to estimate flood extents relative to different event magnitudes (Domeneghetti et al., 2013, p. 3128). Deterministic flood inundation maps are usually produced in order to classify flood plains into dry areas and areas that might potentially be flooded (Figure 25a) (Alfonso et al., 2016, p. 1026). A probabilistic approach consists of more, individual steps. Among others, behavioural models are used that take account of hydrological uncertainty referring to the magnitude of a specific flood event (Figure 25b) (Alfonso et al., 2016, p. 1026).

[89] Dealing with uncertainty constitutes a main challenge in spatial planning. DeGraff (2012, p. 53) notes that policy is implemented through laws and regulations that are expressed in a language which tries to avoid the need for interpretation. It will therefore be difficult to incorporate uncertainty into effective planning measures.

[90] The ways of how spatial planning integrates and deals with scientific expertise (i.e. risk information) in Poland, France and Italy will be outlined in Chapter 8.

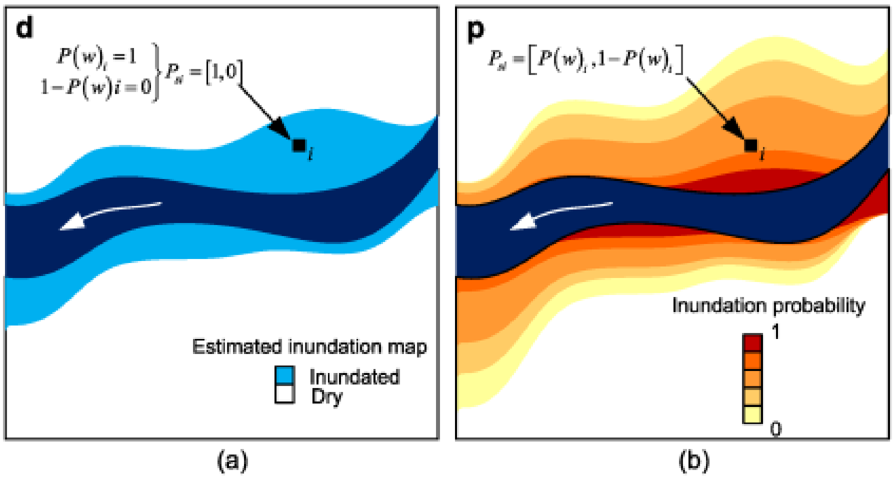

Figure 25 (a) Deterministic and (b) probabilistic representations of a flood extent (Source: Alfonso et al., 2016, p. 1027)

The main difference between these two approaches consists in the consideration of uncertainties. When referring to flood hazard mapping, deterministic predictions of flood extents do not consider uncertainties in the modelling process (Bates et al., 2004). This is why *"deterministic flood maps shield decision-makers from intrinsic sources of uncertainty and therefore lead to the danger of relying on precise, but potentially inaccurate results"* (Alfonso et al., 2016, pp. 1026–1027). This in turn may lead to an incorrect assessment of hazards when used for spatial planning decisions about future developments in the immediate vicinity of flood plains (Di Baldassarre et al., 2010, p. 366). The use of probabilistic flood maps is therefore regarded as more adequate. In contrast to deterministic flood maps, probabilistic flood maps take uncertainty into account by using a methodology to map uncertainty in flood extent predictions (Bates et al., 2004; Di Baldassarre et al., 2010, p. 366). Hence, results of the hazard analysis are presented by quantifying and illustrating the associated uncertainty. Such a fair presentation of results can in fact only be accomplished by a probabilistic approach, which therefore constitutes a more correct representation of the subject (Di Baldassarre et al., 2010; Domeneghetti et al., 2013). It can be argued that *"stakeholders and decision-makers should be provided by hydrologists with probabilistic inundation maps to guide and support the definition of flood mitigation strategies; when deterministic maps are produced it implies that a decision has already been made by hydrologists, who are hence no longer behaving like scientists, but rather as decision-makers themselves"* (Di Baldassare, 2012 cited in Domeneghetti et al., 2013, p. 3128). This can be regarded as a concern. As mentioned above, decision-making is a politically influenced process of tolerating or altering risks. Decisions should therefore not be imposed by sectoral planning entities or scientific experts. Besides, neglecting uncertainties does not allow for a comprehensive analysis of risks. Accordingly, there seems to be a growing consensus today that it is more convenient to apply the probabilistic approach in order to be "*approximately right, rather than precisely wrong*" (Alfonso et al., 2016, p. 1027). Consequently, conceiving inundation hazard as a probability has more recently been encouraged (Bates et al., 2004; Di Baldassarre et al., 2010).

Moreover, there are several types of zoning-related planning instruments that help improve risk prevention. Likewise, there are different models or ways how to integrate these instruments into local spatial plans, due to different legal bases and national legal frameworks. Different possibilities of this integration, their advantages and disadvantages are presented in Table 4.

Table 4 Possibilities of the presentation of natural hazards within a local land use plan (Source: recreated and slightly altered from Greiving and Fleischhauer, 2006, p. 121)

	Coordinated hazard zoning in general land use plan	Specific hazard zoning map in general land use plan with direct binding character	Independent hazard map without a direct binding character to landowners
Description	Consideration of hazard-prone areas during the compilation or review of the local land use plan by a suitable allocation of types of land use and intensity (e.g. informed by SEA)	The hazard zones are displayed in a separate map (zoning map) which has a direct effect on land ownership and property rights. Property owners have the right to object to the hazard zone classification during the elaboration of the zoning map.	Definition of hazard zones within the scope of expert planning – objections may be raised to decisions that are made on the basis of these maps.
Advantages	Possibility of weighing up different concerns. Public involvement facilitates the communication of risks. At the local level, no new instruments are necessary.	The hazard can be considered in a uniform manner by all municipalities (at the local planning level). Provisions have to be implemented and cannot be ignored. The definitions of hazard zones can be applied directly in building approval procedures.	A simple alteration of a hazard zoning map or plan is possible. The administrative expenditure is low. Restrictions can be implemented according to the latest scientific knowledge. The map is suitable for a cooperative strategy that aims to influence existing building structures by individual building protection.
Disadvantages	Land use plans only contain information about hazard-prone areas when a specific reference is made. An alteration of the danger situation (or the level of risk) means the zoning plan must be adapted accordingly.	An alteration of the danger situation (or the level of risk) means that the entire zoning plan has to be adapted accordingly. For legally binding effects, an exact evidence base is needed. Problems of acceptance may arise.	No effectiveness if stakeholders are unwilling to participate and follow the advice. Possibility of conflicting contents in cases with two or more maps or sources of information for the same area.

The first option describes a model in which land use plans are required to take risk information into account during the preparation or review of the plan (Greiving and Fleischhauer, 2006, p. 121). This means that hazard zones are identified with the help of hazard maps, which illustrate the possible extent and intensity of natural hazards. According to the information presented by these maps, different types of land uses can be allocated. Depending on the respective hazard level and after weighing up different interests and demands made towards space, decisions for land uses and developments can be taken. This process from hazard identification to decision-making can be integrated into the SEA procedure. Advantages for such an approach involve a comprehensive weighing up of different concerns, chances and risks. This means that hazards are treated together with other concerns during the weighing up process and can be regarded in a comprehensive way. Moreover, public involvement as an integral part of spatial planning processes provides for an adequate means to communicate risks to the public. Finally, existing planning instruments are already suited to adequately deal with and consider hazard-prone areas. Hence, no additional instruments are required (Greiving and Fleischhauer, 2006, p. 121). Disadvantages include the possibility of ignoring existing information about hazard-prone areas in spatial plans. A change in the hazard situation or the level of risk requires an adaptation of the zoning plan according to new knowledge. Examples for this approach of hazard map integration can be found in Poland and in Germany, for instance.

The second option refers to a model that involves the production of separate hazard or risk maps that are legally binding for spatial plans. They display hazard or risk zones that have to be considered in spatial plans. Consequently, they directly affect land ownership and property rights once they are approved and adopted. Property owners have the right to object to the hazard zoning during the elaboration of the map (Greiving and Fleischhauer, 2006, p. 121). This approach is a main feature of French and Italian risk prevention policies. Both countries have strong risk prevention instruments at hand which have direct impacts on spatial planning practices. An advantage of this approach is that each municipality equally has to integrate respective hazard zones in their local planning documents and implement provisions included in the hazard or risk maps or plans – provided the latter exist (Greiving and Fleischhauer, 2006, p. 121). If the provisions of such maps or plans are legally binding, the consideration of natural hazards is not part of the weighing up process. Respective zones have to be integrated into spatial plans a priori. Provisions are often clear, which makes it convenient to spatial planners to apply according restrictions to local spatial plans. There is no particular knowledge needed for interpreting the hazard map. Finally, the given definitions of hazard zones can be directly applied in building approval procedures (Greiving and Fleischhauer, 2006, p. 121). Accordingly, decision-makers have an instrument at hand that legitimises decisions regarding building permits on single plots of land. However, problems of acceptance can occur due to the missing possibility of politically influencing the mapping process. Decisions are taken by sectoral planning authorities and/or scientific experts, which means that decision-makers and the public are required to accept results gained from numerical modelling (see above). Such an evidence base therefore needs to be precise (Greiving and Fleischhauer, 2006, p. 121). Otherwise, legally binding provisions would hardly be accepted. However, uncertainty resulting from future climate change and errors in data and modelling hardly allow for precise predictions. In order to impose such provisions, legal compliance is therefore needed.

The last option refers to hazard maps or plans that are not legally binding. Such maps and plans mainly have informative content and serve informative purposes. Thus, objections may be raised to planning decisions that are made on their basis (Greiving and Fleischhauer, 2006, p. 121). This approach enables straightforward alterations of both hazard zoning maps and land use plans. Consequently, building restrictions can be implemented according to the most actual scientific knowledge and technical capabilities. It is well-suited for addressing land and property owners and inform them about existing risks with the aim of influencing existing building structures through an implementation of individual protective measures (Greiving and Fleischhauer, 2006, p. 121). A downside of this approach lies in the lack of effectiveness in case of stakeholders' unwillingness to participate and follow the advice, or in a lack of knowledge about the use of such maps. Moreover, this option allows for the preparation of different hazard maps for the same area. When different scientific institutions or public authorities produce hazard maps for the same area, it is most likely that hazards will be analysed differently and outcomes might vary. In the worst case, different approaches produce conflicting contents that impede the translation of the given information into spatial plans. In addition to its maps with a legally binding character, France also disposes of different “cartes informatives” (informative maps) and informal instruments. According to this last approach these maps and plans inform, but there is no legal obligation to consider them.

European countries apply different planning approaches and maps. In some countries even more than one of the above-mentioned models can be found. The reason is that natural hazards are dealt with in different ways. For instance, coordinated hazard zoning maps may exist for flood hazards, while hazard maps with no binding character may exist for landslide hazards (e.g. in Poland, see Chapter 8.1.2). Differences among European countries can mainly be traced back to differences in planning cultures, risk perception and experience with respective hazards in the past.

According to the requirement that maps should be produced for each spatially relevant hazard, maps exist for both flood and landslide hazards. However, the legal bases for producing maps for floods and landslides differ considerably. While the EU Flood Risk Directive provides an ideal framework for flood hazards and ensures a Europe-wide assessment of flood risks by requiring Member States to produce flood hazard and flood risk maps, the production of landslide hazard and/or risk maps can be regulated by each Member State individually.

The EU FRD requires that flood hazard maps have to be prepared for those areas where, based on the preliminary flood risk assessment, significant floods are likely to occur or where a potentially significant risk exists. Article 6 EU FRD specifies that flood hazard maps have to contain information about the flood extent, water depths or water level and, where appropriate, flow velocities for three return periods:

(a) floods with a low probability, or extreme event scenarios;

(b) floods with a medium probability (likely return period ≥ 100 years);

(c) floods with a high probability, where appropriate.

Flood risk maps are required to show the potential adverse consequences in these three scenarios that are expressed in terms of:

(a) the indicative number of inhabitants potentially affected;

(b) type of economic activity of the area potentially affected;

(c) the IPPC installations (larger industrial installations) that might cause accidental pollution in the case of a flood event and potentially affected areas that have been designated for the production of drinking water or for water recreation;

(d) other information that the Member State considers useful.

Although many EU Member States have already completed studies and assessments on flood hazards before the adoption of the EU Flood Risk Directive (Merz et al., 2007, p. 232), available information does not necessarily conform with the required format or extent. This means that most countries have to adjust their former assessment and mapping practices according to the new EU regulations and add missing information. Accordingly, new information about hazards and risks is now available which might, due to necessary changes in national law connected with the implementation of the Directive, have further consequences for the use and handling of this information. On the one hand the Directive ensures conformity in flood risk assessment and management across the EU to a certain degree. On the other hand, it also allows Member-State-specific effectuations, which means that actual legal regulations and practices will differ among EU countries.

Spatial planning is one of the main target groups of flood hazard maps. Implications of the EU FRD might be quite essential, since the Directive facilitates the provision of information about hazards and risks which might be of great importance for spatial planning. Wagner (2008, p. 777), for example, points out that hazard maps, by illustrating even the extent of rare flood events, constitute a useful tool for local planning, since responsible authorities can more easily consider the actual state of endangerment (in contrast to flood risk maps)[91]. The fact that flood hazard maps prepared according to the EU FRD requirements now have to illustrate the extent of an extreme flood event can be of particular importance for spatial planning. Before the adoption of the FRD, usually only the 50-year or 100-year flood events were presented on maps. The illustration of flood events with low probability and high intensity, i.e. so-called extreme floods, makes it possible for spatial planning to take into account those rare events in which the flood exceeds protection measures or where structural measures fail to fully protect the area (e.g. dike breaches) and areas behind dikes that were considered "safe" are affected[92]. Merz et al. (2007, p. 246) state that in this respect it is necessary to make users aware of the limitations of maps. Users should not perceive such information as certain and accurate. This is why maps should always communicate uncertainty and indicate the error range as clearly as possible in order to provide the end-users with a realistic idea of the accuracy of the information. The selected flood probabilities (recurrence intervals) and the scales of hazard maps applied in each of the Member States can vary according to local conditions or circumstances. Some countries include additional data in the maps (e.g. river bed loads or drifting ice) (Müller, 2013, p. 119). Main characteristics of flood hazard and risk maps are outlined and summarised in Table 5[93].

[91] In general, flood maps *"give a more direct and stronger impression of the spatial distribution of the flood risk than other forms of presentation (verbal description, diagrams)"* (Merz et al., 2007, p. 247).

[92] Traditionally, EU flood control was mainly characterised through either reactive practices such as emergency response or through flood control by structural measures. However, after realising the negative effects of former flood control strategies, a paradigm shift from classical flood protection as an engineering task towards more proactive action, non-structural measures and an integrated flood risk management was considered necessary (WMO, 2006; Büchele et al., 2006, p. 485). Therefore, extreme flood events have to be investigated more consequently (Büchele et al., 2006, p. 485) and taken into account in local spatial planning practices. One major drawback and difficulty in considering extreme events in spatial planning is the high uncertainty related to the estimation of extreme discharges (Merz et al., 2007, p. 245).

[93] In addition to flood hazard and flood risk maps, there are flood danger maps and flood vulnerability maps. In contrast to flood hazard maps, flood danger maps do not contain any information about the exceedance probability. Instead, they merely show historic or synthetic flood events like an inundation area for a historic flood or a map with the distribution of water depth. Flood vulnerability maps provide information about the flood exposure or they present the susceptibility of elements at risk (Merz et al., 2007, pp. 240–241).

Table 5 Characteristics for flood maps available in Europe (Source: recreated from EXCIMAP, 2007, p. 11)

	Flood hazard map	Flood risk map
Content	Flood parameters such as • Flood extent according to probability classes, according to past events • Flood depth • Flow velocity • Flood propagation • Degree of danger	Risk parameters such as • Assets at risk • Flood vulnerability • Probable damage • Probable loss (per unit time)
Purpose and use	• Land use planning and land management • Watershed management • Water management planning • Hazard assessment on local level • Emergency planning and management • Planning of technical measures • Overall awareness building	• Basis for policy dialogue • Priority setting for measures • Flood Risk Management Strategy (prevention, mitigation) • Emergency management (e. g. the determination of main assets) • Overall awareness building
Scale	• Local level: 1:5,000 to 25,000: various parameters • National level, whole river basin: 1:50,000 to 1:1,000,000: in general only flood extent	• 1:5,000 to 1:25,000 • 1:50,000 to 1:1,000,000
Accuracy	• High: cadastre level for detailed maps • Low: whole river basin, national level	• High: cadastre level • Low: whole river basin, national level
Target group / use	• National, regional or local land use planning • Flood managers • Emergency services • Forest services (watershed management) • Public at large	• Insurance • National, regional or local emergency services • National, regional or local water and land use managers

Merz et al. (2007, p. 245) stress that *"flood maps have to be updated in order to take into account developments that significantly affect the flood situation"*. There is no standard time interval for updating the maps, but it depends on the specific rate of changes of relevant developments. Relevant developments to be considered include, for instance, changes in retention capacity of a catchment area, changes in settlements structures (i.e. changes in exposure) or climate change. However, the change in flood hazard and the according need to update flood hazard maps is considered comparably small. In contrast, the change in vulnerability due to growing urban development is expected to be larger, which is why flood risk maps need to be updated regularly (Merz et al., 2007, p. 245). When local spatial plans are amended or updated it is still important that spatial planners have access to the most recent hazard maps and that the information provided represents the most current and actual state of knowledge.

As mentioned above, hazard maps are not necessarily legally binding. This means that a hazard map as such cannot guide land use or exert any power on urban development. Only when the information provided by a hazard map is integrated into a legally binding land use plan, it can impact urban development. By implication, if spatial planning neglects or even ignores hazard information, restrictions on land use, construction projects or single buildings may not be exerted. This is why it is important that spatial planning at both local and regional scale takes available hazard maps into account so that the information can be indirectly implemented through planning instruments.

Despite the fact that there is no EU-wide regulation on how to produce and provide landslide hazard and/or risk maps, some EU countries include landslide hazard maps into their spatial planning legislation (see Chapter 4.2.1). This implies that spatial planning can make use of an adequate evidence base providing information about landslide hazards, which can also be easily applied by planners. The availability of fairly accurate information on landslides, especially in the form of maps, is a key prerequisite for incorporating landslide risk into land use planning decisions. At the current stage, inventories of landslides exist in many European countries, but access is often restricted, although the benefit of publicly available inventories for stakeholders and decision-makers is cannot be denied (EEA, 2010, p. 91). All three countries – Poland, France and Italy – have a nationwide inventory. Maps in Poland are produced at the largest scale (1:10,000 versus 1:25,000 in France and Italy) and the inventory includes a public web service on landslides under current development that can be accessed by anyone. Such comparably detailed and easily accessible information could be of particular use for spatial planning authorities.

Landslide hazard maps visualise potential landslide events, show the areas where landslides are likely to occur and provide information about the magnitude and character of landslides. According to the U.S. Geological Survey (USGS), a landslide hazard map should indicate *"the annual probability (likelihood) of landslides occurring throughout an area"* and not only refer to *"the chances that a landslide may form at a particular place, but also the chances that a landslide from farther upslope may strike that place"* (Spiker and Gori, 2000, p. 40). Several approaches and methodologies have been developed worldwide to assess landslide hazards, which have advanced the ability of scientists to identify the spatial and temporal occurrence of landslides as well as their intensity (Chacón et al., 2006, pp. 342–343; Fell et al., 2005, p. 3). Predicting and assessing landslide hazards generally involves the following four steps (Selby 1993; Jones 1995 cited in Lee and Jones, 2004, pp. 79–80):

1. Identify the areas and locations which could potentially be affected;
2. Define the size and extent of the areas that necessitate further examination and assessment;
3. Map and record those areas with permanently active landslides or where landslides have already occurred in the past;
4. Identify slope units, topography, deposits or stratigraphic units which prove unstable.

The results of such hazard assessments can then be illustrated and visualised in maps, which constitute important information bases for spatial planners and engineers. The problem is that often landslide hazard assessments still only define the characteristics and mechanisms of the hazard and where it might occur and neglect information about the probability of occurrence. Lee and Jones (2004, p. 80) see the reason in the difficulty to determine *"the association between factors, such as potential triggering events, and landslide activity across a broad area"*. Hence, most assessments only take account of the susceptibility of an area to landslides or the high, medium and low likelihood that a landslide will happen (Lee and Jones, 2004, p. 80). Yet, such information can be of importance for spatial planning. Even without exactly knowing the probability of occurrence knowledge about the spatial occurrence of a landslide as well as its possible intensity is crucial. Such information may result in land use restrictions and the application of building codes in order to restrict construction activities or to allow building under certain conditions by requiring an adjustment of the buildings to a given hazard potential.

Landslide hazard maps are a fundamental basis for the evaluation of landslide risks. Landslide risk maps show *"the expected annual cost of landslide damage throughout an area"* and "*combine the probability information from a landslide hazard map with an analysis of all possible consequences (property damage, casualties, and loss of service)"* (Spiker and Gori, 2000, p. 40). After assessing the landslide hazard and risk, risk management measures can be implemented. Some geological factors that trigger landslides cannot be influenced (e.g. topography, soil structure and hydrological condition). Other factors such as land cover and slope excavation can be influenced by local spatial planning (see Chapter 4.2.1). However, the preparation and production of landslide hazard and risk maps will remain a challenge (Chacón et al., 2006, p. 345).

When addressing the ways of how risk information should be communicated and made comprehensible so that it can be adequately translated into legally binding regulations within the spatial planning process, the role of experts and scientific advisors needs to be regarded. There are several reasons for looking at the role of expert advice in providing risk information, namely problems related to uncertainties in risk information, difficulties related to their responsibility and liability as well as problems related to their understanding of what exactly the needs of information users are. The problems related to uncertainties in risk information have been discussed above. Uncertainties will never be fully eliminated. Instead, due to climate change there will probably be an increasing level of uncertainty. Spatial planning will have to deal with this uncertainty in the best possible way, e.g. by applying the "no-regret" principle[94]. A harmonisation of user needs and information providers in turn can be achieved by an improved communication (see above). Difficulties related to responsibility and reliability are handled differently in EU countries, as there is no common approach to establish advisory structures and processes. Consequently, *"the roles of people or institutions that commission advice, those who produce advice, and those who take decisions based on advice differ"* (OECD, 2015, p. 5). This also has direct consequences for the responsibilities and liabilities of scientists that produce risk information. Problems related to risk communication between experts as information providers and spatial planners as information users will be discussed below.

A survey carried out by the OECD (2015, p. 24) found that advisory structures of EU countries usually do not have a clear description of responsibilities. Consequently, individuals might be exposed to legal liability, although it should actually be the respective governments that is held responsible for decision-making. It should be acknowledged, that generally it is rather unlikely that experts face prosecution for underestimating or incorrectly assessing a risk. According to the OECD (2015, p. 26) prosecution of scientists has been rare until today. However, the OECD study also points out that the first case in a country often sets an example and may stimulate further cases. This means that any first case in which scientific experts are made responsible for their – supposedly – incorrect hazard assessments may pave

[94] An original definition for "no-regret policy" was provided by the IPCC in its 4th Assessment report. It was defined as *"a policy that would generate net social and/or economic benefits irrespective of whether or not anthropogenic climate change occurs"* (IPCC, 2007, p. 878). The "principle of no regret" favours the implementation of "no-regret" measures, which constitute suitable means to cope with climate change uncertainties. No-regret strategies and measures are supposed to yield benefits even in the absence of climate change (Hallegatte, 2009, p. 244; Heltberg et al., 2009, p. 89; Greiving and Fleischhauer, 2010, p. 65; Birkmann et al. 2012, p. 98).

the way for further such prosecutions in the future. The “Aquila case” in Italy is an example where scientists have been held liable for system failures[95]. This case has not only brought previously neglected issues of responsibilities and liabilities to the centre of attention in science and policy-making. It has also raised the possible danger that the quality of expert advice and scientific analysis may be adversely affected and influenced in the future (OECD, 2015, p. 24). If scientists have to face possible personal consequences of their input, this might be detrimental to the information provided. As a consequence, legal responsibilities and liabilities of scientific experts should be clarified, at least on a national basis, in order to avoid adverse impacts on the quality of risk information.

Regarding the difficulties related to a missing coordination of scientific and planning interests (see above), it first needs to be pointed out that communication of risk information is usually seen as *“a means of transmitting technical or scientific information regarding risk from a known, intentional source (the experts) along designated channels, to specified recipients (the public, decision-makers)”* (Bell and Tobin, 2007, p. 303). This also applies to the communication of hazards and risks by flood maps, which is mostly organised in a top-down manner. Such a one-way communication is manifested by the fact that addressees and users of the maps – such as spatial planners – are merely considered as receivers of risk information and are therefore not involved in the development process of the maps (Meyer et al., 2012, p. 1702). It has been mentioned above that stakeholder involvement and participation is crucial for an effective risk management strategy. Accordingly, end-users of flood hazard and risk maps should also be involved in the mapping process[96] (Merz et al., 2007, p. 248).

Such a one-direction communication by maps leads to the second problem: contents of maps often do not address end-users’ needs (Meyer et al., 2012, p. 1702). Flood maps are often produced and visualised by those with scientific expertise, technical knowledge and modelling know-how. Besides, flood maps are created without considering the challenge of targeted communication to spatial planners or other groups of experts and stakeholders. This means that the designed maps present information in a way that is hard to understand for lay persons and that maps are provided to the end users regardless of whether or not they comprehend the included message (Fuchs et al., 2009, p. 53; Holub and Fuchs, 2009, p. 533; Meyer et al., 2011, p. 50). Good maps ensure a clear communication with end users. Due to the fact that different users apply such maps and that information may be misinterpreted, it is crucial to consider the message to be conveyed and the respective users to be addressed (Merz et al., 2007, p. 247). However, Meyer et al. (2012, p. 1702) came to the conclusion that *“in practice maps often fail to attain their potential to fulfil the needs of different users, to raise awareness and provide a clear and understandable source of information for planning”*. Consequently, whether maps inform or misinform and whether they clarify or confuse depends on how well the information has been communicated from experts to end users.

When looking at landslide hazard maps, similar problems occur. Incorporating landslide information into regulations and ordinances equally requires respective map users to correctly understand and interpret the

[95] Following the L’Aquila earthquake in 2009, prison sentences were issued for seven scientists who provided scientific advice prior to the disaster. Due to this decision, there have been more than 40 legal suits in Italy alone until 2015 (OECD, 2015, p. 24). Thus, in this example the first case did indeed set a precedent.

[96] The EU FRD already asks Member States to encourage the involvement of interested stakeholders when producing flood risk management plans (Art. 10). However, stakeholder involvement in the process of flood mapping can be considered just as important.

information. Again, this necessitates a continued interaction between spatial planners and scientific experts (here: geological professionals). DeGraff (2012, p. 53) underlines that even though all stakeholders should be involved, it is particularly crucial to engage landslide hazard scientists and engineering professionals in the translation of landslide hazard information. Such an expert involvement is needed in order to develop and implement effective and sustainable policies and regulations that aim to reduce the landslide hazard. Their contribution involves clarification of technical terms used in the regulations and the development of guidelines which satisfy and meet planning requirements and enable an adequate transformation of hazard maps into spatial planning regulations (DeGraff, 2012, p. 58). In the case of landslide hazards, interaction between scientific experts and spatial planners might be even more important than in case of flood hazards, as impacts of landslides are even harder to predict and assess. Cascini et al. (2005, p. 200) enumerate contributing factors which cause some of the difficulties related to landslide hazard and risk zoning such as: *"the intrinsic complexity of both landslides and their geological environment; the sector-based approach generally used in many countries, which can produce untimely and, sometimes, misleading answers to societal requests; the lack of understanding and acceptance of concepts of hazard and risk by both the politicians and populations; the absence of data […]."* Problems in using landslide hazard and risk maps in spatial planning are also related to the respective scales of the maps. In order to avoid problems of scale, hazard and risk maps must be produced at an adequate scale. Large scale maps of 1:5,000, however, require a high degree of accuracy in defining the boundaries of the hazard zones and in determining the magnitude and frequency of landslides (Cascini et al., 2005, p. 229). At least in respect to some of the methodological limitations in producing hazard maps, expert know-how by geological professionals can help spatial planners realise the residual risks as well as the level of risk tolerated by the respective government and the population (e.g. the property owner). Such considerations are essential, as it is usually the local government and/or the owner of the property that have to take the final decision and that also have to take over responsibility and costs in case of a damaging landslide event (DeGraff, 2012, pp. 58–59).

Again, this hints at the importance of promoting more effective communication between information providers and information users. It is, however, also important to consider that in any case, the scientific information used in spatial planning processes should be considered along with economic, cultural, political, environmental, and societal factors as part as the weighing up process. This holds true for all spatially relevant natural hazards. If risk information is used in the spatial planning process when weighing up different concerns, spatial planners need to fully understand the information – including the methodology behind the risk analysis. Otherwise it will be hard for planners to accurately evaluate the situation and assign an adequate value to risk-related concerns in comparison with other interests. After all, the final statement should involve a justification for each decision. This is only possible when fully understanding the present situation, which also involves comprehension of the hazard conditions of the territory. Simply taking and using the risk-related content and applying it to the local plan without reflecting on the provided information and without pondering the consequences can be precarious. Hence it is indispensable that spatial planners understand the information they use and the rationale behind them.

It can be assumed that the FRD will generally lead to higher awareness of flood risks, effectuating a shift from a safety culture to a risk culture (Müller, 2013, p. 124). Creating risk awareness, however, also strongly depends on how well information is communicated. In addition, the perception of risk varies between experts and lay persons. Despite the fact that risk information is necessary for improving risk awareness, only little information exists regarding the required design of the needed maps and the ways in which they have to be created in order to represent useful tools for risk communication and planning decisions (Meyer et al., 2011, pp. 50–51). After all, different end-users have different requirements for map design and content. These requirements and needs should also be communicated from end users to map providers. Hence, a two-way communication process is essential in order to provide meaningful information and create sufficient awareness. Involving various stakeholders and bringing together scientists and end users will in the end help to enable a better understanding of user needs and to support a better comprehension of the provided information[97].

However, a key issue in this respect is the problem that the information of experts and sectoral planning entities can only be as good as the demands that were formulated by spatial planners. In other words, only when spatial planners – or end users in general – are able to express their specific demands on maps, their respective needs may be considered by information providers. This is why further investigations will be useful to shed light on differing demands of end users. This study will therefore examine whether spatial planners express specific demands for maps – or other types of risk information or whether they are even able to formulate their demands.

4.3 Summary

European countries are characterised by specific historical, political or legal aspects. In addition, there are differences in cultural and socio-economic backgrounds, e.g. differences in traditions, attitudes, beliefs and values. Differences in planning systems, planning and risk cultures define the ways in which risk information is produced and communicated and disaster risks are dealt with at the local planning level. The question of how risk-related information is currently dealt with during planning processes therefore requires the consideration of all these components.

Discourse-oriented approaches help find a consensus and facilitate communication among different actors so that political decisions might be more easily understood, accepted and supported. This important aspect has to be acknowledged by spatial planners due to the fact that decision-makers usually favour planning decisions which are supported and accepted by the general public. Relying on only formal instruments and hazard zoning maps or plans is not sufficient due to the fact that legally binding effects require an exact evidence base, which can hardly be provided. In order to avoid problems of acceptance, communication and discourse-oriented approaches are additionally required. In countries where informal planning instruments are not as common, other solutions should be found that help fill this gap. The SEA procedure, for instance, offers appropriate ways for a more cooperative approach and for integrating purposeful stakeholder involvement.

Both risk assessment and management are integrated parts of the planning process. However, national approaches differ in terms of whether and how the scientific basis is taken into account. Difficulties may arise related to the comprehension and interpretation of risk information, constituting one of the reasons why risk information is not (or cannot be) appropriately taken into account. This hints at the importance of sufficient coordination and cooperation between different stakeholders, in this case between sectoral and

[97] This problem will also be further examined and discussed later in this study.

spatial planning entities in particular. After all, the sole provision of expert knowledge and risk information cannot be the solution.

This chapter also introduces a number of problems which hamper the integration of risk assessment and management into spatial planning. Two major problems are represented by the problems of fit and scale. These problems require further consideration during the planning process in order to be dealt with adequately. The problem of fit, for instance, can be addressed by a better coordination between sectoral and spatial interests.

Finally, this chapter discussed the integration of risk assessment into spatial planning in more detail by underlining the importance of mainstreaming risk assessment into urban planning or land use policy development and implementation. In this context, hazard and risk maps constitute a main information base for spatial planning, provided they exist in an appropriate spatial scale. Different planning levels require a differentiated level of accuracy of information. Hazard maps can be legally binding or not and there are different ways of integrating hazard maps into spatial plans. Depending on the prevalent model, spatial planning has differing possibilities to deal with this information. There are advantages and disadvantages to each approach. In general, a two-way-communication transfer should be established and chosen over a mere provision of risk information. Whether risk information can be used appropriately also depends on how well the information is communicated. The ability of spatial planners to formulate demands towards the providers of information is a prerequisite. Risks are most likely dealt with differently and also roles and demands of spatial planners – or their ability to formulate demands – vary. How exactly these approaches and ways of dealing with risk information look will be presented in more detail in Chapters 8 and 9.

5. Strategic Environmental Assessment and disaster risks

In the last 20 years different assessment methods made their way into European policy, including the Environmental Impact Assessment (EIA) and the Strategic Environmental Assessment (SEA). Such environmental assessment methods were introduced to avoid and mitigate potential negative environmental impacts. Depending on the severity of potential negative effects on the environment, measures have to be taken to avoid, minimise or compensate such effects. Moreover, by aligning a planned development with alternative developments, a final decision can be directed towards the best or least harmful option. In order to ensure a minimum level of consistency among EU Member States, EU Directives were adopted for both EIA and SEA. Spatial planning plays an important role in this context, being one of the main addressees of the SEA Directive and one of the most appropriate contexts for using SEA.

EIA and SEA can be important instruments for risk reduction, as outlined by authors such as Greiving (2004), Fleischhauer et al. (2006), Benson and Twigg (2007) and Profice (2011). As part of the SEA process plans, programmes and policies (PPPs) are analysed for their potential environmental consequences. Accordingly, SEA provides an ideal and already existing framework for integrating risk assessments. This is because by implementing a plan, the vulnerability of an area towards disasters may change. Increasing the vulnerability means increasing the risk. By integrating risk assessments into the SEA process, the tool can serve to support the consideration and integration of natural risks into regulatory frameworks and spatial plans (European Commission, 2013, p. 17; European Commission DG Environment, 2008, p. 39; Greiving, 2004, p. 11; OECD, 2010b, p. 8; Peltonen, 2006, p. 162). SEA may also help to solve one of the main problems for any planning system: To devise a means to predict possible future changes that may affect the system (Cullingworth and Nadin, 2006, p. 2) and to handle both predictable and hardly predictable impacts.

This chapter will first describe the main features of the SEA Directive by shortly explaining the main stages of the SEA and by separately referring to the role of consultation and participation within the SEA process. In the second part of the chapter, the link between SEA and disaster risk will be closer examined. Both parts provide the basis for the elaboration of the concept in Chapter 11.

5.1 Strategic Environmental Assessment Directive

The Strategic Environmental Assessment Directive, published by the European Parliament under Directive 2001/42/EC, specifies the environmental assessment of policies, plans and programmes[98]. It has been established after recognising that the already implemented and widely accepted EIA may happen too late within the planning process and that negative impacts need to be considered earlier. Besides, possible alternatives need to be elaborated and considered early in the process in order to allow for a reasonable choice of a final planning option. Another reason for the development of the SEA Directive was the growing consciousness of an increasing environmental degradation, which could be linked to an increased relevance of sustainable development in policy making (Jones et al., 2005a, pp. 6–7).

[98] Environmental assessment can be considered as "*an important tool for integrating environmental considerations into the preparation and adoption of certain plans and programmes which are likely to have significant effects on the environment in the Member States, because it ensures that such effects of implementing plans and programmes are taken into account during their preparation and before their adoption*" (CEC, 2001b, Recital 4).

Box 1 General benefits of SEA (Source: adapted from Dalal-Clayton and Sadler, 2005, pp. 22–25; European Commission DG Environment, 2009, pp. 125–126; Jones et al., 2005b, pp. 21–22)

General benefits of SEA

- Consideration of environmental objectives during the preparation of PPPs and integration of environmental concerns into decision making, thus making PPPs more environmental-friendly;
- Participation and involvement of public authorities and interaction between authorities, which helps to facilitate and promote consultations and cooperation as well as coordination between environmental and other sectoral authorities and proponents of PPPs;
- Participation and involvement of the public, which leads to greater openness and accountability and helps to build public trust;
- Enabling a range of perspectives influencing the contents of the plan through participatory processes which broaden the perspective of planning authorities;
- More transparent, integrated and balanced decision-making processes;
- Enhanced conformity with the preconditions of the environmental policy concerned;
- Consideration of alternatives early in the process, previously often ignored;
- Effective analysis of cumulative effects;
- Facilitated consideration of long-range and delayed effects;
- Identification of best practicable options for reaching desired outcomes while minimising negative effects;
- Reconciliation of different goals and objectives in order to promote genuine sustainable development;
- Saving time and money by disregarding problematic options and avoiding costly mitigation or remediation measures.

Box 2 General constraints of SEA (Source: adapted from Jones et al., 2005b, p. 24)

General constraints of SEA

- Public sector departments are seldom integrated, making addressing environmental effects, which often cross institutional boundaries, difficult;
- Spatial plans are often produced and validated by the same organisation, resulting in a lack of neutrality;
- Robust procedures for integrating SEA into spatial plans are rare, thus restricting its influence on decision-making;
- Qualitative assessment techniques are poorly developed;
- Lack of consensus on how to deal with representations that result from consultation and public participation;
- Monitoring is rarely considered and undertaken.

Jones et al. (2005a, p. 7) explain the purpose of SEA of land use plans by noting that the directive *"is intended to help predict potential environmental impacts that occur as a result of their implementation, as part of the wider promotion of the planning system as a tool to help deliver sustainable development"*. SEA therefore enables decision-makers *“to develop policies and strategies that are based on a sound analysis and understanding of their sustainability implications”* (Dalal-Clayton and Sadler, 2005, p. 22). Main benefits of SEA include its proactive dealing with environmental concerns, which enables decision-makers to minimise costs and avoid missed opportunities related to inadequate information and restricted choices (Dalal-Clayton and Sadler, 2005, p. 22). After all, SEA is a process that offers relevant information for spatial planners and other stakeholders on environmental effects of a proposed PPP (Jones et al., 2005b, p. 18). Accordingly, the central aim of SEA is the provision of essential information on possible adverse environmental impacts of a policy, plan or programme, so that decision makers can modify and adjust such impacts during early stages of decision-making processes to make decisions more environmentally sound and sustainable (Fundingsland Tetlow and Hanusch, 2012, p. 15; Jones et al., 2005b, p. 18). It can therefore perfectly serve as a decision-aiding tool (Sadler and Verheem, 1996). The process of SEA is believed to make public authorities check their plans and programmes for existing, sustainable development promoting factors.

The European Union considers SEA an essential instrument for both environmental protection and sustainable development (European Commission DG Environment, 2003). It seems to be widely accepted in academic literature that – starting from the early 1990s – SEA has evolved in a positive way during the last two decades (Fundingsland Tetlow and Hanusch, 2012, p. 17). Some authors, however, also point at certain difficulties in SEA application and realisation. Brown and Thérivel (2000, p. 183), for instance, hint at difficulties in advancing from merely a useful concept to a widely applied and consistent practice. Fundingsland Tetlow and Hanusch (2012, p. 20) concluded that *“some authors (e.g. Thérivel et al. 2009, West et al. 2011) report evidence of SEA being perceived among some planners and decision-makers as an exercise to meet legislative requirements, rather than a process which adds real value to the planning process.”* Box 1 and Box 2 summarise general (potential) benefits and constraints of current SEA practices.

Integrating SEA into the planning process is a prerequisite for the effectiveness of SEA. A mere integration of the SEA process is not sufficient, however (Stoeglehner et al., 2009, p. 118). In many cases, SEA is only introduced to the decision-making process, once a draft version of the PPP has been prepared, i.e. once important decisions related to the PPP have already been taken (Lobos and Partidário, 2014, p. 39). While SEA should provide information during the plan-making process and serve as a decision-aiding tool, in fact SEA often evaluates specific development proposals that have already been prepared. Lobos and Partidário (2014, p. 39) learned that in few cases SEA is indeed introduced at a very early stage of the planning and decision-making process. In these cases, SEA forms part of the discussion related to the definition of strategic objectives. Hence, it is able to influence the development and comparison of alternatives. Yet, according to Lobos and Partidário (2014, p. 39), *“many of these cases correspond however to studies carried out before the initiation of the formal drafting of PPP, often to diagnose and establish a strategic reference framework for planning”*[99]. Moreover, Stoeglehner et al. (2009, p. 118) argue that *“even when SEA is nominally integrated with planning, there are still two parallel processes*

[99] One such example is the „ekofizjografia” in Poland, which will be introduced in Chapter 8.

effectively taking place: planning and assessment". Therefore, "ownership"[100] of SEA on the part of SEA professionals is required so they can accept the procedure as a useful tool and not just as an obligatory, formal activity without added value. Aiming at an increased SEA effectiveness will require a better linkage between planning and assessment processes so that spatial planners can better hold and exercise "ownership" of SEA processes and outcomes (Stoeglehner et al., 2009, p. 118).

A report from COWI for the European Commission DG Environment (European Commission DG Environment, 2009) on the application and effectiveness of the Directive on Strategic Environmental Assessment states that until now, SEA mainly contributed to an enhanced organisation and structure of the planning process[101]. While most Member States reported that, based on a SEA the contents of a plan or programme had been changed relatively often, SEA usually did not change the central and basic goals of a PPP. A majority of Member States emphasised that the change of contents happened gradually in the course of the preparation of the plan or programme, due to the iterative character of the SEA (European Commission DG Environment, 2009, p. 121). This confirms the relevance of an early integration of environmental considerations into planning procedures. Furthermore, the report reveals current problems and disadvantages of the SEA process, highlights benefits and signals some opportunities for improving the current SEA Directive. For instance, adjustments are needed which aim at extending the scope of the SEA Directive in order to better include specific problematic issues such as climate change and disaster risks (European Commission DG Environment, 2009, p. 118). Recognised opportunities for improvement include (European Commission DG Environment, 2009, pp. 135–136):

- Improving the capacity of the Member States so that an effective implementation of the SEA Directive can be ensured.
- Providing more guidance to Member States, especially in regard to the interpretation of specific key concepts (e.g. screening criteria, identification and consideration of alternatives, coordination mechanisms etc.) and the consideration of better integration of climate change and biodiversity issues.

Especially the provision of more guidance on a better integration of climate change and biodiversity issues has been addressed by the EC in the meantime. In 2013 the Commission published the "Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment" (European Commission, 2013), which is supposed to help SEA practitioners to better integrate these considerations into their work. Not only does the EU guidance raise awareness by encouraging SEA practitioners and plan-makers to think about the importance of such issues for an SEA. It also explains how to assess climate change and biodiversity related issues during all steps of the SEA process (European Commission, 2013, p. 9). Guidance is also missing in terms of monitoring. When considering the fact that monitoring is still not an issue in some Member States and that it often constitutes a general problem (European

[100] The term "ownership" means that spatial planners want, use and incorporate SEA elements into their planning activity. To the contrary, *"if planners 'disown' the elements/emphases SEA brings, then they refuse to acknowledge or accept them as their own, repudiate them, deny or refute them, or ignore them"* (Stoeglehner et al., 2009, p. 115).

[101] This includes, in particular, the integration of new procedural stages into the planning process, the integration of environmental considerations into decision making as well as facilitating a strengthened relationship between environmental and planning authorities (European Commission DG Environment, 2009, pp. 120–121).

Commission DG Environment, 2009, p. 10), new guidance documents could also address aspects related to monitoring and evaluation as one of the key concepts.

The report further highlights that many Member States have declared the current lack of a well-established methodology to identify potential impacts a key problem (European Commission DG Environment, 2009, p. 117). Based on the results of the study, the EC concluded that climate change issues are only considered in SEA on a case-by-case basis, mainly for plans or programmes (PPs) with potential significant effects on climate (e.g. transport and energy PPs). However, a trend towards considering and integrating climate change in other PPs is observable (European Commission DG Environment, 2009, pp. 117–118). It should be added, however, that the examples mentioned in the report merely refer to climate change mitigation by aiming at a reduction of greenhouse gas emissions or at carbon neutrality. The above-mentioned EU guidance could therefore be helpful in also promoting the integration of climate change adaptation into PPPs.

It has to be acknowledged that different EU countries are at different stages of SEA implementation and development. Environmental assessment processes operate under different conditions, which is why SEA processes in different countries vary considerably and different approaches are adopted in different contexts and circumstances (Dalal-Clayton and Sadler, 2005, p. 23; Jones et al., 2005b, p. 19). Jha-Thakur et al. (2009, p. 133), for instance, examined SEA practices in Germany, Italy and the UK and noticed that *"owing to their unique contextual and methodological influences, the three countries developed distinct approaches to SEA"*. Fundingsland Tetlow and Hanusch (2012, p. 15), after evaluating the state of the art of SEA, conclude *"that SEA has evolved rapidly into a broad field of application and that the 'family of SEA approaches' continues to develop"*. This is also the reason why SEA practices are applied with varying degrees of effectiveness. There are different factors that determine the success or shortfall of SEA as a decision-support instrument (Cashmore et al., 2009). Therefore, not only implementation, application and methodological approaches differ. Also the effectiveness of SEA varies in terms of positively influencing decision-making processes, policy outcomes and development planning. Hence, it is likely that the application and role of SEA differs in the countries of the examined case studies and that stakeholders involved in a SEA process consider it differently useful.

In summary, there are both benefits and constraints to current SEA practices and differences in SEA application between the EU countries exist. Nevertheless, a final conclusion about the success or the drawbacks of the Directive itself cannot be reached, as the application of SEA is not yet developed enough to allow for fixed statements on a future amendment (European Commission DG Environment, 2009, p. 132). While Member States *"seem to prefer stability in the legislative requirements, to allow SEA systems and processes to settle down and provide the opportunity to establish robust ways of using SEAs to improve plan-making"* (European Commission DG Environment, 2009, p. 132), guidance from the EU can be seen as an important means to improve the effectiveness of SEA practices. In this regard, the above-mentioned "Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment" serves as useful information to be considered when addressing and solving problems related to climate change and loss of biodiversity. Additional guidance documents could also prove to be helpful.

In the following, the SEA main stages will be outlined briefly.

5.1.1 Strategic Environmental Assessment stages

The need for Strategic Environmental Assessment to provide timely and relevant information for decision-making processes from the start advises particular steps (or stages) to SEA. Even though SEA is a flexible process and tailored to specific circumstances, a number of stages can be followed that can be considered standard practice (Jones et al., 2005b, p. 19; OECD, 2006, p. 54; Therivel, 2010, p. 16). Practical experience suggests four main stages (OECD, 2006, p. 54):

1. Establishing the context for SEA
2. Implementing SEA
3. Informing and influencing decision-making
4. Monitoring and evaluation

Each of these stages can again be divided into sub-steps, requiring certain activities. The single SEA steps follow in a logical sequence, with the exception of the consultation and participation of different stakeholders as well as the integration into decision-making. While the former *"must be considered as a parallel, continuous process"*, the latter *"is conceived primarily as an 'approach', rather than a 'step', or a task"* (European Commission DG for Energy and Transport, 2005, p. 11). Consultation and participation will be explained as a separate part of SEA in Chapter 5.1.2. Main stages and sub-steps are merged in Figure 26.

Establishing the context for SEA	•Setting the context and objectives •Establishing the baseline
Screening	•Decide whether SEA is necessary •Identify environmental relevance and likely significant effects
Scoping	•Define issues to be considered within SEA •Consult on the scope of SEA •Determine preliminary alternatives
Environmental Assessment	•Predict and describe the significant environmental effects •Evaluate the effects •Determine measures to avoid, minimize, compensate
SEA reporting	•Draft SEA report •Review draft report •Prepare final SEA report
Informing and influencing decision-making	•Integration of the environmental assessment into decision-making •Taking into account the results
Monitoring and evaluation	•Monitoring •Evaluation

Figure 26 SEA steps (Source: adapted from OECD, 2006, p. 54)

The process for making a local spatial plan usually starts with a decision on elaborating a new or amending an existing plan. After this decision has officially been taken, the context for the environmental assessment has to be established, as plans and programs prepared for town and country planning are subject to an environmental assessment (CEC, 2001b, Article 3, Paragraph 2). Exceptions exist for plans and programs which *"determine the use of small areas at local level and minor modifications to plans and programmes"* (CEC, 2001b, Recital 10) and that only require an environmental assessment in cases they are likely to have significant environmental effects.

1. Establishing the context for SEA

SEA context and environmental baseline

This step includes setting the context of SEA and describing and establishing the environmental baseline. It therefore requires the collection of baseline information about the environment and the identification of environmental problems. The step also involves the identification of relevant stakeholders as well as links to other strategic actions (OECD, 2006, p. 54; Therivel, 2010, p. 16).

Screening

Closely related to the establishment of objectives is the screening. During a screening process, aims and objectives of the plan are examined as well as its overall purpose (Jones et al., 2005b, p. 19). The purpose of screening in SEA is quite simple: It serves to determine whether SEA is necessary or required. Screening is only required for plans or programmes that are not automatically subject to SEA. It is also required when plans or programmes in question address the use of small areas and/or minor modifications to an existing plan. Screening aims to find out whether the plan or programme is likely to have significant environmental effects. If the answer is in the affirmative, SEA is necessary. Criteria for determining the likely significance of environmental effects are listed in Annex II of the SEA Directive.

2. Implementing SEA

Implementation predominantly consists in scoping, in the actual environmental assessment and in environmental reporting, i.e. in preparing an environmental report.

Scoping

Scoping is the step in which the content, the extent and the level of detail of those matters are determined which should be addressed in the environmental information and at subsequent SEA stages. Hence, scoping includes the identification of SEA objectives and indicators. It therefore addresses the questions of how SEA intends to improve the planning process and which environmental and sustainability issues to include. Scoping also involves determining the general environmental issues, likely significant impacts and preliminary alternatives to be studied during the subsequent environmental assessment and the content to be included in the environmental report (Fischer and Phylip-Jones, 2008, p. 138; Jones et al., 2005b, p. 19; OECD, 2006, p. 56).

Considering alternatives at an early stage may clarify environmental advantages and disadvantages of development options (OECD, 2006, p. 56) and may prompt responsible actors to reflect on the rationale of the plan or programme (European Commission DG for Energy and Transport, 2005, p. 35). This is why it is important to already define reasonable and practical alternatives of the PPP at this stage of the planning and SEA process. The screening step may constitute an essential basis for scoping, if information during screening has already been thoroughly collected.

Environmental assessment

During the environmental assessment several tasks have to be completed. First of all, environmental assessment requires the collection of baseline information. After all, the assessment necessitates a thorough understanding of the environment and its social systems that may potentially be affected (OECD, 2006, p. 57). Consequently, baseline environmental data needs to be collected of those issues identified during the scoping process. Such information and data is supposed to provide a basis so that planners and SEA practitioners can examine predicted impacts of the plan against the anticipated changes in a future environment with and without an implementation of the plan (Jones et al., 2005b, p. 19). When collecting information, particular attention should be paid to relevant ecological and social systems, their resilience and sustainability as well as their importance for human well-being (OECD, 2006, p. 57).

Further steps of the assessment include (Jones et al., 2005b, pp. 19–20):

- Undertaking an impact prediction
- Undertaking an impact evaluation
- Developing a mitigation strategy

Potential impacts can be identified and predicted by using SEA objectives and criteria as well as the collected baseline information and data. An impact prediction should be undertaken for both, the original plan proposal as well as for reasonable alternatives. However, an identification of impacts for PPPs and their alternatives is more difficult than identifying impacts of a project. The OECD (2006, p. 57) explains that *"the range of options or variables under consideration is often harder to define with certainty because the transmission channels through which effects may be experienced may be very complex, involving many aspects which are difficult to predict and analyse"*. Hence, predicting impacts under uncertain conditions constitutes a real challenge. Measures such as a comparison between best case and worst case scenarios can help reach an approximation (OECD, 2006, p. 57). When evaluating the predicted impacts, an according acceptability of the plan and its alternatives should be taken into account. In this sense, the significance of the respective environmental impacts should be compared in order to be able to determine the best option available.

Measures need to be identified which enhance opportunities and mitigate negative effects. In fact, this aspect cannot be considered a separate step within the SEA procedure, as mitigation should always be considered throughout the SEA process. Instead of determining mitigation measures versus the end of the assessment process, continual refinement of the plan should be ensured by continuously developing and adapting mitigation measures. Nevertheless, possible residual impacts of the chosen option must be addressed (Jones et al., 2005b, p. 20). Even when adverse impacts cannot be fully mitigated, at least a "win-win" situation or "low-regret" or "no-regret" measures should be aimed for. Provided this is impossible, the trade-offs must be documented and made transparent to decision-makers (OECD, 2006, p. 58). According to the SEA Directive, different mitigation measures are possible (see Annex I): Above all, negative impacts should be avoided, if possible. Else, they should be reduced or compensated by using appropriate measures (CEC, 2001b, Annex I (g)). In the event of predicted, highly irreversible, adverse effects, the selection of a less risky alternative is advisable. For situations that are less severe, standard mitigation measures can be selected to reduce and minimise a negative impact by applying the ALARP principle (OECD, 2006, p. 58). Finally, the residual negative impacts are evaluated. This evaluation is performed against the SEA objectives and criteria.

SEA reporting

Article 2 of the SEA Directive requires *"the preparation of an environmental report, the carrying out of consultations, the taking into account of the environmental report and the results of the consultations in decision-making and the provision of information on the decision in accordance with Articles 4 to 9"* (CEC, 2001b). Both the preparation of the environmental report and consultations form part of the SEA reporting phase.

The environmental report represents a key element of the environmental assessment. The Directive sets out in Article 5 that where SEA is required, *"an environmental report shall be prepared in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme, are identified, described and evaluated"* (CEC, 2001b). Hence, it provides the findings of the environmental assessment on all relevant environmental topic areas (The Scottish Government, 2010). Specific demands towards the report in terms of content are outlined in Annex I of the SEA Directive. The SEA report must be publicly available and should also present a rationale for conclusions (Dalal-Clayton and Sadler, 2005, p. 15; Jones et al., 2005b, p. 20).

Once the draft report has been elaborated, there must be an independent evaluation or review. This "quality check" or review is done by environmental agencies and other interested entities as well as the public in order to ensure the credibility of the assessment (Dalal-Clayton and Sadler, 2005, p. 15; European Commission DG for Energy and Transport, 2005, p. 60; OECD, 2006, p. 58). The review should also make sure that all requirements are met and significant impacts related to the implementation of the proposed plan and suggested alternatives are sufficiently described (European Commission DG for Energy and Transport, 2005, p. 13).

3. *Informing and influencing decision-making*

The SEA Directive requires in Article 8, that *"the environmental report prepared pursuant to Article 5, the opinions expressed pursuant to Article 6 and the results of an transboundary consultations entered into pursuant to Article 7 shall be taken into account during the preparation of the plan or programme and before its adoption or submission to the legislative procedure"* (CEC, 2001b). This means that the environmental report has to be provided to decision-makers together with or as part of the PPP in preparation and considered in decision-making.

It has to be ensured that decision-makers are aware of all key environmental issues. Furthermore, decision-makers need to grasp all options and possible measures open to them, the likely effects of respective choices – positive and negative – as well as consequences if no decisions were to be taken. Sufficient information on the different options has to be provided so that decision-makers can consider them in the weighing of interests (European Commission DG for Energy and Transport, 2005, p. 13; OECD, 2006, p. 60). The final decision then needs to be explained in detail and any changes of the PPP need to be fully justified. Responsible authorities are therefore asked to prepare a summary of how they have taken account of the findings expressed in the environmental report, how results have been integrated into the PPP and how results of consultations have been considered (CEC, 2001b, Article 9). In particular, reasons for not adopting some of the recommendations provided by the report must be specified and outlined (Dalal-Clayton and Sadler, 2005, p. 15; European Commission DG for Energy and Transport, 2005, p. 13; Office of the Deputy Prime Minister, 2005, p. 37). This is important when aiming at a transparent, reasonable and sensible decision-making process. After all, the weighing up process needs to be properly documented, as decisions will be questioned by the public.

4. *Monitoring and evaluation*

For an environmental assessment to be effective, it is required to *"monitor the significant environmental effects of the implementation of plans and programmes in order, inter alia, to identify at an early stage unforeseen adverse effects, and to be able to undertake appropriate remedial action"* (CEC, 2001b, Article 10). The aim of monitoring consists in checking consistency with the implementation plan, i.e. ensuring that measures have in fact been implemented, tracking the progress of the PPP and verifying goal achievement. Respective results should also feed into a formal evaluation of the monitoring process as part of the revision of the plan or programme (OECD, 2006, p. 60).

5.1.2 Consultation and participation

Stakeholder involvement can be considered a vital element of SEA, which may entail benefits for the planning process on many different levels, if properly managed and applied. The SEA Directive sets out in Article 6 that a draft plan shall be made available to relevant authorities. Moreover, the Directive requires that both authorities and the public *"shall be given an early and effective opportunity within appropriate time frames to express their opinion on the draft plan or programme and the accompanying environmental report before the adoption of the plan or programme or its submission to the legislative procedure"* (CEC, 2001b).

Despite the fact that the SEA Directive does not specifically mention the need for stakeholder involvement or participation, but solely requires the information and consultation of different authorities and the public, there is a growing consensus about the essential role that public involvement plays as part of SEA (see e.g. Elling, 2011; Gauthier et al., 2011; Partidário, 2003). It is therefore considered a valuable element by the SEA community (Rega and Baldizzone, 2015, p. 22). The OECD (2006, p. 42), for instance, highlights that SEA can improve decision-making related to the plan or programme in consideration, by integrating public engagement in the decision-making process. According to this OECD good practice guidance (2006), public engagement is crucial as it will help make planning projects more effective by reflecting opinions, interests, concerns and knowledge of the public in the decision-making process. In fact, *"effective public engagement will impart a higher degree of confidence in reaching a decision, and will lower the risk of a decision that could lead to unfavourable results"* (OECD, 2006, p. 45). The latter is particularly important when considering the fact that decisions made for the future are often taken under uncertainty. A decision made under uncertain conditions is therefore more likely to be accepted by the public if the public was sufficiently engaged and involved in the decision-making process (see Chapter 3.2). The sole provision of information to different stakeholder groups and the realisation of consultations, which merely enable stakeholders to express their opinions, are not considered sufficient in terms of promoting the decision-making process. A more active involvement of the public is required if a more effective outcome of the environmental assessment is sought. Furthermore, stakeholders themselves will be the ones who are most affected by the impacts of the plan or programme.

In order to understand the importance of consultation and public participation, the difference between these terms must be clear. In fact, there is often some confusion about the correct use of the terms consultation and participation and stakeholder involvement. In general, the intensity of stakeholder engagement and public participation may vary within a process (see Figure 27): From passive interactions such as simple information activities (one-way-communication) via consultation to more dialogue-oriented activities where stakeholders actively participate and help design the process (Fleischhauer et al., 2012, p. 2787; IPCC, 2007, p. 142). While information is the lowest level of involvement, consultation enables stakeholders to take a stand and present their ideas and therefore involves more stakeholder commitment. Participation is the highest degree of involvement and means that stakeholders may also influence decisions and help develop and implement a project (Arbter et al., 2005, p. 9).

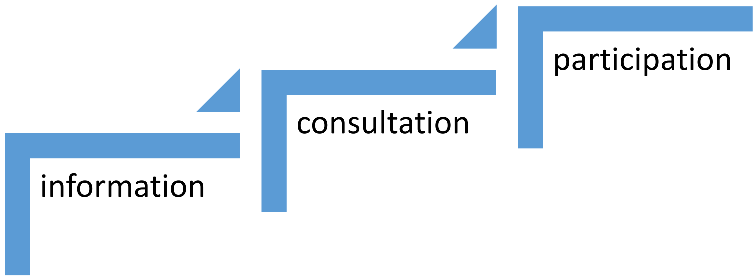

Figure 27 Degrees of stakeholder participation (Source: adapted from Arbter et al., 2005, p. 9)

Within this study, the term "information" refers to the provision of information to stakeholders. The terms consultation, participation and involvement are used according to definitions provided by Hughes (1998, p. 23). In this sense, consultation *"implies a process with little share or control over the process for consultees"* (Hughes, 1998, p. 22), participation defines *"a process by which stakeholders are allowed to influence, share and control the decision-making process"* (Hughes, 1998, p. 22) and the term stakeholder involvement encompasses all different types of stakeholder interactions, therefore comprising both consultation and participation. Finally, the term engagement refers to processes, strategies and ways of involving stakeholders in decision-making processes. It means the active involvement of stakeholders and within this study therefore refers to techniques that ensure stakeholder consultation and participation as the two active ways of involving stakeholders.

It should be highlighted at this point that stakeholder involvement often only consists of information or consultation. Analyses conducted by Lobos and Partidario (2014) and Rega and Baldizzone (2015) revealed that participation requiring a more active role of participants is often restricted to public authorities, public and private organisations, NGOs and other environmental experts. In contrast, involvement of the general public usually consists of consultation and the provision of information. Hence, the public often does not have a particularly proactive role. Such findings concerning current SEA practices should be taken into consideration when reflecting on the role of consultation and participation of stakeholders in SEA for risk reduction purposes.

Consultation

Consultation shall be carried out at all stages of the SEA process. It is therefore not considered a separate stage or step, but rather accompanies the whole environmental assessment procedure. According to the EC guidance on SEA implementation (2003, p. 34), consultation is crucial as it might sometimes bring forth new information that has not been taken account of before and which might lead to substantial adjustments of the PP and thus possibly help reduce its likely significant effects.

The SEA Directive sets out in Article 6 that "*Member States shall designate the authorities to be consulted which, by reason of their specific environmental responsibilities, are likely to be concerned by the environmental effects of implementing plans and programmes"* (CEC, 2001b). This is not a particularly stringent regulation and Member States usually only require the consultation of authorities with environmental competencies[102]. Furthermore, it is not always guaranteed that consultation of environmental authorities is carried out properly. It was stated in the study by COWI for the EC DG Environment (2009, p. 91) on the application and effectiveness of the SEA Directive that *"according to the preliminary evaluation of the experiences with the implementation of the SEA Directive, with a focus on the Structural Funds Programmes the Commission has received some criticism that environmental authorities were not properly consulted on the content and/or results of the SEA process, and that it was not always clear if views of environmental authorities were taken into account in the preparation of the plan/programme"*. Regulations of Article 6 are indeed rather general and broad. It is, however, important to consult such authorities thoroughly. Environmental authorities and other stakeholders may give essential advice on certain topics and give information about any significant ongoing plans that should be considered, but that the plan-making authority may not be aware of. This also involves flood risk plans/maps (European Commission, 2013, p. 31). The consultation of environmental authorities will often lead to new information and conclusions and may help identify further actors to be addressed. This is why a thorough consultation is of vital importance for the quality of the environmental assessment and the integrity of the PP.

According to Article 6, the public has to be consulted as well (see above). This includes *"the public affected or likely to be affected by, or having an interest in, the decision-making subject to this Directive, including relevant non-governmental organisations, such as those promoting environmental protection and other organisations concerned"* (CEC, 2001b). This phrasing implies that the relevant, affected and/or interested public will be different in each case and that the identification of which stakeholder groups are affected or interested implies complex assessments (European Commission DG Environment, 2009, p. 91). It is still important, however, that Member States legally define what is meant by the term "public". Many Member States employ the widest possible definition for the "public" by interpreting it as "everyone", including NGOs (European Commission DG Environment, 2009, p. 90). When looking at environmental problems related to natural risk in particular, the OECD (2010b, p. 10) suggests consulting entities and organisations such as sectoral planning agencies, scientific and technical services, NGOs engaged in risk

[102] For instance, the Italian Legislative Decree 152/2006 determines that at the regional level competent authorities include the public administration responsible for the safeguarding, protection and enhancement of the environment. In France, the environmental authority ("Autorité environnementale") has to be consulted for its opinion on the environmental report and on the consideration of the environment by the finalised plan or programme. It is asked for its opinion before initiating the participation of the public (CGDD and CEREMA, 2015, p. 14).

reduction and sustainable development, risk reduction experts and practitioners, representatives of the local community and other.

Information: providing information to stakeholders

- Public announcement
- Flyers
- Website
- Information event
- other options of providing access to information

Consultation I: consulting stakeholders to receive information, no influence of the process

- Questionnaire, Interview
- Statements
- etc.

Consultation II: consulting stakeholders to ask for opinions, no share in decision-making

- Discussion event
- Dissemination meetings
- etc.

Participation: collaborating with different stakeholders, co-determining the decision-making process

- Round table
- Mediation
- Working Group
- etc.

Figure 28 Intensities of stakeholder involvement (Source: adapted from Arbter et al., 2005; IPCC, 2007)

Participation

As explained above, participation exceeds the mere consultation of stakeholders by adding a collaborative element to stakeholder involvement (see Figure 28). Active public participation should be facilitated starting from the implementation of SEA (stage two) and be carried out throughout the process until the review of the draft SEA report (OECD, 2006, pp. 13–14). Its intention and purpose lies in the co-determination of decisions by several different stakeholders. Accordingly, the goal of stakeholder participation in SEA consists in identifying ideal development strategies and measures, which are accepted and supported by the majority of stakeholders. The participation of many different stakeholders encompasses several opportunities, including (Partidário, 2003, p. 59):

- Identification of public concerns
- Soliciting different perspectives on options to achieve aims and targets
- Sharing diverse expertise
- Checking for accuracy of the PPP
- Gaining acceptance for the PPP and respective SEA results.

In addition, public participation will enable an exchange of information and knowledge, the cross-referencing of different perspectives and an integrated vision of the problem (Partidário, 2012). Consultation is often not sufficient, especially when considering the fact that not all affected members of the public might be reached. It is, however, necessary to include as many opinions as possible in order to take the most convenient decision. This is why efforts need to be made to identify and engage all members of the public, including the most vulnerable and most exposed to environmental problems (OECD, 2006, pp. 13–14), which are at the same time often those who have the most difficulties in participating (e.g. elderly people, disabled, poor etc.).

Although the influence of public participation as part of the SEA process on a plan or programme is still considered limited by a number of international SEA experts that took part in a study about the use and effectiveness of SEA practice conducted by Rega and Baldizzone (2015, p. 114), the surveyed SEA experts also acknowledged benefits for the quality of the plan or programme in cases where public participation took place. In addition, Rega and Baldizzone (2015, p. 114) made out two further take-home points from their survey: First, the surveyed SEA experts mentioned a number of benefits related to effective public engagement. While some of them are related to improvements of the individual PP and the respective SEA process, many benefits concern the "democratisation of decision-making" (Rega and Baldizzone, 2015, p. 114). This means that effective public participation can also serve to increase awareness of the public, promote transparency and accountability of the decision-making process, foster mutual learning and enable to build trust. Second, respondents recognise a positive correlation between the degree and extent of public engagement and the environmental friendliness of a PP[103]. Factors identified by the respondents that hamper effective public participation include lack of political willingness by proponents, insufficient information on the SEA process by the public, and weakness of the current legal framework. Accordingly, impeding factors are not just related to the actual SEA practice, but to a broader framework including the political, institutional and legal context (Rega and Baldizzone, 2015, p. 114). Due to the fact that proper public participation could significantly influence the quality of the plan in environmental terms, efforts should be made to enable and intensify more effective public engagement in future SEA processes.

5.2 Linking SEA and disaster risk management

For the purpose of this research and the further elaboration of the topic at hand it is necessary to find out to what extent disaster risks are currently considered and dealt with during an SEA process. Further investigations will therefore address the question of whether risk information is used in the SEA process or whether disaster risk is rather being neglected as an issue and environmental concern. Furthermore, the research will focus on aspects related to the handling of disaster risk and uncertainty in SEAs.

While some typical characteristics describing the state of the art of SEA practices in the case studies will be further outlined in Chapters 6 and 9, the following sub-chapters focus on the general role of SEA in disaster risk reduction and in building resilience to plans and programmes in the light of a changing climate. The first part deals with the general need for including risk assessments, or risk information respectively, into SEA. The second part deals with how SEA can be a supporting tool in spatial planning processes that provides adequate information about disaster risks.

5.2.1 Risk-informed SEA

The suitability of SEA for mainstreaming disaster risk is apparent. There is a clear linkage between the SEA Directive as such and natural and technological risks in general, since many terms used in the Directive

[103] Rega and Baldizzone (2015, p. 114) conclude from these results that *"given that this is the feeling of surveyed expert in the current situation of relatively limited public participation, it is presumable that this correlation would be even more significant if more involving and thorough engagement process were carried out"*.

correspond to the common definitions of hazard and risk. This is the reason why the general approach of the Directive can be regarded as risk-related (Greiving, 2004). Besides, the consideration of problems related to climate change and climate change-induced risks has to be an important element in SEA applications (see Chapter 5.1). This has also been stressed by the European Commission (2008, p. 38), which points out that an effective integration of a risk impact assessment requires an adequate implementation of SEA mechanisms that more specifically focus on risk prevention. Integrating issues related to disaster risk reduction into SEA requires a purposeful use of risk information throughout the assessment process. This means that in order to achieve a risk-informed SEA process, disaster risk needs to be considered and information about risks applied in each stage of the process.

In addition to considering potential effects of the plan on the climate, it is also important to *"assess the PP against the future baseline and key trends and their drivers taking into account other PPs"* as well as to *"consider the impact that predicted changes in the climate and biodiversity will have on the proposed PP, potentially over a long timescale, and its resilience and capacity to cope"* (European Commission, 2013, p. 10) (see Figure 29). It makes sense to relate these statements towards disaster risk and to additionally consider the long-term consequences of risks associated with climate change on the plan[104]. In this respect, the OECD (2010b, p. 23) has already specified the role of SEA in relation to disaster risk by explaining that *"SEA can be used to incorporate consideration both of i) how development objectives can be affected by disaster risk and ii) how PPPs can influence the vulnerability of communities to disaster risk."* The reason for considering the future baseline is that the reference state of the environment and environmental conditions, which are used as a basis for determining significant impacts of a plan, will fundamentally change. Impacts of a plan or environmental changes induced by the plan that today would not be considered significant, or would not even occur under present conditions, could indeed be expected under the signs of climate change. Therefore, the SEAs should consider the fact that plans and programmes are operating within an evolving environmental baseline (European Commission, 2013) and therefore within a changing environment that might make different demands and pose different threats to a plan or programme.

[104] The European Commission (2013, p. 17) clearly states in its guidance that *"for climate change, in particular, it will be important to consider early in the SEA process not just the impacts of the PP on climate and climate change, but also the impact of a changing climate on the PP and its implementation"*.

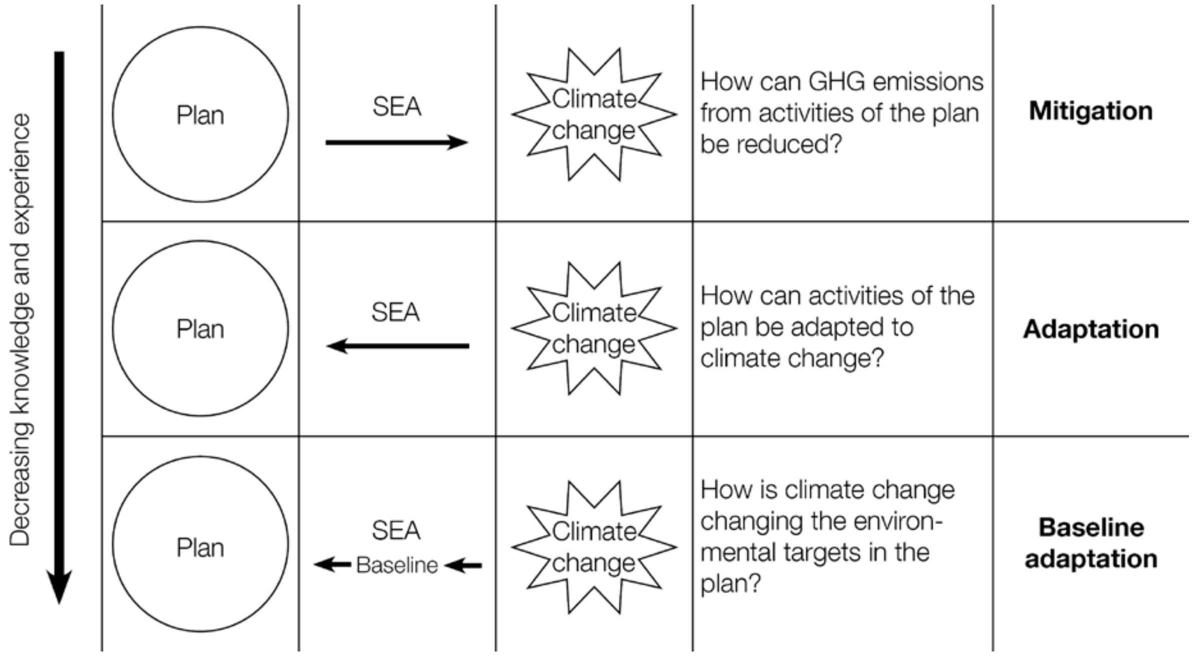

Figure 29 Integrating climate change into SEA (Source: recreated and altered from Larsen et al., 2012, p. 34; Wilson and Piper, 2010, p. 154)

The need to evaluate both current and future baseline conditions, has been outlined by the SEA Directive which, in Annex I, requires the provision of information on *"the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme"* (CEC, 2001b, Annex I (b)). Consequently, the SEA Directive already anticipates a possible change in the environmental baseline without the implementation of the PPP, which should necessarily be evaluated during the assessment process. When considering the fact that present structures and conditions are changing over time, it is therefore crucial to not only look at the current state of the art and assess possible impacts of the plan or programme on the current environmental factors, but to also consider possible impacts of the plan on a future environment and possible impacts of the future environment on the plan, respectively. Obviously, this includes the consideration of a potential increase in extreme events, which might cause negative effects for a planned development in the long run. Keeping in mind that a changing climate might change the pattern of the occurrence of natural hazards, a consideration of disaster risk in SEA is crucial. Using risk information about the potential occurrence of natural hazards as part of the SEA process thus constitutes a necessary precondition in order to be able to adequately anticipate and deal with such a risk. Finally, acknowledging uncertainty when developing the baseline is just as important. After all, depending on the respective time and spatial scale being considered, some degree of uncertainty is inevitable (European Commission, 2013, p. 41).

It is not only important to assess plans and programmes against the future baseline in terms of changes in climatic patterns, but also to assess and consider socio-economic development and changes in demographic structures. A declining population, for instance, automatically decreases the vulnerability against natural hazards and extreme weather events as fewer inhabitants exposed to hazards mean lower chances of loss of life and material assets. Vice versa, in growing communities there will be a growing number of elements at risk and therefore a higher vulnerability. The European Commission (2013, p. 39) explains in this context: *"In addition to climate scenarios, it is important to consider socio-economic* *scenarios as this will help assess future vulnerability to climate change*." Accordingly, environmental assessments for current and future baseline conditions should be directed towards climatic, social and economic changes.

According to Greiving (2004, p. 16), SEA constitutes an already existing procedural framework for managing risks that threaten the environment and can be seen as a key instrument for integrating the notion of disaster risk reduction into planning processes. As mentioned above, the Directive demands an environmental assessment for plans and programmes which are likely to have significant environmental effects. More precisely, this refers to likely significant effects on issues such as *"biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors*" (CEC, 2001b, Annex I (f)). This assessment of significant effects can in fact be regarded as a key task of SEA (Greiving, 2004, p. 14). As disaster risks can have significant effects on many of the mentioned issues, risks should automatically be considered within an SEA. This, in turn, means that disaster risks should generally be discussed as potential, significant (adverse) effects on the environment as part of the legally required environmental report (see Chapter 5.1.1). Annex II, Paragraph 2 of the Directive refers to characteristics of the significant effects as well as the area likely to be affected (CEC, 2001b):

- the probability, duration, frequency and reversibility of the effects,
- the cumulative nature of the effects,
- the transboundary nature of the effects,
- the risks to human health or the environment (e.g. due to accidents),
- the magnitude and spatial extent of the effects (geographical area and size of the population likely to be affected),
- the value and vulnerability of the area likely to be affected due to:
    - special natural characteristics or cultural heritage,
    - exceeded environmental quality standards or limit values,
    - intensive land use,
- the effects on areas or landscapes which have a recognised national, Community or international protection status.

Numerous of these aspects are clearly linked to disaster risk (e.g. probability and frequency, magnitude and spatial extent of effects as well as the vulnerability of the area). An increasing damage potential or a change of the hazard potential as a result of the implementation of a plan can be considered a "significant effect" on the environment (Greiving and Fleischhauer, 2006, p. 117). Greiving (2002, p. 248) concludes that the stages and requirements of the SEA Directive are closely related to the steps that usually make up the risk assessment process: hazard identification, risk analysis and risk evaluation. Hence, combining both processes by aligning risk assessment and SEA stages is advisable, as such an integrated and comprehensive approach will facilitate the planning process (see Figure 30).

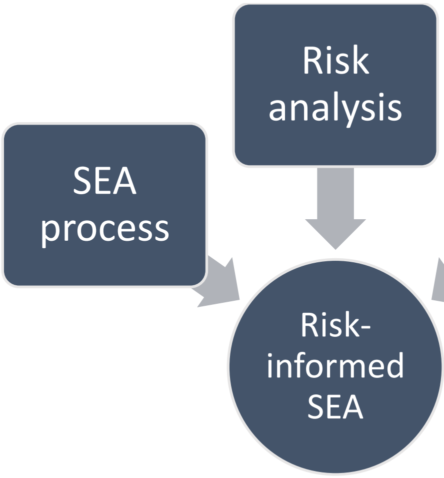

Figure 30 Elements of mainstreaming disaster risk into SEA (Source: own illustration)

This feature and task of environmental assessments has also recently been highlighted and strengthened by the European Commission. The EC decided to more explicitly integrate these issues into EU legislation. In May 2014 the amendment for the Environmental Impact Assessment Directive (Council Directive 2014/52/EU of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment) entered into force, which now pays greater attention to those threats and challenges that were not particularly obvious when the original Directive entered into force in 1985. Due to the fact that environmental issues such as climate change and disaster risks have become more important in policy making, the Commission recognised the need to consider them as separate elements in the assessment and decision-making process[105]. Consequently, the newly amended Directive specifically addresses issues of climate change and disaster prevention. Both elements are now better and more clearly reflected in the assessment process. In fact, Article 3 of the Directive has been amended to the effect that a second paragraph was added, which requires an EIA to also consider *"expected effects deriving from the vulnerability of the project to risks of major accidents and/or disaster"* (CEC, 2014). Moreover, the wording in Annex III, Paragraph 1 and Annex IV, Paragraph 4 implies that "climate" as one of the environmental factors has to be seen in the wider context of climate change. According to Annex III, Paragraph 1 *"the risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change"* (CEC, 2014) needs to be considered. Annex IV (5) requires the environmental report to include a description of the likely significant impacts of the project on climate as well as the vulnerability of the project to climate change. The latter is of particular importance in this context. By referring to the vulnerability of the project to climate change, the EC highlights the need to also look at how the project might be affected by a changing climate. Instead of merely assessing adverse impacts of the project on the environment, assessments also need to consider possible impacts on the project.

EU Member States have to apply the new regulations by May 2017 in order to comply with the Directive. Since EU Directives are implemented differently into national laws and are always adapted to the respective national context, consequences of the EIA amendment will differ across the EU. Technically

[105] Council Directive 2011/92/EU only took climate into account as one of the environmental factors that form part of the assessment according to Article 3 (CEC, 2011). By separately listing climate change and risks of disasters as two important environmental issues in policy-making, both aspects should constitute equally important elements in the assessment and decision-making processes, but be assessed separately.

speaking, the EIA Directive is predominantly directed towards projects. Yet, it might still impact plans or programmes at the local planning level. Such impacts need to be determined for every country individually by looking at the respective legislative basis of both EIA and SEA Directive[106]. Apart from this, the reason for introducing the SEA Directive in addition to the EIA Directive was based on the fact that initially an assessment of environmental impacts happened at too late a stage within the planning process. Therefore, it would be quite a reasonable step if the SEA Directive was amended accordingly. This is why there is a high probability that an amendment of the SEA Directive with similar improvements will happen.

The benefit of integrating risk assessments into SEA is obvious. Environmental assessments need to be completed before an approval for a plan is given. An SEA serves to incorporate issues such as climate change and disaster risk from the early stages of developing a plan or programme and throughout the whole process of developing a PP (European Commission, 2013, p. 16). In addition, possible mitigation measures need to be determined before the adoption of the plan, which is why there is a clear potential and asset for the SEA to assess and consider risks and risk prevention measures (European Commission DG Environment, 2008), which then need to be adopted and implemented by the plan. It is important to highlight, however, that *"implementation of the SEA Directive at Member State level differs considerably, and risk prevention and disaster risk reduction are not necessarily addressed in a sufficient and effective manner"* (European Commission DG Environment, 2008, p. 39). Due to the fact, that the wording of the SEA Directive (currently) does not explicitly foresee an assessment of disaster risks, there is also no guarantee that according provisions are integrated into national legislation and that the environmental risks will actually be assessed.

In recent years, some reports highlighted the need to take account of climate change and disaster risk within the SEA process[107]. Moreover, research has been carried out to examine the role of SEAs for climate change resilience and risk reduction objectives (e.g. Eales et al., 2011; Larsen et al., 2012; Larsen et al., 2013; Slootweg and Jones, 2011; Wanczura, 2006a; 2010; Wilson and Piper, 2010). It is interesting to note that hardly any research specifically focuses on the integration of disaster risk reduction. Most contributions that can be found in academic literature refer to the integration of climate change mitigation and adaptation. However, as already mentioned a distinction has to be made between climate change and disaster risks. Nevertheless, due to the strong interlinkages between disaster risk reduction and climate change, certain results are expected to be equally valid for both. Besides, the lack of references in academic literature to SEA practice with regard to disaster risk reduction underlines the meaningfulness of this present research (see Chapter 1.1).

The studies referred to above conclude that neither climate change nor natural hazards are considered and particularly well integrated in SEA practices. Wanczura (2006a, p. 180), for instance, concluded from

[106] In Germany, for instance, according to the Federal Building Code the requirements of EIA and SEA are commonly evaluated in a comprehensive environmental assessment at the local planning level. This is why amendments of the EIA Directive have to be implemented in a way that ensures an alignment with and consideration of requirements of the SEA Directive (Battis et al., 2015, pp. 6–7). For more information on the consequences of the EIA Directive on the Federal Building Code in Germany see Battis et al. (2015).

[107] This includes, for example, the final report "Assessing the Potential for a Comprehensive Community Strategy for the prevention of Natural and Manmade Disasters" by the European Commission DG Environment (2008), two reports by the OECD (2008b; 2010b) on "Strategic Environmental Assessment and Climate Change" and "Strategic Environmental Assessment and Disaster Risk Reduction" as well as the European Commission's (2013) "Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment".

conducting research on the integration of hazard and risk assessments into spatial planning in eight EU countries as part of the ARMONIA project, that *"currently none of the analysed countries are actively considering natural hazards within SEA processes"*. Larsen et al. (2012, pp. 38–39) and Wilson and Piper (2010) observed that if climate change plays a role in SEA, practice primarily focuses on climate change mitigation. Less focus is placed on adaptation. In general, practice often fails to incorporate a broad scope towards climate change issues. Different studies therefore confirm the results of the study undertaken by COWI for the EC DG Environment (2009, p. 118), which concluded that *"specific attention to climate change issues appears to still be limited in many Member States"*. Hence, the lack of consideration of climate change and disaster risk reduction in SEA processes is obvious.

An integration of climate change and disaster risk reduction into SEA also implies and necessitates the adoption a future perspective and the dealing with uncertainties. After all, due to the complexity of systems and the difficulties to completely define the interrelatedness of individual elements and their effects as well as the potential cumulative nature of effects, climate change related consequences can hardly be fully predicted. By nature, SEA is concerned with future developments, which is why dealing with uncertainties in the assessment process is a prerequisite (Tennøy et al., 2006; Thissen and Agustinata, 2008). In this context, it should be noted that SEA is not only a suitable tool to incorporate risk assessments. It is also suited to acknowledge uncertainty and to integrate an analysis of rather uncertain impacts on planning decisions (European Commission, 2013; Zhu et al., 2011). Besides, SEA can be assigned the task to process uncertainties and to further communicate it to the responsible planning and decision-making authorities. However, handling uncertainty at each stage of the SEA process is one of the key challenges and the consideration of uncertainty still seems neglected in many SEA studies (Fischer, 2010). SEA can react to such challenges with the concept of resilience as well as by acknowledging limitations of the current knowledge by applying the precautionary principle (European Commission, 2013, p. 17). How this can be accomplished and how this will help facilitate dealing with risks in spatial planning is covered in Chapter 5.2.2.

5.2.2 Using SEA as a tool to inform spatial planning

Applying a risk-informed SEA process necessitates the use of appropriate information about risks. However, the mere use of risk information in SEA is not sufficient. In addition to using risk information, issues regarding disaster risk have to be properly mainstreamed into the SEA process. This also involves the management and decision-making stages. Hence, using risk information in SEA requires the processing of information in such a way that it ultimately informs spatial planning processes and can be easily adopted and turned into planning decisions which preferably foster resilience. Information about risks has to be communicated to spatial planners and SEA practitioners throughout the SEA process during all stages. It has to be presented in a way that is readily applicable and can be easily considered in the weighing up process.

Spatial planners and decision-makers run the risk of promoting environmental degradation in the event of missing or inadequate information about the current state of the environment and a lack of the ability to assess the consequences of their decisions and potential mitigation (Royal Commission on Environment Pollution, p. 76 cited in Jones et al., 2005b, p. 21). In the context of disaster risk reduction it can be assumed that spatial planning does not necessarily exhaust its potential in the context of risk management, as planning practice is sometimes constrained by the lack of adequate risk information. This means that existing information is not always ideally presented and spatial planners sometimes encounter difficulties with correctly interpreting the content of maps, for instance (see Chapter 4.2.3). SEA can be a helpful means to assess complex information. Within an SEA procedure, risk information can be translated or transformed in a way that is more easily applicable. The SEA Directive ensures that authorities with relevant environmental responsibilities and the public are to be consulted during the SEA procedure. This also includes authorities and other institutions with specific knowledge about natural hazards. As plan-making authorities should strive for a thorough and proper consultation (see Chapter 5.1.2), by more intensively addressing environmental and other relevant authorities and stakeholders, information about risks could be made more easily understandable and transferable. In any case, planners or SEA practitioners should leave enough time to properly assess the information when consulting stakeholders (EU Commission 2013, p. 10).

The availability of adequate information alone, however, is only one prerequisite. Moreover, van Stigt et al. (2015, p. 167) concluded from their study that local administrators responsible for spatial planning predominantly make use of information provided by experts to obtain their main goal: Balancing all concerns to arrive at a reasonable decision which in the end is supported by both decision-makers and the public. This implies that the availability of information is not the crucial point. Instead, the authors point at a lesson for environmental experts: *"rather than supplying decision-makers with more or better knowledge about how a plan affects environmental values, they should focus on providing better decision frameworks* […] *"* (van Stigt et al., 2015, p. 167). SEA constitutes such a framework. It represents an existing decision-aiding tool and can therefore already be used to address the mentioned problems.

Existing problems also include the problems of fit, interplay and scale (see Chapter 4.2.2). Carrying out proper consultations can be a possible solution to these problems. On the one hand, consultations offer the possibility to get in touch with different actors. Attempts that enable a two-way communication process may help to better coordinate interests and concerns of different stakeholders. Various perceptions can be considered and the pros and cons of each perception can be weighed up against each other. Comprehensive consultations should always include authorities at both vertical and horizontal scales. On the other hand, consultations may also help solve problems of fit. By consulting authorities at different administrative levels, understanding of the actual risk situation can be provided regardless of whether the affected stakeholders operate or provide information at the same administrative level. Consultations will help interprete the information better and will support spatial planners in assessing possible impacts on plans. The need for transboundary consultations in case of likely significant transboundary effects should not be left unnoticed. For such a case, the SEA Directive requires in Article 7, Paragraph 1 that *"the Member State in whose territory the plan or programme is being prepared shall, before its adoption or submission to the legislative procedure, forward a copy of the draft plan or programme and the relevant environmental report to the other Member State"* (CEC, 2001b). In Article 7, Paragraph 2 the Directive specifies that, *"the Member States concerned shall enter into consultations concerning the likely transboundary environmental effects of implementing the plan or programme and the measures envisaged to reduce or eliminate such effects"* (CEC, 2001b). This hints at common and coordinated agreements on risk reduction and prevention measures. Especially when dealing with floods in large river catchments, transboundary effects have to be taken into account. After all, river floods of major European rivers often affect more than just one Member State. Again, it is important to recall that an environmental assessment does not only involve assessing effects of the plan on the environment, but also those of the environment on the plan. In order to appropriately consider the likelihood of risks originating in a neighbouring country but equally affecting the territory of a plan in question, transboundary consultations are crucial in order to clarify the situation. This way, consultations may clearly help reduce problems related to misfits in spatial information. Finally, problems of scale also can be addressed. This holds true particularly for problems at the temporal scale. Due to the fact that SEA should adopt a future perspective, different temporal scales will automatically be considered (see below in this chapter). SEA can therefore be an important means to overcome problems of fit, interplay and scale.

In general, environmental assessments can help make plans and programmes more resilient towards disasters by addressing first and second order impacts, by identifying cumulative, synergistic and long-term effects and by supporting actions which are able to prevent or minimise potential negative consequences (Jones et al., 2005b, p. 19; Wilson and Piper, 2010, p. 142). It is therefore crucial to integrate climate change and DRR objectives during the SEA process (see Table 6 for examples). Since measures related to climate change adaptation and DRR should not be addressed only at the end of the plan-making process, SEA is an ideal instrument that helps address respective key issues at an early stage of plan development, when there are still many options and alternatives open[108] (European Commission, 2013). As discussed in Chapter 3, climate change-induced risks are likely to increase in the future and must be considered in planning processes and in plans and programmes that are adopted for a long time-span.

Table 6 Examples of SEA climate change and DRR objectives and indicators for climatic factors (Source: adapted from European Commission, 2013, p. 45; Scottish Executive, 2006)

Possible climate-change and DRR-related SEA objectives	Possible climate change and DRR-related SEA indicators
To increase the extent of green spaces in new plans and programmes To reduce vulnerability to the effects of climate change and natural hazards, e.g. flooding, extreme weather events, debris flows To protect human health, material assets and cultural heritage from natural disasters To prevent, reduce and compensate significant adverse effects on the environment resulting from natural hazards To protect (or even expand) native woodland cover to avoid mass movements	Share of green spaces in a plan or programme Amount of development in a flood plain Special natural characteristics, cultural heritage or intensive land use in a flood plain or on/near steep slopes Probability and frequency of flood and landslide hazards Risks to human health or the environment (e.g. due to disasters) Magnitude and spatial extent of flood and landslide hazards Degree of protected native woodland

[108] In fact, for many plans and programmes, the SEA is the only existing tool that legally requires administrative bodies and planners to take account of environmental conditions at an early stage of plan development. In the context of climate change or disaster risk, this might require the consideration of flood/landslide hazard or risk maps (European Commission, 2013, p. 16).

In order to properly address uncertainties, the provided information has to be used in a way that particularly risky planning can be avoided at the best possible rate. This means that planning should focus on measures and activities which preferably generate long-term benefits despite the uncertainties associated with climate change. The reason for such a precautionary approach consists in the fact that in the light of climate change and uncertainties, certain land use decisions might turn out to be unfavourable. After all, risk assessments will always be a mere approximation of the objective hazard. Uncertainties attached to risk statements and the lack of an objective appraisal are one of the reasons why risks provoke considerable controversy in environmental policy. Levelling scientific risk assessments and subjective, intuitive risk perception, however, is not regarded as useful. This is why on the one hand the scientific community, or risk information providers in general, are required to conduct risk assessments as accurately and objective as possible. On the other hand, it is equally important that a rational risk policy acknowledges the issue of risk perception (GACGC, 2000, pp. 38–39). Greiving (2004, p. 13) points out that today, land use decisions are rarely accepted as realities and they are always subject to a public discourse underlying different views about the actual conditions of the environment. Spatial planning has to consider these different views and then decide how risks should be managed. In this regard, the requirement of the SEA Directive to enable public involvement should be underlined (see Article 6, Paragraph 2). Due to the required public involvement, spatial planners and decision-makers will have the opportunity to take into account different perceptions of risk. According to the importance of public consultation and participation above-explained, such public involvement can be vital to vulnerability and risk assessments and for ensuring a rational and comprehensible decision-making process. Obviously, this also involves measures related to disaster risk mitigation or minimisation. This means that public involvement within SEA may help produce plans that are accepted by a majority of stakeholders, including the public (IPCC, 2007, p. 141).

When facing large uncertainties in spatial planning it is generally helpful to follow a resilience driven approach or to apply "resilience thinking"[109] (Slootweg and Jones, 2011; Walker and Salt, 2006). Resilience has been identified as an approach that helps to better handle the occurrence of surprising events and to be better prepared for unexpected disasters (Slootweg and Jones, 2011, p. 264). Developing resilient alternatives will enable the handling of present uncertainties most effectively (Eales et al., 2011). Building resilience into a plan or programme should ideally happen starting from the very beginning of the planning process (European Commission, 2013, p. 17). The task of SEA in this context can be described as informing development of the plan or programme in a way that maximises opportunities related to climate change on the one hand, and on the other hand reducing risks and vulnerabilities (Eales et al., 2011). In this respect, the use of spatial data could be important (European Commission, 2013, p. 33). For floods or extreme rainfall events, this includes the identification of "hot spots", i.e. buildings and infrastructures that presumably are at risk due to their location in a flood zone or a depression. For landslides, this includes the identification of hazard-exposed developments and their respective vulnerability (European Commission, 2013, p. 34).

[109] Slootweg and Jones (2011, p. 264) explain that "resilience thinking" provides *"a structured way of looking at complexity, uncertainty and interrelatedness of systems and processes"* as well as *"new and useful concepts to deal with the interconnectedness of humans and their environment, the uncertainty and unpredictability of events at larger temporal and spatial scales that we need to look at when discussing sustainability, and provides management principles for this"*.

Building long-term resilience into a plan or programme can be accomplished by applying the precautionary principle to guide planning alternatives and measures towards the least harmful options available, for instance (European Commission, 2013, p. 43). This means that spatial planners and SEA practitioners may use the precautionary principle when there is uncertainty about the long-term effects of a plan or programme on climate change, or vice versa, and the nature of the potential risks. They could then develop a plan or programme based on a "no regret" or "low regret" strategy (Eales et al., 2011; European Commission, 2013, p. 43; Greiving, 2010, p. 33). As mentioned in Chapter 4.2.3, no-regret strategies play an important role when facing uncertainties. This way of dealing with uncertainty may furthermore help address the problem of temporal scale. Conditions that prevail today are not simply transferable into the future. Due to the fact that uncertainty makes it difficult to track development processes which occur at different temporal scales, no or low regret strategies are one option to deal with problems at temporal scale. However, such strategies lack adequate operationalisation and there are still difficulties in transferring the idea into practice (Greiving, 2010, p. 33).

No-regret strategies are closely related to the idea of climate proofing. Climate proofing describes *"methods, instruments and procedures that ensure making plans, programmes and strategies as well as associated investments resilient and adaptable towards current and future impacts of climate change* […]" (Birkmann and Fleischhauer, 2009, p. 118). Birkmann and Fleischhauer (2009, p. 123) further explain the goals of climate proofing by stating that in the course of preparing, adopting and approving plans, programmes and projects, possible impacts of climate change and environment that are relevant for the PPP should be taken into account. This involves consideration of climate scenarios as well as exposure to hazards and vulnerability of the respective spatial development objectives towards impacts of climate change. In a broader sense, climate proofing constitutes some sort of environmental assessment. This is why it makes sense to align climate proofing with SEA and EIA (Agrawala et al., 2012; Deasley et al., 2011; OECD, 2008b; Wende et al., 2012). When integrating climate proofing into an SEA, the coping capacity of a plan is tested against a changing climate (Birkmann and Fleischhauer, 2009). Therefore, an integrated climate proofing ensures that not only the impacts of a PPP on the environment are assessed, but that the impacts of a changing environment, caused by climate change, on the PPP also have an influence on the weighing up process. While aspects related to climate proofing refer to climate change mitigation and adaptation only, a similar approach is conceivable for aspects related to disaster risk reduction. Despite the fact that different issues are addressed, the very idea stays the same. This is why an integration of risk assessment into SEA should be just as possible. Due to the obvious benefits, it is even advisable.

Such an approach is also fully in line with the demands of Article 5 of the SEA Directive to identify, describe and evaluate reasonable alternatives as part of the environmental report. During the planning process, appropriate measures have to be determined as an integrated part of decision-making for the plan in question. These measures should be in accordance with the development and protection objectives and could be differentiated into prevention-oriented mitigation, non-structural and structural mitigation measures (Greiving, 2004, pp. 14–15). The comparison of reasonable alternatives should also involve those representing a no-regret strategy. However, also a "zero alternative" can be one of the options. In this case, a decision for non-structural mitigation measures could imply a cancellation of a planned development, if it was directed away from the hazard-exposed area (Greiving, 2004, p. 15). Furthermore, measures should be selected that *"prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme"*[110] (CEC, 2001b, Annex I (g)). Given the opportunity to choose between different management options, spatial planners may decide for the best option available in a specific context. After all, it might not necessarily be the best decision to fully prevent risks by prohibiting any development. Finally, implementing risk reduction measures always necessitates a monitoring process which aims to assess whether the chosen measures were actually implemented and if so, whether they managed to fulfil the intended protection goals (Greiving, 2004, p. 15). Again, the SEA procedure provides a useful basis and framework to integrate a monitoring of risk reduction measures, as it foresees a monitoring of significant environmental effects in Article 10, Paragraph 1. However, when considering the fact that monitoring is rarely considered and undertaken within SEA (see Box 2), efforts and guidance needs to be directed towards facilitating the monitoring process. This can be done by providing appropriate indicators, which aim to evaluate goal attainment of implemented measures. In regard to those measures related to disaster risk, an indicator-based concept that addresses different natural hazards and different protection goals might be helpful (Fleischhauer, 2004).

5.3 Summary

In this chapter, the suitability of SEA for integrating risk assessment and management was described. In particular, it highlighted the need for using risk information in SEA in order to assess negative environmental impacts on the PP and impacts of an evolving baseline on the PP. Although countries apply different SEA approaches and although implementation of the SEA Directive at Member State level may differ considerably, the added value of integrating risk assessment and using risk information in SEA is valid for all EU Member States. Still, outcomes related to climate change and DRR objectives (see Table 6) might take different effects, due to varying degrees of effectiveness of SEA implementation. Assessing the effectiveness of SEA is rather difficult, since such an evaluation is a subjective exercise, which predominantly relies on opinions of stakeholders and experts. Nevertheless, it is crucial to find out whether an SEA of spatial plans has any noticeable impact on decisions regarding contents of the plan or not (Jones et al., 2005a, p. 9). This also involves decisions on climate change mitigation and adaptation as well as disaster risk reduction. An effective implementation of the SEA Directive is crucial for a successful application of envisaged strategies and measures – including those related to disaster risk reduction. This is why the current state of the art of SEA implementation in the case study sites needs to be identified, in order to be able to estimate possible benefits in this regard (see Chapter 9). Moreover, the current lack of a well-established methodology to identify potential negative impacts of the PP on the environment or the environment on the PP give point to the elaboration of a concept for the integration of an assessment of risks into SEA (see Chapter 10 and 11).

[110] In Article 7, Paragraph 2, the SEA Directive also refers to measures that reduce or eliminate adverse effects.

Part III: Empirical study – The cases

6. The context: Ubaye Valley (France), Wieprzówka and Stryszawka Catchments (Poland) and Fella River Catchment (Italy)

It can be assumed that a SEA procedure that integrates risk assessment and management represents a promising concept for dealing with risks in spatial planning. In order to propose a concept which can be applied in different European contexts, it is important to be aware of the respective frameworks the concept should comply with. Regardless of the different spatial planning systems and cultures in Europe, a concept for integrating disaster risk into SEA should be generally applicable. An analysis of administrative structures, spatial planning systems and natural hazard characteristics in the case study areas was carried out according to the analytical framework presented in Chapter 2. This analysis aims to gain knowledge about the contextual framework in which planning practices are established. Knowledge about the contextual basis serves to inform data collection and analysis. In this particular case, this means that understanding of the respective administrative and spatial planning systems as well as SEA practices, in addition to the knowledge gained on disaster risk assessment and management approaches and frameworks outlined in Chapters 3, 4 and 5, will be translated into criteria that guide data collection and analysis (see Chapter 7). The following sub-chapters will therefore focus on the clarification of aspects regarding natural hazards in the case study sites as well as national administrative and spatial planning systems and SEA practices.

Figure 31 Evidence of natural hazards that occurred in the French case study area. Left: Inundation of the Ubaye River in 2008; Right: La Valette landslide from the bottom in 2001 (Sources: Left: EOST/CNRS, Université de Strasbourg, 2016; Right: OMIV - Observatoire Multidisciplinaire des Instabilités de Versants, 2015)

All three case study areas have experienced disasters in recent years due to hydro-meteorological hazards. This is one of the reasons why these case study sites have been selected in the first place. The French case study area was hit by a flash flood event in May 2008, caused by a peak discharge of the Ubaye River when snowmelt coincided with heavy rainfall. It affected and flooded the municipalities of Barcelonnette, Faucon de Barcelonnette and Jausiers, among others (see Figure 31). The study area has also been affected by several landslides. One major landslide is the La Valette landslide (a mudslide,) which occurred close to the municipalities of Barcelonnette and St. Pons in March 1982 (see Figure 31).

Examples of natural hazards in the Polish case study area include flash floods that occurred in the catchment of the Targaniczanka River (a tributary of the Wieprzówka River) in August 2005, causing damages in the municipality of Andrychów. Another flash flood occurred in the catchment of the Frydrychówka River (also a tributary of the Wieprzówka River) in May 2010 and hit the towns Frydrychowice and Przybradz, which both belong to the municipality of Wieprz. Finally, a landslide occurred in the town of Lachowice (municipality of Stryszawa) in September 2001 (see Figure 32).

Figure 32 Evidence of natural hazards that occurred in the Polish case study area. Left: Flash flood that occurred in October 2010 in Przybradz; Right: Landslide in Lachowice (Sources: Left: Courtesy of Municipality of Wieprz; Right: Courtesy of W. Rączkowski, OK PIG-PIB)

Floods and landslides have also occurred in the Italian case study area in the past. One particularly disastrous event occurred in August 2003, when the valley was hit by a severe flash flood and debris flow which caused hundreds of millions of Euros in damages (see Figure 33). The event resulted from a combination of two extreme weather events: heavy rainfall with 355 mm of rain within six hours and a preceding drought which induced an extremely dry soil (Bianchizza et al., 2011, p. 14). Bianchizza et al. (2011, p. 14) further state that while the height of debris flow amounted to 4 metres in the town of Ugovizza, the powerful floods carried away sediments, stones, trees and bushes which, together with the force of the water, caused substantial material damage as well as two casualties.

This disastrous event was followed by constructions of several structural mitigation measures such as dykes, check dams, channels, basins etc. Funds were provided by the National Department of Civil Protection and made available to the regional civil protection agency of Friuli Venezia Giulia. All available money was spent on structural mitigation measures, which today are strongly represented in the valley[111].

[111] According to some interview partners, several structures were only built to fully spend the money. Some even seem to exceed the purpose by being too big. Funds were mainly provided to show support and to give inhabitants a feeling of safety in order to prevent people from leaving the valley.


Figure 33 Flash flood and debris flow event that occurred in the Italian case study area in August 2003. Left: Traces of debris; Right: Erosion and destructed house along the river bed (Source: Courtesy of Armando Coianiz)

All three case study areas are located in mountainous regions and in a river basin. They have experienced floods, flash floods and landslides (mudslides, debris flows, rock falls) in the past. Moreover, due to their exposure to such hazards they are likely to experience similar events in the future. Therefore, strategies and measures need to be implemented which help these areas to prevent and prepare for potential future disasters. Some of the currently implemented mechanisms will be further outlined in Chapter 8.

6.1 Administrative structures of France, Poland and Italy

The consideration and examination of the administrative structures of each country examined is important for understanding the respective planning systems and practices and the competences of actors at different administrative levels. This is why in a first step a short overview over the mostly rather complex administrative structures will be given. Special focus will be put on the different administrative levels, their interlinkages and respective competences.

6.1.1 Administrative system of France

The French Republic is a decentralised, unitary state. Differing responsibilities and competences exist between the central government and local authorities after the state tried to devolve competences and responsibilities in order to strengthen the role of the regional level. This decentralisation process was introduced by the decentralisation legislation at the beginning of the 1980s. Today, regions, departments and municipalities are self-government authorities. However, at the same time the deconcentrated services of the state are responsible for representing and implementing national ideas and standards at the regional level and departmental level (European Communities, 2000, p. 21, 24). Hence, although elements of decentralisation have been established, a certain centralised structure still exists and the state still has quite an important role.

The French administrative system is made up of three levels at sub-national level (see Table 7): The regional level ("régions") is divided into 22 regions and 4 overseas regions. The intermediary level ("départements") consists of 96 departments (and again 4 overseas departments). At the local level ("communes") there are 36,778 municipalities.

Table 7 Territorial organisation in France (Source: own illustration)

State territorial administration	Sub-national governments
22 regional offices (prefectures of the region)	22 regions
96 departmental offices (prefectures of the department) 235 district offices (sub-prefectures of the "arrondissement")	96 departments
	36,778 municipalities

At the highest sub-national level, a distinction needs to be made between the deconcentrated services of the state within the region, i.e. the regional prefect, and within the departments, i.e. the departmental prefect, as well as the regional administration as such, i.e. the self-government authority at regional level. Both kinds of deconcentrated services, within the region and the department, constitute the territorial administration of the state at sub-national level (see Figure 34) (European Communities, 2000, p. 38).

The regional prefect is not directly elected, but appointed by decree. He is the regional representative of the Prime Minister and of each of the national ministries (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006, p. 21). The deconcentrated services of the state are under his authority. He implements national policies in regard to subjects such as spatial planning, economic and rural development, environment, sustainable development etc. and supervises local government acts after the fact. Regional prefects may negotiate and sign agreements with regional authorities in order to represent and substantiate central government interests. This task or privilege may be conferred on the departmental prefect. With regard to spatial planning policies, for instance, the regional prefect supervises the work and duties of the departmental prefects (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006, p. 21; European Communities, 2000, p. 38).

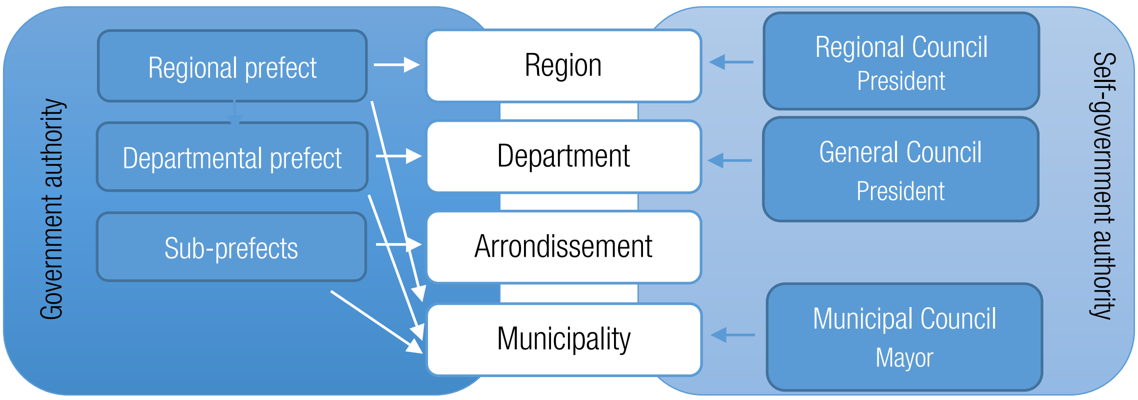

Figure 34 Government and self-government authorities in France (simplified) (Source: own illustration)

The region as a self-government authority is composed of the regional council ("conseil régional"), which is the advisory body of a region, as well as the regional social and economic advisory council ("conseil économique et social régional consultative"). The head of the regional administration is the president of the regional council. The regional council adopts the regional plan ("plan de la région") as well as the state-regional planning contracts ("contrats de plan État-région") and is involved in the formulation of the two planning instruments at the local level, the "schéma de cohérence territorial" (SCoT) and the "plan local d'urbanisme" (PLU) (European Communities, 2000, p. 39). The planning instruments will be explained in detail in Chapter 6.2.

At the intermediary level the departmental prefect is also appointed by decree. The departmental prefect is representative of the central government at department level. He makes sure that the local authority complies with the so-called "projets d'intérêt general" (projects of general interest) (see Chapter 6.2), which have to be considered when preparing urban planning documents. Besides, the departmental prefect can demand the elaboration or review of spatial plans at the local planning level if formulations or revisions of these documents are justified and if they correspond to a common interest (European Communities, 2000, p. 38). In addition to the regional and departmental prefects, there are sub-prefects who are responsible for an arrondissement, which is a subdivision of the department[112]. The sub-prefect ("sous-préfet") is more specifically charged with tasks related to spatial planning. He works closely with local authorities and promotes the implementation of local development projects (European Communities, 2000, p. 38).

The general council ("conseil général") at department level is equivalent to the regional council at regional level, whereas the president of the general council ("président du conseil général") represents the executive body of the department. The competences of the general council reside, among others, in urban planning and equipment. Thus, the department is also involved in the elaboration of local level planning documents. In addition, it is consulted during the preparation of the "plan de la région". However, its main responsibilities lie in health and welfare, infrastructure and transportation as well as education (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006, p. 26; European Communities, 2000, pp. 38–40).

Each municipality has a municipal council ("conseil municipal") which manages local activities. The mayor represents the executive power of the commune. In certain cases mayors also represent the central government and act on behalf of the state (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006, p. 25). For instance, the mayor is responsible for delivering building permits, a duty which is done as a representative of the state. As urban planning is a municipal responsibility, it is the municipal council that adopts the local spatial plan (PLU) in the end (European Communities, 2000, p. 41). In addition to urban planning, a commune has power regarding the following topics: education, social services, infrastructure (e.g. maintaining roads), waste management, transportation, economic services and culture (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006, p. 25).

There are two elements that characterise the influence of councillors at the local level: The "cumul des mandats" as well as the actual, proper competences of local authorities. "Cumul des mandats" can be described as multiple political office holding and means that the majority of deputies – as members of the French Parliament – and the senators are usually also mayors or general and regional councillors. This multiple political office holding is a typical feature of the political system in France and points at the lack of

[112] Each department is divided into several arrondissements, each having its own "sous-préfecture" (sub-prefecture).

division between the national, regional and local political system. However, at the same time the law also grants substantial powers to the executive body at the local level. In addition to the competences that are already constitutionally granted to local authorities, communes can also benefit from the "general competence clause", which means that any local authority can interfere provided a local interest exists and no state or other authorities' competences are being impinged (European Communities, 2000, p. 29). Thus, despite the ongoing controlling function of the prefects, the municipalities gained in authority and executive powers after the decentralisation process[113].

6.1.2 Administrative system of Poland

The Republic of Poland is a unitary state. Since the end of the communist era, Poland increased its efforts to achieve a more democratised process (UN, 2004) and therefore aimed at a decentralisation of powers. Consequently, in 1999 a reform of the Polish administrative system took place which was partly inspired by the French administrative system. In fact, the division into state and self-government authorities according to the French example constitutes a significant element of today's regional and sub-regional structures (Polish Ministry for Regional Development, 2010, pp. 23–24). The national constitution ensures the decentralisation of public power, especially to the municipalities. There are three sub-national levels of self-government (see Table 8): the voivodeship at the regional level, the county at sub-regional level and the municipality at the local level. These levels of government do not represent a hierarchy, but are on the same hierarchical level (OECD, 2008a, p. 175).

Table 8 Territorial organisation in Poland (Source: adapted from OECD, 2008a, p. 175)

State territorial administration	Sub-national governments
16 voivode offices (prefectures)	16 regions (voivodeships)
	314 counties (powiats)
	2,478 municipalities (gminas)

The regional level in Poland consists of 16 voivodeships. Regional self-government authorities consist of a voivodeship council ("sejmik wojewódzki") and a board ("zarząd wojewódzki") (see Figure 35). A marshal ("marszalek") is the head of the executive body of regional self-government, i.e. the board. He is elected and approved by the voivodeship council, which is the legislative body of self-government. It is also the decision-making and reviewing body and is responsible for passing resolutions (e.g. the voivodeship development strategy of the voivodeship spatial management plan). The voivodeship board, as the executive body, is responsible for the preparation of the mentioned documents. The marshal is the voivodeship representative in all external affairs and has full responsibility for strategic and spatial planning (COMMIN - The Baltic Spatial Conceptshare, 2007a, p. 14). This means that ideas for and concepts of development and development management belong to the responsibility of the self-government.

[113] This fact is underlined by recent changes in the legislation on decentralisation which introduced the "principle of experimentation", which assigns a certain power to local governments to temporarily conduct own experiments including tasks that were previously within the responsibilities of the central government. However, if such an experiment succeeds, the power can be conferred on the municipality on a permanent basis (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006, p. 25).

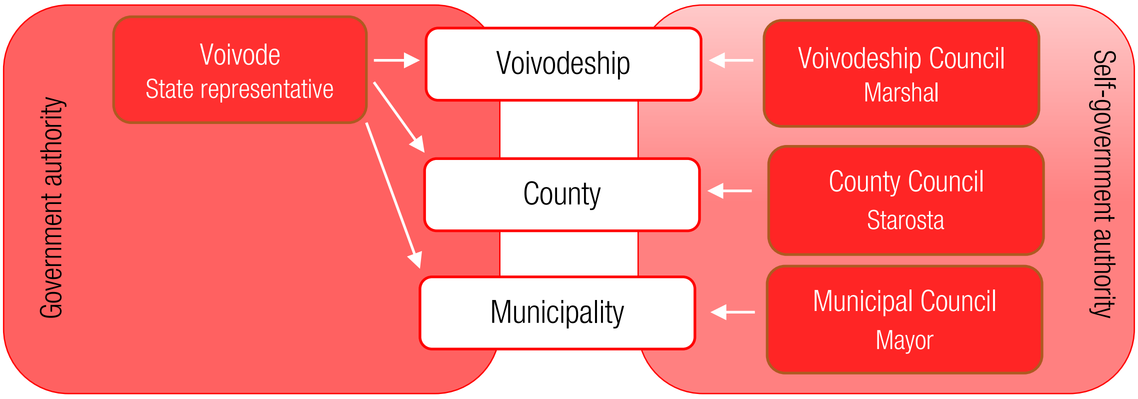

Figure 35 Government and self-government authorities in Poland (simplified) (Source: recreated from Wanczura, 2010, p. 153, own translation)

A governor or voivode ("wojewoda"), the equivalent of the French prefect, is the representative of the central government and appointed by the Prime Minister. The responsibility of the voivode and his subordinate bodies includes the supervision of activities of the voivodeship council. He ensures that all central government decisions are correctly implemented at the voivodeship level from a legal point of view (Polish Ministry for Regional Development, 2010, p. 7). He is responsible for the safety within a voivodeship. In this context, his tasks cover responsibilities within the scope of public defence and public order in crisis situations. Being the representative of the state treasury the voivode is also responsible for the region's use of funds (OECD, 2008a, p. 175; Polish Ministry for Regional Development, 2010, p. 25).

At the sub-regional level there are 314 counties and 65 cities with a county status. According to the act of law, a county ("powiat") performs statutory public tasks, which go beyond those of a commune. Both county and commune together execute all public tasks of local nature. This includes aspects such as nature preservation and spatial management at the local level, including water management (COMMIN - The Baltic Spatial Conceptshare, 2007a, p. 17). It is important to note that counties may not infringe upon the scope of activities of municipalities, as regulated by Article 4, no. 6, Act on County Self-government of 5th June 1998. It may promulgate local law, however. Both voivodeships and municipalities are generally more empowered than counties. Each county has a county council ("rada powiatu") and a county board ("zarząd powiatu"). The "starosta" heads the county board while the county council consists of council members whose works are guided by a chairman (Polish Ministry for Regional Development, 2010, p. 20). In cases of emergency directly connected with an endangered public interest, threats to people's life or health as well as in the cases of expected big material losses, the "starosta" may implement immediate measures, which are also the competence of the county board (COMMIN - The Baltic Spatial Conceptshare, 2007a, p. 19).

Since 1990, the municipality has been the primary local unit of government, as stipulated by the Polish Constitution (UN, 2004, p. 7). From a historical perspective, municipalities have deeper roots and have also been a more influential and important tier of government as compared to the county and voivodeship levels. Chapter VII of the constitution adopted in 1997 determines that the local unit of self-government is the municipality. The Act on Local Self-Government, the Act on County Self-government and the Act on Voivodeship Self-government require that higher tiers may not interfere with the activities of the municipality (UN, 2004, p. 7). However, the state still plays an important role at local government level by providing state grants and by stipulating regional contracts (OECD, 2008a, p. 175).

Municipalities can be classified into urban, urban/rural and rural. Today there are 2478 municipalities, including 65 urban municipalities with a county status. One major difference between the Polish and French administrative systems is the number of local governments (36,000 municipalities in France compared to only about 2,500 municipalities in Poland). Despite several changes of the administrative organisation in Poland over the past century, the total number of municipalities has remained constant. This way Poland has avoided the jurisdictional fragmentation that has complicated decentralisation processes in many other European countries (OECD, 2008a, p. 175). A municipality consists of a council ("rada gminy") as the legislative entity and a municipal board ("zarząd gminy") as the executive entity. The head of the board is the mayor ("wójt") for rural municipalities, a "burmistrz", i.e. a mayor for urban-rural municipalities, or a president ("prezydent") for larger cities. According to the subsidiary principle, a municipality is responsible for all public issues of local importance. They relate to local issues within their proper area of jurisdiction and include aspects such as (COMMIN - The Baltic Spatial Conceptshare, 2007a, p. 19):

- Technical infrastructure (roads, water supply, public transportation, etc.);
- Social infrastructure (schools, health care, welfare system, etc.);
- Public order (civil protection, fire brigades, sanitary safety);
- Spatial and ecological order (spatial planning, environmental protection).

Municipalities can organise themselves in inter-municipal unions, where common issues concerning several municipalities can be addressed. Such an inter-municipal union is not compulsory, however (COMMIN - The Baltic Spatial Conceptshare, 2007a, p. 20).

According to Regulski and Drozda (2015, p. 9), *"Poland is the most decentralized country in Central and Eastern Europe, with powerful and autonomous local government"*. The decentralisation process and the creation of self-government authorities at sub-national level led to a change in control over different tasks, especially in the field of public interests. Local authorities gained the official right to organise public duties on their own behalf, whereas the central government can now only control the adherence of local government acts and decisions to national law (Regulski and Drozda, 2015, p. 9). Local interests became more important and were not influenced or oppressed by central government interests. Local self-governments are now entitled to take their own decisions in their respective field of jurisdiction. Generally, the decentralisation process in Poland is a positive example, as it led to key positive effects in many different areas. Main changes include the increase in living conditions and the evolutionary change in public mentality (Regulski and Drozda, 2015, pp. 9–10). However, municipalities also encountered certain problems. Due to the fact that regions and municipalities had been led by the central government during the communist era, they were not used to guiding their own further development. One of the main problems that are usually encountered in any decentralisation process include a lack of understanding of basic notions of local democracy, like, for instance, a lack of hierarchical dependencies, local responsibility for community affairs, local government property, etc. (Regulski and Drozda, 2015, p. 8).

6.1.3 Administrative system of Italy

Italy is a democratic unitary republic. The regions (“regioni”) are the first level administrative division at sub-national level (see Table 9). Each region is divided into several provinces at the intermediary level[114]. The local level is the lowest level of administration. From the beginning of the 1970s Italian governments pursued the transfer of administrative competences from the central government onto sub-national levels. In 1997 the constitutional law (Law of 15th March 1997, no. 59) introduced an administrative reform and the decentralisation of the central government. Administrative competences at the different administrative levels were officially modified and more power was given and allocated to regional and local levels. These included administrative responsibilities related to their territories, but excluded all responsibilities for key issues of national interest as well as major infrastructure projects (OECD, 2013, p. 43).

Table 9 Territorial organisation in Italy (Source: own illustration)

State territorial administration	Sub-national governments
-	20 regions (regioni)
105 prefectures	107 provinces (province) or "institutional bodies of second level" (including 10 metropolitan cities)
-	7,999 municipalities (comuni)

In 2001, amendments were made to the constitutional law no. 3 of 18th October 2001, which implied further consequences for the power of the central government as well as the regions. The reform aimed to establish the subsidiarity principle into the constitution and gave more policy competences to the regions. This happened at both scales, vertical, i.e. between different administrative levels, as well as horizontal, i.e. between the public and private sector (OECD, 2010a, p. 25).

The first sub-national level in Italy consists of 20 regions. Five of these regions – one of them being Friuli Venezia Giulia – are autonomous regions with special statute concerning legislation, administration and finances. Each region has its own government and parliament. Ordinary regions, however, financially depend on state resources and are therefore limited in their financial autonomy. The regional parliament has independent legislative powers in a number of subjects of regional importance. These issues include land use management and planning as well as risk reduction (UNISDR, 2009b, p. 13). Provinces have to follow regional law and are governed by a provincial president and an elected council.

The intermediary level has 107 provinces. Provinces are groups of municipalities which are governed by a president and an elected council. They have no legislative powers and their decisions or activities have to comply with regional legislation (UNISDR, 2009b, p. 14). Each province also has a prefecture (“prefettura”), governed by a prefect (“prefetto”) who acts as a representative of the state at the provincial and local level (see Figure 36). Prefectures belong to the Ministry of Interior and represent the government at the level of the provinces or the metropolitan cities. The prefect has the overall task of ensuring a coordinated operation of administrative activities of the state offices. He has competences at the provincial level in areas such as immigration and economy.

[114] The region Aosta Valley (“Valle d’Aosta”) in an exception and has no provinces.

At the local level there are 7,999 communes (Istat, 2016). Metropolitan cities have responsibilities in land use management and risk reduction, but do not have any legislative powers. They have to follow national and regional regulations in terms of measures and resources. Smaller communes (towns and villages) are organised into municipalities. Both municipalities and metropolitan cities are governed by an elected mayor and managed by a council (UNISDR, 2009b, p. 14). Municipalities are responsible for local public services, police forces, healthcare etc. Final decisions at the local level are prepared by respective competent departments of local authority, sent to the council committees for a final revision and ultimately implemented by the mayor (UNISDR, 2009b, p. 14).

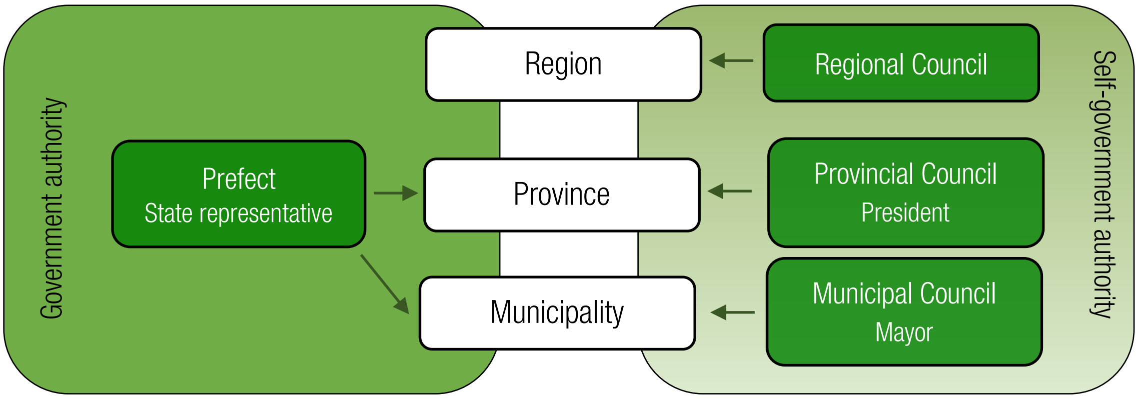

Figure 36 Government and self-government authorities in Italy (simplified) (Source: own illustration)

The administrative reform in the years 1997 to 2001 lead to an integration of competences among different levels of government rather than a strict separation. However, the OECD (2013, p. 43) states that *"areas of concurrent competences were not well defined and it was not clear whether regions would be able to take over administration of central state services in their areas"*. This lack of clarity caused tension in regard to the competences of the state and the regions and even today it affects the relations between the two levels of authority (OECD, 2013, p. 43). These partly difficult relations can therefore also be considered as main issues of the regulatory structure in Italy. This holds also true for issues related to disaster risk management. De Marchi and Scolobig (2012, p. 328) observe that uneasy relations predominantly exist between services that operate at the provincial and the local scale in action fields related to emergency and disaster risk prevention. They continue to explain that *"the complaints of those operating in the technical services tend to centre on the perceived interferences of the political level (town councils, in particular) in risk management decisions*" (De Marchi and Scolobig, 2012, p. 328). The division of powers between the different administrative levels therefore still implies difficulties in Italy, including aspects related to disaster risk reduction.

6.2 Spatial planning systems of France, Poland and Italy

The task of planning processes is to ensure that the many different interests are taken into account when land use decisions are made (Jones et al., 2005c). In this context the concept and task of spatial planning can be described as giving *"geographical expression to the economic, social, cultural and ecological policies of society"* and representing *"an interdisciplinary and comprehensive approach directed towards a* *balanced regional development and the physical organisation of space according to an overall strategy"* (Council of Europe, 1984, p. 2).

An interdisciplinary and comprehensive approach is not always easy to fully accomplish. It requires sufficient knowledge and understanding from a spatial planning point of view about all aspects and issues that play a role in urban and regional development. Moreover, it also requires sufficient information about all these aspects and successful communication between information providers and information users (see Chapter 3.2.4). Jones et al. (2005c) highlight the problem that arises due to this comprehensive function by pointing out that diverse interests need to be considered, such as interests of authorities at different levels, investors, developers, land-owners and citizens as well as several other interest groups which have an interest in planning decisions. All these interests may differ and every group may have different opinions and ideas on how to develop and use land. This is the reason for potential conflicts among the different interest groups that all compete for a limited resource. The task of spatial planning to balance different interests against each other may therefore constitute a real challenge for planning authorities.

According to these descriptions, spatial planning is characterised by an integrated, comprehensive structure which holds a coordinative and spatially-oriented function by considering all scales (national – local). At the national level only a – mostly quite broad and general – national planning strategy is being developed, whereas concrete planning decisions are made at the regional and even more so at the local level. The regional level is in charge of preparing regional plans in which the spatial or physical structure of a region and its development strategy shall be outlined and depicted (Fleischhauer, 2006a, p. 12). Regional planning is described by CEMAT (2007, p. 22) as *"a branch of land-use planning dealing with the organisation of infrastructure, settlement growth and non-built areas at the scale of a region"*. It constitutes a linkage between the overall, broad national development strategy and the detailed implementation strategy with concrete measures and specific land use decisions at the local level. At the local level planning activities aim at a creation of policies and the elaboration of land use as well as building plans in order to formulate concrete decisions on land use within a municipality. Planning at the local level can be referred to as land-use, urban, city or town planning (CEMAT, 2007, p. 34; Fleischhauer, 2006a, p. 12). Its main task consists in *"the physical, social, economic and environmental development of metropolitan regions, municipalities and neighbourhoods"* (CEMAT, 2007, p. 34). Land use planning in municipalities represents the lowest planning level and is usually carried out in two stages. During the first stage a land use plan, mainly referred to as a general or preparatory land use plan, is developed. It consists of a written statement and illustrations that explain and visualise the desired planning direction and land use development. It demonstrates the broad pattern of land use, for the most part encompassing the whole area of a municipality, normally ranging between scales of 1:5,000 and 1:50,000. The second stage involves a planning process, during which concrete definitions on future land development are applied that set the basis for building permissions for new developments and settlements. These detailed land use plans are issued for smaller parts of a municipality and usually contain legally binding planning regulations at scales of 1:500 to 1:5,000 (Fleischhauer, 2006a; Jones et al., 2005c).

6.2.1 Spatial planning system of France

Spatial planning in France, the so-called "aménagement du territoire", can be defined as "*all measures of public authorities [...], which aim at promoting the economical organisation of the national territory in a way which is most desirable*" (Kistenmacher et al, 1994, p. 3 cited in Brandhuber, 2011, p. 47). This definition corresponds to the description of the regional economic approach (see Chapter 4.1). In fact, during the 1960s and 1970s the French planning system was highly centralised and the central government played an important role (Brandhuber, 2011; Geppert, 2014). The pursuit of social and economic objectives was a primary strategy. Accordingly, the concept of French spatial planning was based on centralised, state-led politics that aimed at reducing regional disparities in the form of economic inequalities. Planning efforts were mostly focused on facilitating industrial location and infrastructure development (Brandhuber, 2011, p. 46).

Only with a change in legislation and the introduction of the decentralisation approach in 1982, which promoted the share of decision power with regional, departmental and local governments, spatial planning became more decentralised[115] (Geppert, 2014; Newman and Thornley, 1996). Although the central government is still represented through the prefects in the lower levels of government (see Chapter 6.1.1), considerably more power has been given to regional and local authorities. For instance, in the course of this reorganisation of French planning, planning power was transferred onto the municipal level and the mayor became the main decision maker (Töllner, 2003), while both regional planning and economic development became the responsibility of the newly created regions in order to achieve a better coordination of planning activities (Geppert, 2014). Following a change in legislation, regions were entitled to set up regional plans as a basis for policies directed towards regional development. An actual regional planning approach was initiated – which previously did not exist – representing, however, rather an economic planning approach (European Communities, 2000; Töllner, 2003). A more comprehensive planning of the territory, involving more aspects than economic development planning, did not yet take place. A novelty at the local level was the introduction of a joint development scheme for neighbouring municipalities. Such joint authorities or intercommunal structures were supposed to promote cooperation between communes and enhance local development policies (European Communities, 2000). More reforms in the 1990s and 2000s prompted a further reorganisation of the planning system, which resulted in the fact that the French planning system now moves away from the regional economic planning approach towards a comprehensive integrated approach (Geppert, 2014).

Legal framework

For many years, the French "aménagement du territoire" worked without a legal basis and a specific act for spatial planning. Only after 1992 the need for a separate planning act evolved[116] (Braumann and

[115] The official decentralisation process started with the introduction of the so-called "Loi des droits et libertés des communes, départements et regions" (Law of rights and liberties of communes, departments and regions) on 2nd March 1982. In 1983 the assignment of competencies and according consequences were specified in the law of 7th January 1983 (Töllner, 2003, p. 89).

[116] Kistenmacher (1996, pp. 22–23) explains in this context that as long as the central government had a monopoly on spatial development, spatial planning measures did not seem to require a particular legal framework. Besides, a legal framework was often not considered desirable, as it restricted the discretionary powers of the State.

Elineau, 2003). Consequently, in the 1990s different legal acts were introduced and created a new legislative framework for spatial planning.

The 1995 Spatial Planning and Development Act ("Loi no 95-115 du 4 février 1995 d'orientation pour l'aménagement et le développement du territoire"), commonly referred to as "Loi Pasqua" (Pasqua Act), promoted a better coordination between regional development and physical planning. One of the introduced planning documents are the "Directives territoriales d'aménagement" (DTA), which are supposed *"to summarise the central government's spatial planning objectives and guidelines for the area concerned, with the aim of striking a balance between development and conservation"* (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006, p. 51). In 1999 the Pasqua Act was replaced by the so-called "Loi Voynet" (Voynet Act) ("Loi du 25 juin 1999 d'orientation pour l'aménagement et le développement durable du territoire"). In addition, the introduction of the so-called "Schémas de services collective" (SSC), which abandoned the idea of the elaboration of a single national spatial development scheme as desired by the previous Pasqua Act (Braumann and Elineau, 2003), added the objective of a "sustainable" development to the original objectives of the Pasqua Act[117].

After the Pasqua Act and the Voynet Act, the Law of Solidarity and Urban Renewal ("Loi relative à la solidarité et renouvellement urbain") was introduced in 2000 by the French parliament. This so-called "Loi SRU" is part of the Urban Planning Code and its adoption majorly modified the code[118] (Brandhuber, 2011; Braumann and Elineau, 2003; Töllner, 2003). The Urban Planning Code is the main Act constituting the legal framework for urban planning in France and specifying responsibilities for urban planning documents at different levels. It constitutes the legal framework for different procedures and planning instruments, thus playing a major role in French "aménagement du territoire" (Brandhuber, 2011; European Communities, 2000). The "Loi SRU" modified the Urban Planning Code in a way that instruments and their contents were changed, communes were asked to collaborate and to involve the public more in planning related matters (Töllner, 2003). One of the main amendments represents the introduction of the SCoT ("Schemas de Coherence Territoriale") and the PLU ("Plan Local d'Urbanisme")[119], which replace the previous planning instruments at the local and inter-municipal level, the "Schémas directeurs" (SD) and the "Plan d'Occupation de Sol" (POS). Communes are generally obliged to pursue a greater coherence of urban planning activities and between the different planning tools (Braumann and Elineau, 2003). Consequently, this is in conflict with the more classic understanding of planning which follows a rather technocratic approach. However, it also has to be acknowledged that both public space and the needs of the citizens are given more priority (Töllner, 2003).

While the Urban Planning Code provides the main legal framework for planning and development policies, the "Code rural" (Rural Code) and the "Code de la construction et de l'habitation" (Building and Housing Code) sometimes also have to be consulted in spatial planning related matters (European Communities, 2000). Finally, the new law on access to housing and renovated urbanism ("Loi pour l'Accès au Logement

[117] The term "sustainable" was therefore added to the act's name.

[118] The French "Code de l'urbanisme" is subject to constant amendments. The version used for this work is the version last modified on March 22nd, 2015.

[119] The SCoT and the PLU will be explained below in more detail.

et un Urbanisme Rénové"), introduced in March 2014, will transfer the competences for elaborating the PLU onto the inter-communal scale.

Description of planning practice and current problems

One of the current problems of the French planning system consists in the missing definition of roles and responsibilities of the different actors in spatial planning. Between the regional, departmental and the local level there is neither a formal hierarchy, nor an institutionalised hierarchical ordinance system. In some cases, competences are not clearly defined and tasks not explicitly allocated. This is when it becomes difficult for the local authorities to exercise their responsibility. Accordingly, actions are mostly based on negotiations and contracts (Fleischhauer, 2006b). Spatial planning is one of the areas, where a lack of clear allocation of responsibilities is identifiable. Consequently, the state becomes the co-ordinating actor, even though the power of the local authorities had been enforced by legislation. Braumann and Elineau (2003) point out that although the central government has no legitimation of issuing directives to the local level, it has increased its influence on formally "decentralised" areas in its role as a coordinator, moderator and partner in setting up contracts with municipalities. Hence, even though the involvement of the state in regional and local land use planning has diminished and regional and local governments became rather independent, the central government is still involved in regional and local governments' actions and plan-making by supervising their activities and ensuring the legitimacy and accuracy of plans and projects through the prefects. Thus, despite the decentralisation process, centralised structures are still visible, also in regard to planning-related aspects.

While the state holds onto his influence, the power of the regions is lower. The non-existent hierarchy among the different authorities leads to the fact that regions do not have any option to formulate binding regulations for the department and local level (Fleischhauer, 2006b; Interview F-VI, 2013). In fact, a binding character of spatial plans exists only at the local level (Brandhuber, 2011, p. 90). Regions can only influence the lower levels by discussions, concepts, contracts and other, rather informal instruments, i.e. by non-binding regulations. As a result, regional authorities often face diverging and opposing interests expressed by local authorities. This effect can even be enforced when dealing with agglomerations or joint authorities in the form of inter-municipal co-operations, i.e. the "intercommunalités" (Fleischhauer, 2006b).

As mentioned above, one of the main goals of French spatial planning consists in providing a balanced development of space as well as in avoiding and reducing disparities and inequalities. Despite the fact that spatial planning is usually seen as a holistic approach and that it coordinates different interests and spatial demands (see Chapter 4.1), spatial planning in France pursues the *"animation of economic, social, cultural and environmental development"* (Lacour et al., 2008 cited in Scholles, 2009, p. 138). In fact, horizontal relations and a cross-sectoral perspective hardly exist in French spatial planning. While interdisciplinary and cross-sectoral tasks are a main aspect of spatial planning in Germany, justifying the weighing up of economic, social and environmental concerns, in France such a coordinating feature of spatial planning does not exist (Brandhuber, 2011, p. 92). A weighing up of interests does not take place to the same extent as in other European countries. In contrast, sectoral planning policies do not necessarily have to be coordinated with spatial planning goals, which renders a weighing up redundant.

Still, Article L110 of the Urban Planning Code asks for harmonised land use decisions by local authorities. Hence, some sort of coordination of different spatial demands is required nonetheless.

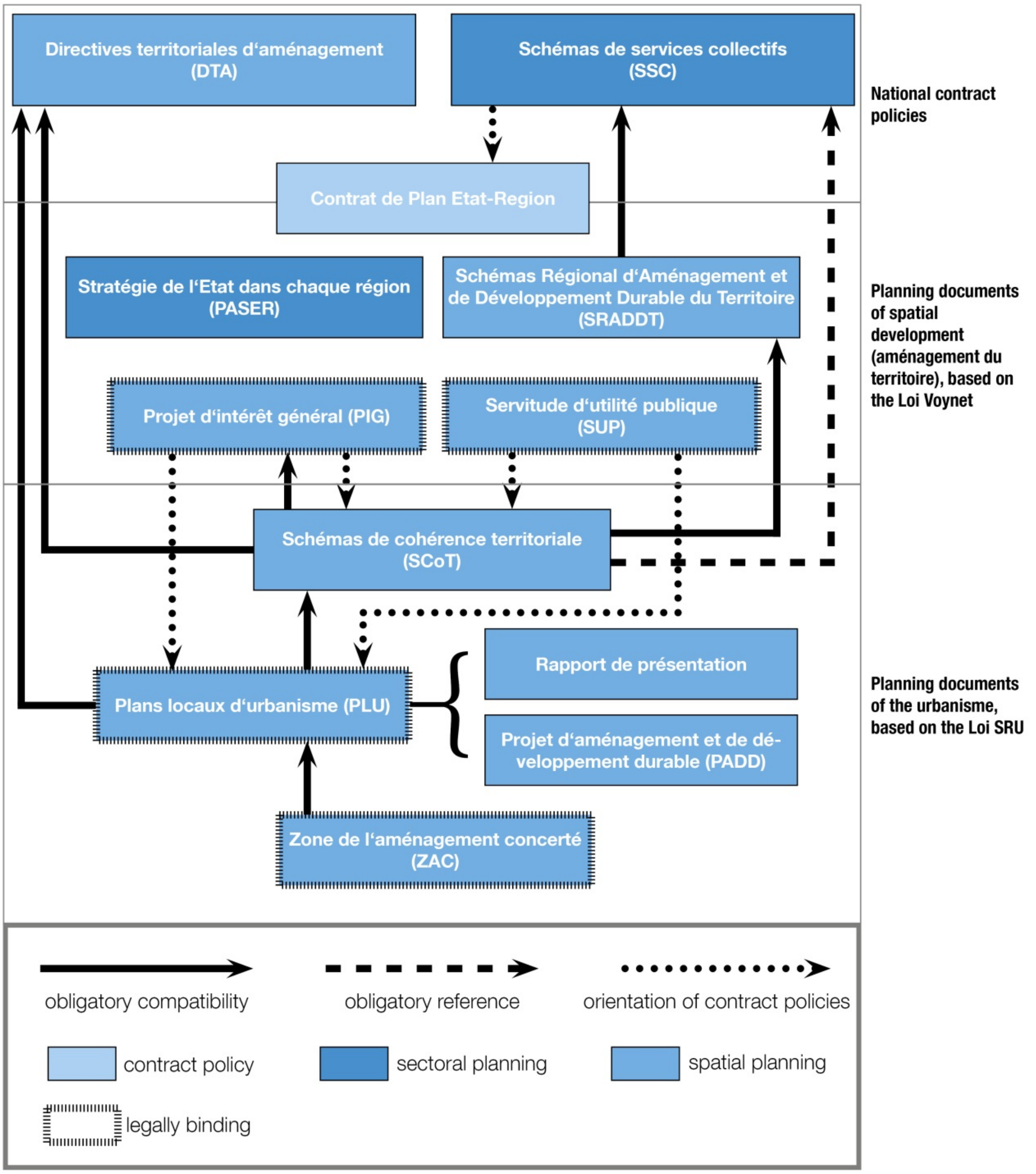

Figure 37 Relevant spatial planning documents in France (Source: recreated and altered from Braumann and Elineau, 2003)

Planning instruments

While moving towards the comprehensive integrated approach, the French planning system acquired new characteristics. In this sense, an improved vertical and horizontal cooperation and policy integration were main objectives. The hierarchy of planning instruments for regulatory and strategic planning was therefore adjusted in order to achieve better coherence (Geppert, 2014). Today, planning powers exist at each of the three levels of French government: at the national, regional and local level. They are elaborated by different tiers of public authorities and exist in different types and forms at national, regional, intercommunal and communal scale (see Figure 37). In the following, the existing planning instruments will be introduced and explained.

National level

In comparison to many other European countries, there is no spatial planning or development document at the national level in France. Only sectoral guidelines influencing spatial planning documents are set up by the central government. These are the Spatial Planning Directives ("Directives territoriale d'aménagement" or "DTA") and the Collective Service Schemes ("Schémas de Services Collectifs" or "SSC").

Spatial Planning Directives

Spatial Planning Directives are binding for local planning documents. DTAs determine development trends of specific areas or pre-defined territories such as mountainous and coastal areas or urban regions that any planning document of a lower level must take into account and comply with. On the one hand, it includes and describes areas of national interest or in public hand, such as national road networks and networks of transportation development, public facilities, environmental protection etc. On the other hand, it includes elements which need to be taken into account by local authorities in all the local planning documents (Guet, 2005). It is important to point out, that DTAs are planning documents at a meso-level, which means they do not have to correspond to any administrative border. DTAs are established by decree, prepared by the central government, and then further elaborated by the prefectures while involving and consulting local authorities. A DTA can be particularly helpful in areas where different authorities have opposing interests or ideas which might make territorial coordination difficult and when aiming at a better coordination of planning documents at the local planning level, especially when a SCoT is missing (Braumann and Elineau, 2003; DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006; European Communities, 2000; Guet, 2005). Thus, rather general and strategic planning issues are facilitated by the prefectures and imposed on the local governments.

Collective service schemes

Collective service schemes are non-binding, sectoral or public service plans, which are set up at the national level, setting a framework for the regional equivalent of such plans (Brandhuber, 2011, p. 79). They were finally adopted in 2002. There are nine single plans, which were elaborated for different sectors and set guidelines for different policies on education, culture, transport, health, energy, natural and rural areas, among others. SSCs can be considered as strategic instruments and development strategies that include targets or a long-term prospective which help policies focus on sustainable development until the year 2020 (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006; European Communities, 2000). Hence, the content is based on a prognosis for a period of 20 years. This prognosis shall identify changing conditions and needs of the population, in order to account for demographic and climatic changes[120] (Brandhuber, 2011, p. 79).

Regional level

After the decentralisation reform, the regional level gained more responsibility and hence now has its own planning documents. These planning documents have no binding effects, however. In general, regions

[120] The SSCs can be compared with the German central-place concept ("Zentrale-Orte-Konzept"), which have the same objective, but are not appointed by the national level. Instead, central places are the responsibility of the states ("Bundesländer") (Brandhuber, 2011, p. 79).

have a more strategic role by providing strategic guidelines and coordinating strategies and actions at lower levels of administration.

Regional land use and development schemes of the territory and Regional land use and sustainable development schemes of the territory

The targets, prospects and strategies of the SSCs have to be included in the planning documents of the regional level, the so-called “Schémas Régional d’Aménagement et de développement du Territoire” or “SRADT” (Regional land use and development schemes of the territory), which were introduced by the Pasqua Act and changed into the “Schémas Régional d’Aménagement et de développement durable du Territoire” or “SRADDT” (Regional land use and sustainable development schemes of the territory) by the Voynet Act in 1999. The SRADT/SRADDT is comparable with a regional development plan. It is set up by the regions by consulting both departments and local governments and provides orientations in areas like environmental policies, sustainable development, infrastructural facilities etc. (Braumann and Elineau, 2003). These schemes are non-binding for local plans and have little spatial dimension. They rather just provide rough indications for local land use planning (Braumann and Elineau, 2003; Geppert, 2014). The reform from 1995, which involved the creation of the SRADT, determined a hierarchy between regional and local planning documents. This hierarchy was then suppressed again by the reform in 1999 (Geppert 2014, p. 112). However, the so-called “Law Grenelle 2” (“Loi du 12 juillet 2010 portant engagement national pour l'environnement”) states that the local level planning documents (SCoT, PLU, “cartes communales”) must be "compatible" with the SRADDT (Article 5). This statement is important in the sense that the SRADDT was specifically criticised for its lack of enforceability, which has limited the feasibility of this instrument (LE COURRIER des maires et des élus locaux, 2010).

Central Government Plan of Strategic Action for the Region

The “Projet d’action stratégique de l’Etat en région” or “PASER” (Central Government Plan of Strategic Action for the Region) was introduced after the 2004 reforms and constitutes a tool used by the central government to define its orientation for each of the regions[121]. The PASER translates the policy priorities of the central government into strategies and objectives at the regional level. It is set up by the regional prefect, includes strategic guidelines for the next three years and aims at a sustainable development of the region by taking account of its individual characteristics and conditions. Hence, it serves to maintain a coherence of actions taken by regional and sub-regional governments, originally established at the national level (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006).

The PASER constitutes the new reference tool within the relations between the central and regional administration. This tool is both a dialogue and management tool. Since it defines the priorities of the state in the region, the PASER reflects the central government’s “point of view” with respect to regional authorities, especially for contracting reasons (Gévart, 2006). It is therefore used as a basis for negotiations with the regional council when preparing the “Contrat de plan Etat-région” (CPER) (see below).

[121] In addition to the PASER there are also according plans for the department called “Projet d’action stratégique de l’Etat en département” (PASED), which in turn must be aligned with the plans for the region (DIACT and Directorate of Development Policies at the Ministry of Foreign Affairs, 2006).

A PASER is primarily structured around four or five major orientations, divided into objectives and performance indicators (Gévart, 2006). Contents are related to both sectoral and territorial matters. In the case of the region Provence-Alpes-Côte d'Azur, the state services have determined four key priorities, while each key priority is divided into directions, which are again divided into more concrete operational objectives[122]. Being a strategic tool, the plan involves an analysis of regional characteristics by highlighting the region's strengths and weaknesses. The priorities and objectives that are defined based on this analysis, constitute strategic guidelines for a short-term period. Accordingly, they can serve as an orientation for regional and local level policies. However, due to being a relatively new instrument, its effectiveness and influence are yet to be determined.

State-region planning contracts

In its regional development studies the European Commission (2000, p. 44) describes the "Contrats de plan Etat-région" or "CPER" as plans which *"are used by the State as a means to implement its planning and development policies, and allocate relatively greater funding resources to the poorest of regions"*. Originally designed as an implementation tool of the plan at national level, the contract is now an agreement between the state and a region, securing co-ordinated action between central government and regional authorities and listing joint investments of different projects – especially related to technical infrastructure – per programmatic period (i.e. for seven years). It regulates the implementation of a project and the state's planning and development policies respectively, including the determination of required funding and the definition of financial responsibilities. On the one hand a CPER allows the state to allocate its budget specifically to poorer regions, thus adopting the role of a financial adjustment instrument. On the other hand it allows the regions to plan ahead, since they are now committed to the procedure (Braumann and Elineau, 2003; European Communities, 2000; Geppert, 2014).

The CPER is negotiated between the regional prefect – as the representative of the state – and the president of the regional council. As CPER tend to usually incorporate other territorial authorities, such as the departments, the state happens to gain large control over sub-national authorities, especially regarding investment policies (Braumann and Elineau, 2003). Through these contracts the state therefore still has a substantial saying in aspects related to regional development planning.

Moreover, some discrepancies remain related to the existence of administrative boundaries (see "problem of fit"). For instance, Geppert (2014) mentions the lack of cross-border coordination between regions and the lack of hierarchy between local governments. Many difficulties do not respect administrative boundaries, which is why addressing a problem solely within the jurisdiction of a region often fails. Strategies and actions must be coordinated when aiming at a long-term success. Still, CPERs are generally considered more important in regard to effectiveness and enforceability as compared to the other regional instruments (Braumann and Elineau, 2003).

[122] For example, the PASER of the region Provence-Alpes-Côte d'Azur lists the following four priorities: *"1. Guide a sustainable and solidary management of the regional territory, 2. Respond to the economic crisis and structural change with innovation and the support of mutations, 3. Reduce social and regional inequalities, 4. Carry out effective public actions which are adapted to the needs of the region and the population"* (Secrétariat Général pour les Affaires Régionales, 2009, p. 36, own translation). Within the first priority, one of the directions is directed towards *"ensuring a reasonable management of resources within spatial planning policies, preventing major risks and reducing the vulnerability of the citizens"* (Secrétariat Général pour les Affaires Régionales, 2009, p. 41, own translation).

Local level (inter-municipal and municipal)

Plan for Territorial Coherence

The "Schémas de Cohérence Territorial" or "SCoT" (Plan for Territorial Coherence), introduced by the reform in 2000 (Loi SRU) and until then called "Schémas Directeurs", are planning tools for the inter-municipal level and can be referred to as strategic land use plans. In most cases they include a bigger core city and its rural surroundings. In the French spatial planning system there has been a focus on strengthening the collaboration between neighbouring municipalities in order to coordinate their development strategies. This is why in France a planning instrument exists that covers several municipalities. By coordinating local plans and policies, a SCoT ensures vertical and horizontal harmonisation of development strategies (Geppert, 2014; Oxley et al., 2009). These development strategies need to be considered in local land use planning documents at communal level. This means that once implemented a SCoT is binding for further documents of local development, e.g. the PLU, which needs to correspond to the SCoT and apply to its strategic goals (Oxley et al., 2009). The formulation of the SCoT is not obligatory, however.

SCoTs aim at giving strategic guidance to spatial development and ensuring coherence between different sectoral policies. Hence, the main task of a SCoT consists in harmonising the diverse policy areas such as transport and infrastructure, housing, retail and economic development. Another point of interest is the protection of the environment (Brandhuber, 2011; Oxley et al., 2009). While the previous "Schémas Directeurs" simply synthesised the different land uses of the municipalities, the SCoT involves the elaboration of common municipal projects for a period of ten years (Brandhuber, 2011, p. 77).

Neighbouring municipalities can build such an association of municipalities on a voluntary basis. Consequently, the situation is heterogeneous. While sometimes a SCoT hardly covers areas beyond the physical agglomeration, it can equally cover large functional urban areas (Geppert, 2014). This planning instrument is particularly useful for developed and rather densely populated inter-communal networks in order to control a common development (Braumann and Elineau, 2003). This is why sparsely populated areas are hardly covered by a SCoT. Figure 1 in Appendix 2 shows the progress of existing SCoTs as of the year 2014 in the region Alpes-Provence-Côte d'Azur. As illustrated, in the department "Alpes-de-Hautes-Provence" one SCoT has been approved so far (Région Manosque) and one SCoT is being elaborated (Pays de Seyne). Barcelonnette and the surrounding municipalities form an association of municipalities in the form of an "Etablissement public de coopération intercommunale" (EPCI), the so-called "communauté de communes de la vallée de l'Ubaye" (CCVU). The CCVU involves 14 communes with a total of 7.770 inhabitants, but has not prepared a SCoT yet. However, the new law of 2014 asks the CCVU to take over competences in urbanism by elaborating a PLU at inter-communal scale as well as a SCoT, both now constituting essential planning tools. As a consequence, the CCVU will have both planning instruments available by the official deadline in March 2017 (CCVU, 2015a).

The SCoT consists of three main components, as regulated in Article R122-2 of the Urban Planning Code. The first component is the "rapport de présentation" (presentation report), which is an analysis of the use of natural, agricultural and forestry areas over the last ten years and thus contains a diagnosis regarding economic and population development projections as well as needs identified in terms of economic development, spatial planning, environment, social balance of housing, transport and services.

Furthermore, the “rapport de presentation” analyses the initial state of the environment and its potential development in case some areas are significantly affected by the implementation of the plan as well as significant effects expected from its implementation. It also describes the problems evolving from the adoption of the plan for the protection of areas of special importance for the environment. The second component is the “document d’orientation” (orientation document) and includes the specification of the general spatial use. The last component are the “documents graphiques” (graphical documents) with maps and graphical illustrations (Brandhuber, 2011, p. 77).

The SCoT, being a strategic plan, only gives strategic guidance and formulates relatively broad objectives, it does not provide explicit designations for land development. As a consequence, most of the existing SCoTs remain rather non-committal until today (Brandhuber, 2011, p. 77).

Local Spatial Plan

The main planning instrument at the scale of the municipality is the “Plan local d’urbanisme” (PLU) (Local Spatial Plan), which replaced the “Plan d’Occupation des Sols” (POS) in the year 2000. It covers the whole area of a commune or groups of communes. The scale of the PLU ranges between 1:5,000 and 1:20,000. Single areas can be depicted on a smaller scale (Töllner, 2003).

Responsible for the formulation of a PLU are the local authorities. The elaboration of a PLU is not obligatory. Even though the local government is the responsible authority, the central government still authorises the final decision and has a saying in the implementation. The national level also provides the “Territorial Diagnosis”, a mandatory document that needs to be part of any plan or proposal. Plans are often formulated before the diagnosis, however (Oxley et al., 2009). Once adopted, the PLU is legally binding. It also has to correspond to sectoral plans at the local level such as the transportation plan (“Plan de déplacements urbains” and the housing programme (“Programme local de l’habitat”) (Braumann and Elineau, 2003).

Notably, the PLU has to specify the statements made in the SCoT. In the absence of a SCoT provisions of the PLU have to at least comply with provisions of the DTA. Provisions include, in particular, delineating building areas as well as determining areas for the different types of land uses and defining permissible uses. It also has to determine regulations for the admissibility of the construction of building sites, their intended purpose and the building types. This is just the minimum content however, which is being completed by further regulations (Töllner, 2003). Many of the regulations of the PLU such as constructional constraints, building alignment, height, density, volume and material are regulations, which “may” be included and set up, but it is not obligatory. The PLU can also set up regulations related to the design of the building (“règles concernant l’aspect extérieur des constructions”, Urban Planning Code, L 123-1, 4) in order to ensure the overall architectural quality (Töllner, 2003).

The former POS was considered too bureaucratic and it had been criticised for lacking coherence. It treated each commune separately, without looking at the bigger picture. As a consequence, planning became very much oriented towards single projects and development goals (Goodchild, 2003). Besides, its main purpose was a regulating one. This means that the POS mainly set up legally binding regulations for land use (Töllner, 2003). Changes in planning law attempted to improve both coherence and direction. While the regulatory provisions remained the same, main differences can be found in the relationship of the PLU to sectoral plans and its policy content (Goodchild, 2003). Furthermore, today the PLU does not only determine and regulate the general land-use, but constitutes the frame for ensuring the coherence of different planning-related interventions at the local level. It specifies the measures and impacts regarding public spaces, the environment and the landscape (Töllner, 2003).

The PLU consists of a “rapport de présentation”, a regulatory document (“règlement”), as well as of a new element called “Projet d’Aménagement et de Développement Durable” (PADD). The “rapport de presentation” analyses the initial state of the environment. It must justify and outline the demarcation of different zones within the PLU that were drawn as part of spatial planning decisions (Code de l'urbanisme, Article R123-2). Matters analysed include the environment, economy, transport, demography etc. These documents are accompanied by graphical illustrations and maps (Brandhuber, 2011, p. 78). Furthermore, it also involves the environmental report as part of the SEA. The “règlement” (regulatory document) involves arrangements and provisions, which necessarily have to be considered for each area within the different zones. It defines the intended purposes of the areas within the zones. If necessary, it should also determine the types of uses that can be prohibited or which require specific provisions[123] (Töllner, 2003). The graphical documents have to illustrate graphical arrangements related to the “zones urbaines” (urban zones), “zones d’urbanisation future” (zones for future development) and the “zones naturelles” (natural zones) (see Appendix 2, Figure 2). However, these arrangements are not unitarily defined (Töllner, 2003).

Urban zones, labelled as zones U, include those areas which can be immediately developed upon approval of the PLU. They dispose of all necessary public infrastructures (Commune de Jausiers, 2008b). The zones for future development are the zones which currently lack or have insufficient public infrastructures, even though certain zones are situated within the city centre and already partially dispose of required infrastructures. For example, many of the zones concerned require new routes in order to be connected, or at least an improvement of existing routes which are insufficiently dimensioned (Commune de Jausiers, 2008b). Natural zones are divided into different types of zones according to their uses in particular. Natural zone A means “zone agricole” (agricultural zone) and is primarily reserved for agricultural activities. Natural zone N involves areas protected for their landscape and due to ecological aspects as well as those areas that neither have an agricultural purpose nor are suitable for urban development. The PLU of Jausiers distinguishes between the zone Nh, the natural zone with limited constructability (“zone naturelle à constructibilité limitée”) and the zone Nt, the natural zone with recreation and camping grounds (“zone naturelle avec aires de loisir et camping”) (Commune de Jausiers, 2008c).

The PADD (Spatial management and sustainable development project) is one of the most important innovations of the new planning law. As Goodchild (2003) explains, the PADD *“has two main elements – a compulsory element that comprises the general policy statement and a discretionary element that specifies the intentions in relation to the treatment of specific areas and policy initiatives (the city centre, neighbourhoods, the treatment of public spaces, and the preservation of landscapes)”*. It thus incorporates a vision beyond the regulatory provisions. The PADD *“defines, in accordance with the objectives and principles set out in Articles L.110 and L.121-1, the guidelines for planning and development applicable*

[123] In the case of the PLU of Jausiers regulations include – besides the already mentioned aspects – provisions on the volume of buildings, maximum height, materials and colours, fences, garden sheds, swimming pools etc. Some areas within the PLU of Jausiers are exposed to natural risks as defined by the risk prevention plan (“Plan de prevention des risques”) (see Chapter 8.1.1). In these areas it is obligatory to follow the regulations of the PPR (Commune de Jausiers, 2008c).

for the entire community" (Urban Planning Code Article R123-3, own translation). These rules have to comply with the rules of public safety and also need to take account of natural hazards. According to Fleischhauer (2006, p. 41) natural and technological risks are covered by the policy initiatives and thus considered in a PADD. Furthermore, in coherence with existing standards of sustainable development, the PLU must consider the provisions of documents dealing with the prevention of natural hazards and, if existent, adapt the regulations of the risk prevention plan.

The PLU aims at establishing a preferably diversified land use by following the standards of a sustainable development. However, it should be pointed out that the PLU is not solely about sustainable development but rather about both managing the territory and developing it in a sustainable way (Goodchild, 2003). Since a PLU is the legal basis for granting a building permit, areas not covered by a PLU may not be granted a building permit and thus not be built up (Geppert, 2014). The link between the "rapport de présentation" and risk management becomes apparent when acknowledging the fact that some areas or zones can be designated non-constructible or areas at risk. It thus contributes to the management of natural risk in spatial planning in the form of reducing the vulnerability of an area.

Zone of the concerted development

On an even smaller scale than the PLU there are the so-called "zones de l'aménagement concerté" (ZAC) (Zones of the concerted development), an urban development plan for predefined zones and for the implementation of a specific development scheme. In such a ZAC urban planners make specific proposals for the development of a plot such as definite housing projects. Accordingly, they contain *"the plans for urbanisation, lotification (division into individual plots for eventual use), provision of specific facilities, architectural and technical specifications, and form the basis for applications for building permission"* (Oxley et al., 2009, p. 23). They also include arrangements for consulting the public as well as budgeting.

Most development schemes are handled by local authorities. However, major projects are often supported or induced by the state. ZACs have to be compatible with the strategies and objectives outlined in the PLU, provided a PLU exists (European Communities, 2000). If a PLU exists and the development scheme of the ZAC diverts from the PLU, there are nevertheless options to negotiate and approve the ZAC, in case it is in line with the strategic guidelines of the SCoT. In order to be able to start with the building process, a building permit needs to be issued that comprises specific conditions regarding the planned development. Should the development comply with the ZAC and the PLU, the permit will be granted (Oxley et al., 2009).

General Interest Project and Public Utility Easement

The "Projets d'intérêt general" or "PIG" (General Interest Project) and "the Servitude d'utilité publique" or "SUP" (Public Utility Easement) are tools that the prefect can make use of. The PIG *"enables the Prefect to override the decision concerning the land-use in risky areas if the latter has not been taken into account enough"* (Merad and Dechy, 2010, p. 6). This means that a PIG can be used to manage disaster risk, since its provisions need to be considered in urban planning documents. SUPs include certain conditions imposed on property rights, which result from national legislation and which are of public interest (European Communities, 2000). Just like with the PIG, SUPs need to be included into the urban planning documents in order to make them legally binding. One important example of an SUP in the context of this work is the PPR.

Informal planning

There is no specific term for "informal planning" in France, as a direct translation such as "planification informelle" or similar terms do not exist. Nevertheless, developments and planning approaches exist which match the idea and the characteristics of "informal planning". Such developments focus in particular on the coordination of different levels of planning as well as on the involvement of actors that are usually not involved in formal planning processes. A distinction can be made between activities that concern the plan making and plan development, which can be defined as the "projet urbain" (urban project), and between activities addressing the general stakeholder involvement, which is defined as "concertation" (consultation) (Töllner, 2003).

The "projet urbain" is not a single measure, but rather a collection of planning instruments and processes. They always concern single projects and aim at achieving a specific, initially defined goal. A "concertation" can be understood as a consultation of stakeholders that are somehow affected by a certain decision and who are asked about their opinion within the process before making a final decision. A "concertation" always involves creating a dialogue with all actors involved (Töllner, 2003).

According to Töllner (2003), the relation between formal and informal planning changed significantly after the introduction of Voynet Act. The former Act only obligated to carry out a so-called "enquête publique" (public inquiry). Such a public inquiry, however, does not include a consultation of stakeholders in the sense of involvement. It takes place later in the planning process, when a detailed planning has already been completed. It therefore often has little influence on the final results and decision (Geppert, 2014). The problem is that these comments have to be considered and that each fundamental adjustment or change following a public hearing requires a new public inquiry. Such an approach can lead to a very long planning process. Instead, a consultation aims at finding solutions, which best conform to the expectations of all stakeholders. A consultation could be used in order to reach predefined goals and to address those aspects which can be solved through a consultation (Töllner, 2003). Accordingly, if a consultation is well and properly done, the advancement of the project or the plan can be facilitated, since a consensus has already been achieved and certain problems have been solved at an early stage of the planning process.

However, even though legal and procedural provisions are at place and different planning instruments exist which promote public involvement, the actual involvement of all stakeholders remains challenging, since public participation is generally rather low in French culture. In fact, *"the involvement of non-institutional actors, the private sector, NGOs and citizens is not a strong feature of French planning culture"* (Geppert, 2014, p. 117). Nevertheless, the focus on public involvement is growing. The benefit of a proper consultation is beyond dispute, after all. While most of the time and energy has been directed towards institutional aspects, planning modes and tools have changed, however (Geppert, 2014). This asks for a better alignment of institutional issues and new planning tools.

6.2.2 Spatial planning system of Poland

The planning system in Poland has been subject to continuous changes, especially since the collapse of the Soviet bloc. After 1989 spatial planning in Poland was influenced by many internal and external driving forces, such as a macro-economic reform, the emergence of territorial disparities, foreign investors and the accession into the EU. Different pressures and influences resulted in a system, which is *"characterized* *by a strong fracture between the strategic activities undertaken at the national and regional levels – highly influenced by the EU discourse and expenditure policy – and local development practice – strongly embedded in market forces and dominated by private interests"* (Cotella, 2014, p. 256). The generic term for the spatial organisation of social systems as well as the shaping of the spatial organisation and structure can be translated as "spatial development" or "spatial economy" ("gospodarka przestrzenna") rather than spatial planning. Moreover, the Polish planning system is characterised by an approach, which closely links spatial planning and economic development and which is less process-oriented than planning approaches of other European countries, such as Germany for instance. Besides, planning in Poland is thought to having a more regulating than constitutive role, due to the fact that operative and implementation-oriented planning instruments are missing (Ebert et al., 2012).

Today the system is divided into two different areas of responsibility: the tasks of the central government on the one hand and the tasks of territorial self-government on the other hand. Comprehensive spatial planning is the responsibility of self-governmental authorities. Accordingly, the council of ministers together with the Ministry of Regional Development is the responsible entity for spatial planning at the national level, while the voivodeship board and the voivodeship parliament as well as the municipal board and the municipal council are the responsible entities at regional and municipal scale, respectively (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 5). The regional self-government authority, headed by the marshal of the voivoideship, is also responsible for comprehensive, socio-economic planning[124]. Further institutions involved in spatial planning include public institutions such as regional development agencies, NGOs, foundations and private institutes (Cotella, 2014; Kramer and Kołodziejski, 2011).

Legal framework

In the Polish legal system there is no holistic legal framework for spatial planning related issues, but planning regulations are divided between different laws. Bielawska-Roepke (2009, p. 69), for instance, criticises that *"some laws or legal acts solely refer to spatial development but do not comprise the whole problem; others only relate to partial questions"*. This is why the system can generally be rated as fragmentary and inconsistent and this probably is also one of the reasons for the above-mentioned lack of coordination.

The current basis for the Polish spatial planning system constitutes the Spatial Planning and Development Act of 2003 ("Ustawa o planowaniu i zagospodarowaniu przestrzennym")[125]. According to the Spatial Planning and Development Act, spatial planning has to be managed at all administrative levels according to the country's territorial division. It hence defines the principles for the formulation of policies which are then implemented by self-government authorities at lower levels of government. Principles outlined in the act strongly aim at achieving spatial order and sustainable development.

[124] The voivode, as the regional representative of the state, has responsibilities in areas such as public safety, health and environment and ensures a fruitful cooperation between the regional and central governments.

[125] The most recent amendment to the Spatial Planning and Development Act was introduced in May 2016. However, this study predominantly refers to a previous version from April 2012. The 2012 version of the Spatial Planning and Development Act was taken as a reference version, as it was in force at the time the empirical study was carried out in the Polish case study site. The latest amendment was only adopted afterwards and it happened too late to be properly included and considered in this work.

Despite the fact that the amendment in 2010 achieves a simplification and acceleration of planning processes, many questions still remain unanswered. For instance, the original draft of the amendment tried to address and achieve the introduction of a clear hierarchy of planning instruments, the strengthening of the role of the local (legally binding) land use plan, the introduction of local provisions for urban construction as a clear, legal basis for decisions on building permits in areas not covered by a legally binding local land use plan, among others. However, the actual amendment in 2010 did not include according regulations (Ebert et al., 2012, p. 9). Due to this lack of legal and realistic regulations, the introduction of standards regarding the structure and development methods of spatial management plans turns out to be a difficult venture (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 8).

A further shortcoming of the amendment in 2012 is that some draft bills for the regulation of particular spatial tasks, which were already decided, were also not implemented into established law. Moreover, *"due to its establishment in many so-called sectoral laws, the polish planning system shows legal loopholes which contribute to the fact that certain planning regulations cannot be implemented in practice"* (Ebert et al., 2012, p. 9, own translation). In addition, as Ebert et al. (2012, p. 9) explain, a deficiency can be seen in the autonomy of the communes and the lack of legal, higher-level designations, which allows local governments to avoid those definitions of specific planning regulations that would restrict the private sector in its pursuit of economic development. This means that current regulations still allow a quick and straightforward designation of former agricultural land into building land and the use of outskirts or unsealed rural landscapes for the planning of new housing areas. In case a local, legally binding land use plan does not exist, designations and provisions elaborated for the building and management of areas are often imprecise

Finally, it is interesting to note that until the latest amendment of the Spatial Planning and Development Act in May 2016, there was no legal imperative to weigh up different interests and concerns. Only in the amendment in May 2016 such an imperative was added to Article 1 of the Act, which now demands that *"when determining the use of the land or when specifying a potential way of development and land use, the entity weighs up public and private interests, included those presented in the form of proposals and comments, aimed at protecting the existing territory, […]"* (own translation). Thus, the latest amendment introduces the legal basis for a mutual weighing up of public and private interests in the planning process. Accordingly, so far a legal basis for weighing up different concerns was missing. Still, in practice such a weighing up process was supposed to take place. Nevertheless, difficulties were encountered when economic interests prevailed. This problem and other problems related to the planning practice in Poland will now be shortly explained.

Description of planning practice and current problems

With the administrative reform in 1999 and the introduction of the new Spatial Planning and Development Act in 2003, the regional level gained more competencies in spatial planning and development. However, the planning law still assigned a supervisory role to the national government so that regional governments remained under the influence of the central government. This "supervision" resulted in the fact that regional planning is hardly able to intervene in significant policies affecting urban areas within their area of responsibility, but was almost solely used to transfer central government priorities to the regional level. Exceptions included major regional infrastructure projects as well as specific environmental topics. In contrast, to a certain extent the voivodeships were forced to integrate sectoral policies adopted at the national level due to the financial dependence on the central government so that sufficient financial resources could be obtained in order to achieve their own objectives (Cotella, 2014; OECD, 2011).

While the sub-regional level, i.e. the county, has no spatial planning competences, local self-governments are responsible for defining type and intensity of land use by locating specific functions and determining the type and form of buildings as part of their legally binding planning documents (Grochowski and Pieniążek, 2008). However, the OECD (2008a, p. 110) points out, that *"although spatial planning is in principle a legal requirement and a prerogative of local governments (gminas and voivodships), most local governments do not have proper planning systems."* The reason is that only preparatory land use plans need to be prepared, while local spatial plans are not compulsory and, due to the lack of capacity at the local level, are often not accomplished. Municipal planning often lacks a long-term vision and there is hardly any coordination at an inter-municipal scale, since communes do not cooperate enough in the planning process. They have neither incentives nor conviction to do so. As a consequence, land use decisions have a narrow focus and do not necessarily consider the "bigger picture", which may lead to an unfavourable use of space (OECD, 2008a, p. 111).

A further problem can be seen in the links between spatial planning and sectoral planning documents, which is characterised by an asymmetry of relations between single documents of strategic, spatial, social and economic planning (Bielawska-Roepke, 2009). Wanczura (2006b) hints at a lack of cooperation between comprehensive plans and sectoral plans. There is no real obligation to coordinate different planning documents and to include the contents of certain sectoral plans into spatial planning documents. Besides, Polish laws on spatial and sectoral planning lack coherence[126]. Regions, districts and municipalities all have responsibilities in various sectoral issues, such as health, transport, education, water and environment, among others, whereas jurisdiction is related to territorial boundaries. However, these policy areas usually ask for effective vertical and horizontal coordination, but often such coordination does not exist (OECD, 2011). The spatial planning law only passes forward the recommendation of considering certain sectoral plans in the plan-making process. This kind of regulation is thought to be too weak and cannot be fully effective (Wanczura, 2006b).

Problems occur at both levels voivodeship and municipal. At the voivodeship level there is no comprehensive spatial planning approach which comprises both physical and socio-economic development (OECD, 2008a). At the municipal level a lack of binding national spatial planning policies hampers the integration of municipal planning across sectors, i.e. coordination at a horizontal scale. Similar difficulties in harmonisation and coordination of planning also apply to policies and planning efforts carried out at an inter-communal scale between municipalities or between municipalities and regions, i.e. at a vertical scale. Although a legal framework for the development of local spatial plans and their coordination with plans of the voivodeship level exists, the spatial planning law does not *"require or provide incentives for municipalities in the same functional urban area to co-ordinate spatial planning and its provisions for co-ordination of regional plans with municipal plans are not enforced"* (OECD, 2011,

[126] For instance, the regulations of the Spatial Planning and Development Act and the Act on the Principles of Development Policy, which focuses on social and economic planning, constitute two independent systems which are not coordinated (Bielawska-Roepke, 2009).

p. 165). Consequently, this lack of coordination exacerbates the management of urban development, an efficient use of resources as well as the pursuing of common goals. It also evokes the problem of spatial fit in the sense that problems that extend beyond the municipal boundaries are difficult to grasp.

Above explanations lead to the realisation that there are gaps in existing laws and that more specific links between sectoral and spatial planning tools as well as between different administrative levels are usually missing. Existing laws lack clear regulations and standards on how to incorporate sectoral plans into land use planning documents and how to coordinate different documents. In addition to social and economic planning, this also applies to sectoral planning instruments in the areas of transport, energy and forestry[127].

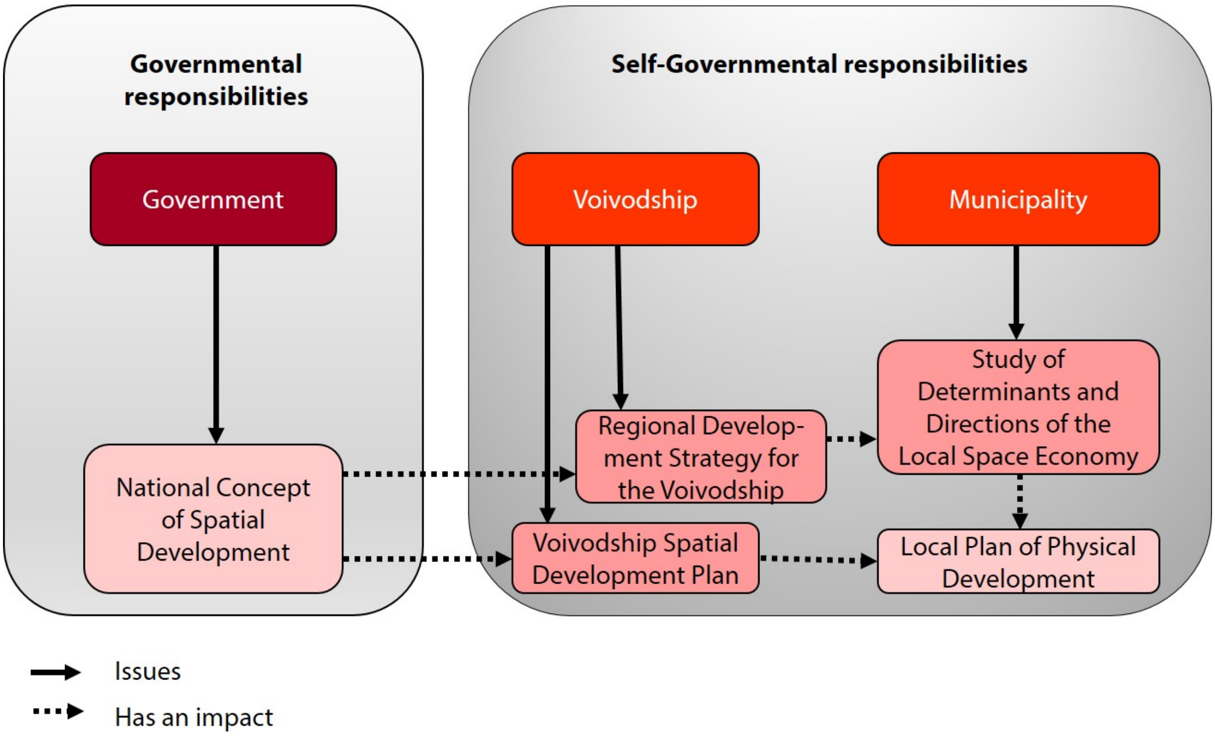

Figure 38 Relevant spatial planning documents in Poland (Source: adapted from Wanczura, 2010, p. 154, own translation)

Planning instruments

The planning system in Poland covers the scales from national to local, while spatial planning instruments exist at three levels: state (national level), voivodeships (regional level) and communes (local level). There is no hierarchy between higher and lower level planning documents. Only the local land use development plan has a binding status. The most important planning instruments are illustrated in Figure 38.

National level

Plans and documents being prepared at the national level involve the National Concept of Spatial Development ("Koncepcja Przestrzennego Zagospodarowania Kraju"), the National Development Plan ("Narodowy Plan Rozwoju") and the Sectoral Operative Programs ("Sektorowy Program Operacyjny"). The most important plan in terms of planning purposes is the National Concept of Spatial Development.

[127]In regard to forestry, there are only little links between spatial planning and the forestry sector which is mainly due to the fact, that planning takes mostly place outside of forest areas. This means that forest plans do not necessarily have to be complied to.

National Concept of Spatial Development (NCSD)

According to the Spatial Planning and Development Act the National Concept of Spatial Development provides guidelines that aim to achieve structural changes in the country. It is a strategic instrument with a prognostic nature which defines conditions, objectives and directions for sustainable development of the country and the actions necessary for its achievement. It therefore constitutes a comprehensive vision of a dynamic and sustainable spatial development (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 29; Ebert et al., 2012, p. 16).

On the one hand, the national concept serves information purposes by including a compilation of planning-related information. On the other hand, *"it defines the principles for the elaboration of programmes for the realization of public investments of national meaning and is in this respect binding for further administrative action"* (Ebert et al., 2012, p. 16, own translation). Prepared by central government authorities in a two-way communication process by involving regional self-governments, sectoral interest groups and other actors, these guidelines are not generally binding for third parties and thus have limited legal value. Although there is a statutory obligation for lower level plans to comply with contents, objectives and provisions provided by the respective higher level plans, the document has no clear binding effect (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 28; Grochowski and Pieniążek, 2008). As a consequence, even though guidelines of the NCSD form the basis for the elaboration of plans at voivodeship (regional) level, they can be applied more or less voluntarily (Bielawska-Roepke, 2009; Cotella, 2014).

National Development Plans (NDP) and Sectoral Operative Programs

National Development Plans (NDP) ("Narodowy Plan Rozwoju") are documents elaborated for a short-term period. The first NDPs that were prepared for the periods 2000-2003 and 2004-2006 pretty much focused on pre-accession support. There was also a set of Sectoral Operative Programs ("Sektorowy Program Operacyjny"), that accompanied the NDP 2004-2006 and that *"focused on the achievement of sectoral goals of national relevance and defined the budget devoted by each of the involved government sectoral agencies"* (Cotella, 2014, p. 264). The first NDPs provided indicative guidelines addressing the further development of the country's territory after the fall of the communist-led government in 1989. EU influence was apparent, while the definition of national goals did not seem to be the first priority. At this stage, the Polish national planning approach has been criticised for its low degree of sectoral coordination and the missing horizontal interplay between different sectoral policies and government institutions. Due to this lack of coordination, sectoral ministries often generated duplication and contradiction of different sectoral policies. The new NDP (2007-2013), however, attempted to overcome existing difficulties and inadequacies by integrating different sectoral policies and by focusing on a more comprehensive strategy for the development of the Polish territory in general (Cotella, 2014, p. 265).

Regional level

While the decentralisation process provided the regional level with more autonomous powers, the Spatial Planning Act introduced new planning instruments in the year 2003: The Regional Development Strategy for the Voivodeship ("Strategia Rozwoju Regionalnego Wojewodztwa") and the Voivodeship Spatial Development Plan ("Plan Zagospodarowania Przestrzennego Wojewodztwa"). Moreover, regional contracts ("kontrakty regionalne") were introduced that specify the relations between the national level and the voivodeships (Cotella, 2014, p. 267).

Regional Development Strategy for the Voivodeship and Voivodeship Spatial Development Plan

At the voivodeship level the regional self-government is required by law to develop the Regional Development Strategy for the Voivodeship and the Voivodeship Spatial Development Plan. All planning documents have to be submitted to the voivodeship legislative bodies. Concerning governmental tasks, the voivodeship spatial management plan has to be agreed upon with the Prime Minister. In addition, self-government authorities at the sub-regional and municipal level have to give their opinion on the plans (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 25).

The Voivodeship Spatial Development Plan is not universally binding, but it is binding for public administration (i.e. it is neither binding for citizens, nor for corporate bodies) and provides the principles and guidelines of the spatial development of each voivodeship. It is usually elaborated at a scale of 1:200,000, but there is no prescribed scale and actual scales may differ. It defines certain rules of spatial organisation within the jurisdiction of the voivodeship in regard to areas endangered by floods and protected areas, for instance (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 24)

In addition, the Voivodeship Spatial Development Plan has to consider those statements of the NCSP that concern the respective voivodeship, while its proper statements have to be considered by preparatory land use plans at local scale (Cotella, 2014; Ebert et al., 2012). Contents of the plan are closely related to the Regional Development Strategy for the Voivodeship, which specifies the conditions, objectives and the direction of the development of a voivodeship as well as principles of economic development (Cotella, 2014; Ebert et al., 2012).

Regional Contracts

Regional contracts are contractual agreements between the voivodeships and the central government. Partly inspired by the French state-regional planning contracts, these contracts have been set up in 2001 in order to coordinate activities of the central government with policies and development objectives of the regional self-government authorities (OECD, 2008a, p. 20, 2011, p. 21). However, at present their purpose and use does not really meet these objectives, since regional interests are set aside and a pursuit of regional development objectives is often impeded. Today they merely serve as the implementation tool of EU structural and regional funds and to coordinate the co-financing of programmes of the European Commission.

At sub-regional level no real planning instruments exist and counties have no designated tasks to prepare separate plans of spatial development. Counties provide only non-obligatory studies and analyses or may prepare development strategies of a more general nature focusing on the economic development within their area of responsibility. This might explain their rather small role in spatial planning as compared to voivodeships and municipalities (Grochowski and Pieniążek, 2008).

Local level

At the local level there are two spatial planning documents: The Study of Determinants and Directions of the Local Space Economy ("Studium uwarunkowan i kierunkow zagospodarowania przestrzennego gminy”), which constitutes the preparatory land use plan as well as the Local Plan of Physical Development (“Miejscowy plan zagospodarowania przestrzennego”) which serves as the detailed land use plan. Both planning documents have to be accompanied by a so-called “Study of Natural Conditions” (“Opracowanie ekofizjograficzne“), not to be confused with the also obligatory environmental report (“Prognoza oddziaływania na środowisko“) as requested by the EU SEA Directive.

Study of Determinants and Directions of the Local Space Economy

The 2003 Spatial Planning and Development Act legally requires municipalities to prepare the Study of Determinants and Directions of the Local Space Economy (the study). The study therefore constitutes an obligatory spatial planning document at the local planning level. It always covers the whole area of a municipality (see Appendix 2, Figure 6). Depending on the size of the commune, scales at which the studies are prepared range between 1:10,000 and 1:25,000 (COMMIN - The Baltic Spatial Conceptshare, 2007b).

Before the adoption of such a study, a draft version is checked and approved by the voivodeship board and the voivode in order to ensure its conformity with regional principles and objectives. Furthermore, according to the Water Law, it has to be approved by the director of the Regional Water Management Board. The mayor can also ask for opinions on the study from the head of the county, from neighbouring municipalities, as well as the responsible entity for geological administration (i.e. the regional geological survey), among others (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 16). Provided feedback can contribute to the quality of the study, although these opinions are not legally binding,.

The Study of Determinants and Directions of the Local Space Economy is an act of spatial policy of a municipality and presents the perspectives of the spatial development for its jurisdiction (Cotella, 2014; Ebert et al., 2012). However, it can also be considered as an act of economic development policy, making this double role of the study a typical element of the Polish planning system (COMMIN - The Baltic Spatial Conceptshare, 2007b, p. 14). In this context the study defines guidelines and includes indications of (COMMIN - The Baltic Spatial Conceptshare, 2007b, pp. 14–15):

- the determined land use as well as the direction of changes in its land use, including an indication of areas to be excluded from construction development;
- the demarcation of protected areas (in particular for natural resources of the environment, cultural landscapes and mining);
- areas exposed to flood and landslide hazards;
- directions and directives for the management and organisation of agriculture and forest land;
- etc.

While the preparation of this study is required by law, the plan itself is not legally binding. Accordingly, a legally binding protection for the mentioned protected areas and areas exposed to natural hazards (floods and landslides) can only be accomplished through an existing Local Plan of Physical Development, because the Study of Determinants and Directions of the Local Space Economy cannot provide a legal basis for administrative decisions towards third parties and thus not prohibit building activities (Ebert et al., 2012). As a consequence, in order to enforce statements and provisions made at the level of the preparatory land use plan, contents of the study have to be translated into legally binding regulations as part of the Local Plan of Physical Development.

Local Plan of Physical Development (LPPD)

The Local Plan of Physical Development (LPPD) is the main spatial development plan at the local level, determining the long-term spatial development of the municipality. The main objectives involve (Grochowski and Pieniążek, 2008):

- the regulation of land use;
- the coordination of development activities through infrastructural investments;
- the establishment of local standards concerning construction of new buildings and other investments;
- the delineation of boundaries of protected areas;
- the provision of architectural parameters and detailed conditions of land-use;
- the provision of guidelines for monitoring of construction;
- the division of the area covered by the plan into single building plots.

The plan is prepared by the municipality and approved by the mayor. In contrast to the aforementioned study, this plan is not obligatory, but is usually prepared when the commune sees a need for a detailed land use plan. It is a legally binding instrument, meaning that the provisions have to be followed by local authorities, public institutions and the public (COMMIN - The Baltic Spatial Conceptshare, 2007b, pp. 17–18). In 2003, all local spatial plans adopted before 1995 lost validity. Since the Polish government did not make the design of new plans compulsory and many municipalities lacked financial and human resources to make new plans, in 2008 only 17% of the municipalities had such a LPPD (OECD, 2008a, 2011).

The LPPD is prepared for selected areas of a commune at scales of 1:500, 1:1,000 or 1:2,000 (see Appendix 2, Figure 7 for an example). Among others, the LDDP generally and obligatorily defines according to Article 15, Paragraph 2 of the Spatial Planning and Development Act:

- the allocation of land for different purposes and uses;
- directions concerning zoning and specific development principles;
- rules for the protection and development of spatial order;
- requirements arising from the needs of the public space design, the principles related to building interventions (e.g. density of built use, maximum height of the building, the minimum number of parking spaces, building lines);
- limits of land use or objects to be protected, determined on the basis of separate provisions, including mining areas as well as areas exposed to flood hazards and mass movements;
- detailed rules on land development and restrictions on its use, including building bans.

Due to the fact that municipalities are free to decide for which parts of their territory a LPPD should be drawn, development processes at the local scale are rather unregulated. Often local governments avoid the preparation of a LPPD as they prefer to directly negotiate with private investors (Cotella, 2014). Local planning is thus characterised by a weak planning function and by dominant ad hoc attributes (OECD, 2011), taking decisions rather on a short-term case-by-case basis than by focusing on and considering longer-term concerns of the municipal territory. Instead of producing LPPDs, municipal governments realise urban development through the "decyzja o warunkach zabodowy" (Cotella, 2014, p. 271; Majchrowska, 2011, p. 89). These so-called "decisions on development conditions" are similar to development permits, but they are not connected to any local plan and therefore do not have to correspond to higher-level government policies and guidelines. They mainly serve as plan substitutes for those areas of a commune not covered by a LDDP (OECD, 2011). In many cases these decisions do also not conform to the Study of Determinants and Directions of the Local Space Economy. In fact, due to their simplified procedure and their lack of control of a more comprehensive urban development, the "decyzja" hampers the spatial and functional order of urban development (Cotella, 2014, p. 271). This undermines the importance of the existence of legally binding local land use plans, which provide for a better reliance and predictability of decisions on future land-uses (OECD, 2011).

Studies of Natural Environmental Conditions

Studies of Natural Environmental Conditions or "eco-physiographic studies" ("Opracowanie ekofizjograficzne" or simply "Ekofizjografia") are state of the environment reports which are usually made at the beginning of each planning process. An eco-physiographic study consists of detailed information about the natural resources and the environment in a municipality (Maćkowiak-Pandera and Jessel, 2005). It illustrates how the environment and its components act and interact and therefore tries to conceive the system as a whole. By identifying the main elements that characterise the environmental system and its functionality, the eco-physiographic study tries to help manage natural and environmental conditions appropriately within the planning process (Koreleski, 2008).

These studies are obligatory documents for the preparation of a Study of Determinants and Directions of the Local Space Economy and a Local Plan of Physical Development. Local level planning documents are based on their outcomes and thus depend on the quality of these analyses (Papińska, 2007). The obligation to develop eco-physiographic studies is based on the Act on Access to Information on the Environment[128] and the Environmental Protection Law[129]. Their purpose consists in providing conditions for maintaining a natural balance and ensuring a rational management of the environment (Koreleski, 2008).

Eco-physiographic studies include a cartographic part and a descriptive part. The cartographic material in particular constitutes an important evidence base for spatial planners, as they illustrate (Koreleski, 2008):

- where prevailing environmental conditions support the realisation of the spatial concept;
- which areas are problematic and require deeper analyses;
- which physiographic elements facilitate or enable the realisation of certain investment projects (buildings, roads, etc.) and which conditions make them difficult or even impossible.

The implementation of eco-physiographic studies is considered as labour-intensive, time-consuming and costly (Papińska, 2007). Other drawbacks include inaccuracies in the delimitation of geological-geomorphological aspects, methodological shortcomings in the assessment of the resistance to human pressures and the lack of carrying out prognoses on environmental changes (Koreleski, 2009).

[128] „Ustawa z dnia 9 listopada 2000 r. o dostępie do informacji o środowisku i jego ochronie oraz o ocenach oddziaływania na środowisko"

[129] „Ustawa z dnia 27 kwietnia 2001 r. Prawo ochrony środowiska"

However, eco-physiographic studies play an essential role for the realisation of projects and plans by considering the necessary principles of sustainable development. It is also important to acknowledge that they *"should emerge as a result of cooperation, apart from planners, between various experts in physiography and ecology, such as geographers, geologists, hydrologists, pedologists, biologists, farmers, foresters, etc."* (Koreleski, 2008, p. 46). This means that the study could ensure cooperation between different actors and therefore enable a more comprehensive analysis of the territory. Since this is not necessarily the case, structures or processes should be put in place, which facilitate the involvement of ecologists, geologists etc. in the process of creating Studies of Natural Environmental Conditions together with spatial planners (Koreleski, 2009). Eco-physiographic studies also serve as a basis for creating environmental assessments of spatial management projects and planning documents in accordance with the EIA and the SEA Directives (Koreleski, 2008).

Informal planning

In Poland, informal planning in the form of cooperating planning approaches that encompass different institutions and administrative levels hardly takes place. The same applies to the involvement of non-governmental organisations and the population. Instead of having integrative and cooperative participation processes, "public involvement" in Poland consists of a simple provision of information and public relations work (Grotz, 2005). According to Ebert et al. (2012, p. 4, own translation) "*complementary planning tools (urban framework plans, master plans and other) without any universal, legally-binding impact have a low priority in planning practices; accordingly the Polish planning law does neither recognize a consideration of non-legally regulated planning activities, nor an implementation-oriented set of planning tools*". Nevertheless, the existing legal framework does not hamper the implementation of informal planning methods and instruments. Still the current focus lies on regulatory instruments and only few Polish authorities feel the need to establish more cooperative and integrative planning processes (Grotz, 2005).

A reason for this limited application of informal planning instruments may be the fact that Polish spatial economy, i.e. spatial economic development, generally has a rather regulating task (see above), which merely establishes and facilitates the technical and legal framework for private investment activities. After all, according to the legal guidelines, the Polish spatial economy primarily focuses on the protection of spatial order and sustainable development. Accordingly, legal regulations are required in order to ensure the close combination of spatial planning and economic development. This explains why Polish spatial economy directs its planning attention to developing new areas, while at the same time neglecting the further development of existing developments and already built-up areas. In fact, the latter is not considered as a separate planning task, as specific planning approaches addressing developed areas do not exist (Ebert et al., 2012).

Especially after joining the EU in May 2004, public participation procedures have been advanced in order to conform to EU regulations. In this respect, in October 2008 the Act on the access to information about environment and its protection, on public participation in the protection of environment and on environmental impact assessments[130] was introduced (Majchrowska, 2011, p. 88). The spatial planning system in Poland legally enables public participation in decision-making and planning processes at all

[130] „Ustawa z dnia 3 października 2008 r. o udostępnianiu informacji o środowisku i jego ochronie, udziale społeczeństwa w ochronie środowiska oraz o ocenach oddziaływania na środowisko"

planning levels, including the local level (Feltynowski, 2015, p. 281). As set out in the law, the public is entitled (Majchrowska, 2011, p. 89):

- to be informed about planned developments,
- to put forward petitions,
- to express their opinion during the consultation period of a draft plan,
- to suggest changes and
- to ask for improvements and to appeal in case proposals are rejected.

However, the current planning practice in Poland favours a direct negotiation with investors and the use of building permits. Hence, public participation can be avoided. This prevailing approach of urban planning practices implies that *"it is actually impossible to achieve any consensus with or within local communities"* and that it provides *"an excuse for eliminating community participation from planning practice"* (Cotella, 2014, p. 273). As a result, private investors often heavily influence urban development while the inhabitants hardly get a chance to participate.

Moreover, the privilege of public participation in decision-making is not always cherished. The public is not interested in exercising this right and participating in public discussions and decisions on future urban development (Feltynowski, 2015, p. 288; Kasprzyk et al., 2007). Kasprzyk et al. (2007) explain that a long practice of centralised planning during the communist times, which did not allow for public participation, is the reason for a lack of tradition of public participation. The public is not yet used to be involved. Finally, lack of trust in decisions of public authorities reduces the effectiveness of public participation. However, local knowledge and input from inhabitants is in fact an important basis for evidence-base spatial planning. Public participation can represent an ideal way to provide political support and acceptance for decisions (Feltynowski, 2015, p. 288). Enabling public participation therefore helps to achieve acceptance for decisions on the use of land.

6.2.3 Spatial planning system of Italy

The Italian spatial planning system is characterised by a centralised structure, whereas the legislative power belongs to both the central state and the regions. In regard to spatial planning regions can be considered as most important actors. For instance, they enact their own laws to set up spatial planning-related regulations. The provinces hold an intermediate position between the regions and the municipalities, but both provinces and municipalities have certain regulatory power. All laws and regulations have to comply with the guidelines and principles of national provisions, however (Galderisi and Menoni, 2006; Pütz et al., 2011). The constitutional reform in 2001 *"changed the denomination of the field of planning competences from "Urbanistica" to "Governo del Territorio" (territorial government), which indicates a wider approach being taken to the spatial dynamics and dismisses an expression related to a mainly urban focus"* (Lingua and Servillo, 2014, p. 128). Consequently, a supra-local vision is becoming more important and less attention is paid to single, urban aspects.

Regions were created because of the decentralisation reform in 1970. Accordingly, also a corresponding decentralisation of responsibilities has taken place, especially in regard to competences related to urban planning (European Commission, 2000). Regions provide planning strategies for the lower levels, i.e. for provinces and municipalities. Concerning the link between general spatial plans and sectoral plans it can be argued that those links are often not conclusively defined for plans at the same (vertical) level. Spatial plans are still supposed to include prescriptions of sectoral plans. After some structural changes regional governments have reviewed their provincial coordination plans in order to link them more closely to sectoral plans and to better incorporate the prescriptions and contents of basin plans, landscape plans etc. A link between spatial and sectoral plans only exists for plans at regional/provincial and at municipal scale (Galderisi and Menoni, 2006).

According to the European Commission (European Commission, 2000) spatial planning in Italy is characterised by strong urban and physical planning, while the concept of economic planning – like in France – does not exist in a legislative framework, but is only present in planning debates. Until today, the Italian planning system separates and differentiates between decision-making and sectoral policies on the one hand and urban planning instruments on the other hand. This separation becomes apparent when considering the fact that each sectoral policy area has to be verified with the regional and municipal urban planning authorities as the responsible entities for territorial specification of such policies, while the financial programming lies in the responsibility of the central government (European Commission, 2000).

Legal framework

The legal basis of the Italian planning system is Law No. 1150 of the year 1942 ("Legge urbanistica"). It was drawn up and introduced by both the central and the local governments. Law 1150/1942 already introduces the urban master plan, the so-called "piano regolatore generale communale" (PRGC) (European Commission, 2000).

The original planning system from 1942 was neither completely structured, nor particularly effective in terms of allocation of powers, functions, competences and resources. As a consequence a reform process was started in the 1970s (Cremaschi, 2003). Regions were created and only since then Italian regions have been exercising legislative power in spatial planning along with a decentralisation of responsibilities from the central government onto the regions (Cremaschi, 2003; European Commission, 2000; Galderisi and Menoni, 2006). However, the regional level has not had the option for a reform of planning instruments, due to the fact that the central government has not issued a legislative framework for urban planning yet.

In the 1980s and 1990s further laws related to spatial planning were introduced. During the 1980s in particular laws regarding landscape planning and the conservation and protection of the environment were drawn up, such as the Law No. 431/1985, which introduced the "Piano Paesistico" (Landscape Plan), today "Piano Paesaggistico" (see below), and the Law No. 183/1989, which introduces the "Piano Bacino" (River Basin Plan).

During the 1990s new legislation dealing with programmes that address the restoration and renewal of towns and their degenerated suburbs were set up. These programmes are the first planning-related instruments that do not focus solely on rigid zoning, but constitute an attempt to a more flexible planning system, based on collaborative approaches between the public and the private sector (European Commission, 2000). It should also be mentioned that Law No. 59/1997 transferred more competencies from the central government to the local level, by affirming the principle of subsidiarity for all institutional levels. Only few decision-making powers remained with the central government, while most tasks became responsibilities of the region and the local administration (Cremaschi, 2003).

Reform processes in the 1990s especially resulted in innovations related to the PRGC. However, the reform process has not yet lead to a final conclusion and a coherent reform is still missing. This is why the reformulation of a governmental urban planning framework law is considered necessary (Elisei, 2003; Lingua and Servillo, 2014). The reason is that several ordinances and court decisions continuously amended the law and changed it to what it represents today. Another reason is that its structure from the year 1942 could not anticipate the changing role of the regions, which today act as protagonists of spatial planning. According to Elisei (2003) the urban planning law gradually turned into a mystery that urban planners can hardly understand. Both urban planners and jurists agree that a new national framework law on urban planning law should be introduced. There is no consensus about how this law should be organised and designed.

As mentioned above, regions are entitled to exercise legislative power in spatial planning. Accordingly, the transition which can be observed in planning practice has been considered in regional laws (Elisei, 2003). In addition to the Law no. 142/1990 on the order of local self-governments and the Legislative Decree 267/2000[131], many regional planning acts exist that largely modified the Italian planning system (Galderisi and Menoni, 2006). Today, the Italian planning system finds its most advanced legislative reference points in these regional acts, which were continuously reformulated and adjusted (Elisei, 2003). Main changes included the replacement of the hierarchical link among local authorities and planning instruments with cooperative and circular links as well as a review of the contents of the provincial coordination plan (Galderisi and Menoni, 2006).

In the Friuli Venezia Giulia region spatial planning is based on the Regional Laws 5/2007[132] and 22/2009[133]. Originally, Regional Law 52/1991[134] was used to control land use and urban planning aimed at regulating the use and the structure of the region, as well as the interventions of urban renewal and building (Article 1, Regional Law 52/1991). However, Regional Law 52/1991 was repealed by Regional Law 5/2007. In the same year, the regional territorial plan ("piano territoriale regionale" (PTR)) was adopted by the regional government. The plan was supposed to substitute the old General Regional Urbanistic Plan ("piano urbanistico regionale generale" (PURG)), which has been in force since 1978. While the PURG followed a conformative dimension of spatial planning, enabling urgent urban problems to be addressed, nowadays planning should focus on adapting to territorial governance requirements (Luca and Lingua, 2014). As a consequence, the PTR was *"aimed at defining a more strategic perspective for regional territorial governance and at outlining new relations with local authorities"* (Luca and Lingua,

[131] Decreto Legislativo 18 agosto 2000, no. 267 "Testo unico delle leggi sull'ordinamento degli enti locali" (Consolidated law on local self-government)

[132] Legge regionale 23 febbraio 2007, n. 5 "Riforma dell'urbanistica e disciplina dell'attivita' edilizia e del paesaggio" (Regional Law 23 February 2007 no. 5 "Reform of planning and regulation of the building activity and the landscape")

[133] Legge regionale 03 dicembre 2009, n. 22 "Procedure per l'avvio della riforma della pianificazione territoriale della Regione" (Regional Law 03 December 2009 no. 22 "Procedures for the start of the spatial planning reform of the region")

[134] Testo della legge regionale 19 novembre 1991, n. 52 "Norme regionali in materia di pianificazione territoriale ed urbanistica" aggiornato con le successive modifiche e integrazioni (Regional Law 19 November 1991 no. 52 "Regional standards in land use planning and urbanism "updated with subsequent amendments and additions)

2014, p. 22). However, after being adopted the PTR has never been officially approved, which is why the PURG was still the only regional plan in force after the adoption of the PTR. Despite the missing approval the PTR still represented a useful reference instrument. Finally, Regional Law 22/2009 foresees that the region performs spatial planning by making use of a new planning instrument, the "Piano del Governo del Territorio", PGT (Territorial Management Plan) (Regione Autonoma Friuli Venezia Giulia, 2013c). The PGT finally substituted the PURG and became the new planning instrument at the regional level.

Regulations for planning at the local level were defined in Regional Law 5/2007 and then specified by Regional Law 12/2008[135] as well as by a decree of the president of the region from March 20, 2008, no. 86[136]. Regional Law 5/2007 provided municipalities with more competencies in terms of spatial planning, which allow them to have full autonomy in the management of their territory (Luca and Lingua, 2014). They were also given all competencies on spatial issues regarding the inter-communal scale. This includes inter-municipal cooperation, which is becoming an important approach to reduce the ongoing fragmentation of Italian municipalities (Fedele and Moini, 2007).

Above elaborations show that the spatial planning legislations or existing laws related to regional and urban planning activities are quite extensive. Regular amendments constructed a legal framework which is comprehensive but sometimes confusing and ultimately even outdated.

Description of planning practice and current problems

The Italian planning system belongs to the "urbanism" tradition (see Chapter 4.1), which is characterised by a planning orientation mainly directed towards urban planning and architectural aspects with a direct impact on personal property rights. Lingua and Servillo (2014, p. 128) list three main aspects which can be considered typical structural features of the Italian planning system: *"a strong predominance of the master plan at the local level, despite the growth of the supra-local planning capacities; the architectural roots of the discipline, supporting a combination of urban design strategies, land-use prescriptions and territorial governance in a complex legislative framework; and the persistence of conformative prescriptions in spite of a largely absent programming capacity"*. The first aspect is owed to the strong autonomous political structure as well as the inertia and rigidity of the Italian planning system. While other EU countries tried to clearly distinguish between strategic development policies and policies directed at a detailed regulation of land use during the 1970s, the local master plan in Italy still continued to include both of these objectives: strategic policy and land use transformation (European Commission, 2000), thus underlining its strong power. The second aspect stems from the interaction between planning as an architectural and urban design matter and planning as a politics and policy issue. Italian planning education is classically strongly connected to architecture and urban design, with the "planner" being an "architect-urbanist", whose task consists in designing the physical development of the urban space and the region (Lingua and Servillo, 2014, p. 128) rather than applying a more comprehensive development approach. This is also in line with the urbanism tradition, which is nowadays still characterised by *"a*

[135] "Integrazioni e modifiche alla legge regionale 5/2007 (Riforma dell'urbanistica e disciplina dell'attività edilizia e del paesaggio)" (Integration and modifications regarding Regional Law 5/2007 (Reform of planning and regulation of the building activity and the landscape))

[136] "Regolamento di attuazione della parte I urbanistica, ai sensi della legge regionale 23 febbraio 2007, n. 5" (Regulations implementing the urban part I, under the Regional Law 23rd of February 2007, no. 5)

strong architectural flavour and concern with urban design, townscape and building control" as well as a regulation which has been "*undertaken through rigid zoning and codes"* (European Communities, 1997, p. 37). However, the Italian debate on the polity of spatial planning and governance also points at issues related to the social construction of decision-making processes (Bellaviti, 1995 cited in Lingua and Servillo, 2014, p. 129) and the importance of scientific knowledge used by planners and decision-makers for supporting planning decisions (Astengo, 1966 cited in Lingua and Servillo, 2014, p. 129), thus partly abandoning a sole focus on architectural aspects and urban design. The third aspect is the conformative nature of planning practices, i.e. the prevailing conforming planning approach, which is characterised by a focus on quantitative parameters and the zoning-based distribution of building rights (Farinós Dasi et al., 2007, p. 48; Lingua and Servillo, 2014, p. 129) (see Chapter 4.1).

Another major problem of the Italian planning system is that of illegal building. Illegal building ("abusivismo edilizio") can be considered as *"one of the most dramatic aspects of territorial change in Italy, particularly in central and southern large cities and territories"* (European Commission, 2000, p. 18). In the southern regions (Calabria, Campania, Sicilia and Puglia), where 55% of all new illegal buildings in Italy are concentrated, it is a matter of second and third homes, while in the northern regions the illegality is mainly related to changes in the use or abuse of non-residential buildings. The only region that has no real problems with illegal building is the Valle d'Aosta region (Legambiente, 2007, p. 6).

One driving force of change in the Italian planning system that is worth mentioning is related to the fact that in Italy often *"exceptional emergencies have become a structural way of promoting change through a sort of "state of emergency" approach"* (Lingua and Servillo, 2014, p. 131). Usually cases of spatially relevant emergency situations or disasters are not associated with a description of a planning system. In contrast, in Italy emergencies and disasters have significantly influenced the planning system and legislative framework, due to their continuous recurrence and due to a political ideology which is based on the idea of responsive planning practices that overcome bureaucratic legislation with ad hoc measures (Lingua and Servillo, 2014, p. 134). Natural disasters in particular prompted immediate planning-related reactions. Lingua and Servillo (2014, p. 134) further explain that natural disasters such as floods, earthquakes, landslides etc. often *"become the occasion to apply top-down special reconstruction laws that allow ordinary planning tools and procedures to be bypassed"*. Accordingly, instant reconstruction often facilitates planning decisions and measures, which differ from existing legislation and norms of existing urban plans. Emergency situations therefore constitute the only case in which the national government can still exert direct powers and decision-making competencies towards regional and local authorities (Lingua and Servillo, 2014, p. 135).

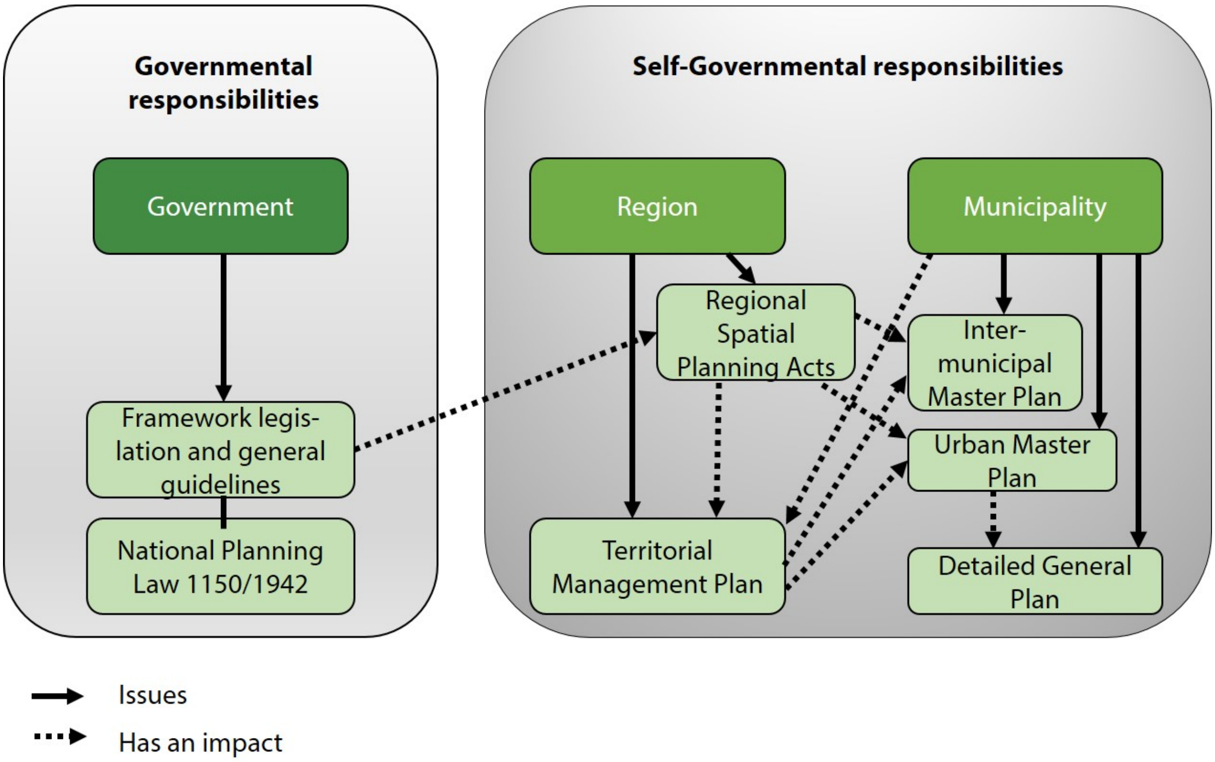

Figure 39 Relevant spatial planning documents in Italy (Source: own illustration)

Planning instruments

Based on the national planning law, spatial planning is carried out at two levels that are hierarchically linked (see Figure 39). The first level involves planning at regional scale. Here general plans provide regulations for the land use distribution of the regional or provincial territory. Existing sectoral plans concern specific topics such as transport, water and landscape. The second level encompasses general urban planning at municipal scale, represented by the master plan ("piano regolatore generale"). Sectoral plans again concern specific topics such as traffic control, noise and atmospheric pollution. Moreover, the second level involves detailed planning of a specific area or the planning of a specific project on a smaller communal territory (Galderisi and Menoni, 2006). The national level is not considered a proper planning level, since the national government only develops general guidelines which include planning activities and land use guidelines. However, these guidelines only serve as a basis for planning activities at the regional and local level[137] (Pütz et al., 2011).

Regional level (region and province)

While in Friuli Venezia Giulia the region performs its spatial planning duties by preparing the PGT (see above), the provinces only elaborate strategic regional programmes. Regarding the Provincial Coordination Plans ("Piani territoriali provinciali di coordinamento" (PTPC)), which were originally required by Regional Law 52/1991 (Article 23), the amended Regional Law 5/2007 does not consider the elaboration of any PTPCs.

[137] For the central government's function of guiding and coordinating urban planning different instruments are used, which do, however, not represent plans in the narrower sense. These instruments represent general objectives of the central government which must be followed by regional and local authorities in defining their land use when preparing their own planning instruments (European Commission, 2000).

Regional territorial plan (PTR)

Originally, the regional authority intended to provide a plan for an improved dialogue between different authorities involved in spatial development. Therefore, the PTR was elaborated in order to offer innovative solutions for problematic situations that exist these days, making it possible to build a "common vision" of the territory, to which everyone can refer (Regione Autonoma Friuli Venezia Giulia, 2007). Today the PTR can be used as a reference framework and source of information, since the plan has only been adopted, but never been approved. Not only does the PTR provide a comprehensive state of the art analysis of the regional territory, but its norms ("norme di attuazione") have also already set up rules and standards which should be considered for the development of the region. According to Article 1, comma 19 Regional Law 22/2009 the technical documentation, which forms part of the PTR, can be used for the elaboration of the territorial government plan (along with the technical documentation of the PURG). Accordingly, it constituted a useful basis for the preparation of the PGT.

Territorial Management Plan (PGT)

The territorial management plan is of strategic nature and defines the objectives for a larger area. The plan was adopted in October 2012 and finally approved in April 2013. A PGT comprises in particular a regional strategic document ("documento territoriale strategico regionale" (DTSR)) and a so-called charter of values ("carta dei valori"). The municipalities actively participate in the elaboration of these two documents. Further documents are part of the PGT, which include:

- a report about the analysis of the regional space ("relazione di analisi del territorio regionale"),
- the technical norms to be implemented ("norme tecniche di attuazione"),
- the environmental report ("rapporto ambientale") as well as
- a non-technical summary of the environmental report ("sintesi non tecnica del rapporto ambientale").

The DTSR is used by the region to determine the strategies of its regional policy, to identify local spatial systems and define their characteristics as well as to guide and coordinate urban and sectoral planning of local authorities. It therefore also incorporates elements of coordination, guides government activities of local entities and a possible reconcilement of plans at all levels both spatial and sectoral (Regione Autonoma Friuli Venezia Giulia, 2013b).

The CDV contains the fundamental values of the region, the elements of the territory which need to be controlled, preserved and developed in so far as they constitute unique heritage of the region (Article 1, Regional Law 22/2009). The CDV is meant to present consolidated areas to be controlled and managed as well as those areas potentially suitable to be developed. It is continuously updated as well as monitored in regard to the physical changes that constantly affect the territory (Regione Autonoma Friuli Venezia Giulia, 2013a). The CDV is an important tool for planning: It reflects the current state of the territory and environment, but it also adopts a future perspective through continuous adaptation to and monitoring of possible future changes. Thematic maps of the CDV provide information about nature and morphology – illustrating natural risks – settlements and infrastructure as well as about spatial planning, sectoral planning and planning with respect to parks and reserves. The latter show the current situation of major provisions of the plan for issues and sectors (e.g. hydro-geological risks, infrastructure, industrial zones, and natural protected areas) that are closely related to the application of the CDV. Knowledge about the existing provisions and regulations is important, as they need to be compared with the objectives of safeguarding and of a functional development of places that the CDV intends to follow in the context of a sustainable management of the territory. This thematic map shows provisions which may have a direct impact on land-uses, for instance in regard to the protection and conservation of biodiversity, development of industrial activities.

Local level (inter-municipal and municipal)

Urban planning in Italy still takes place by using a planning instrument which differs considerably from local planning instruments in other European countries (Cremaschi, 2003). The local spatial plan can therefore be considered a special feature of the Italian planning system.

Municipal planning is carried out at three levels: the inter-communal (Piano Regolatore Intercomunale (PRI)), communal (Piano Regolatore Generale Comunale (PRGC)) and detailed level (Piano Regolatore Particolareggiato Comunale (PRPC)). The master plan at inter-municipal scale is an instrument that controls and regulates building activities at a level of several, neighbouring communes. In accordance with the regional law, planning at inter-municipal scale enables the planning of new residential areas or areas for industrial, artisanal, commercial or touristic use, or an expansion of existing ones. It may also provide for infrastructure, public services or facilities of public interest[138]. The legally binding PRGC covers the whole territory of a municipality and can be considered the strongest and most effective planning tool in Italy. The third level concerns detailed or executive plans for specific areas. After the change in legislation in 1990, the central government has no approving authority anymore but all communal plans must be developed by local authorities and are approved by either the regional or the provincial government, that also have to ensure the plans' compliance with higher level plans and provisions (Besteher et al., 2010; Pütz et al., 2011).

Urban master plan

According to National Law 1150/1942, the PRGC determines the land use for the whole territory of the commune. The preparation and approval of a PRGC is mandatory for every Italian municipality. Although it usually requires an executive plan for the implementation of its designations, a PRGC often provides options of direct implementation by proprietors by issuing building permits (European Commission, 2000). The PRGC identifies and develops provisions for those areas that are subject to particular restrictions. Such restrictions can include building constraints due to historical-cultural, environmental or hydro-geological reasons or a certain required distance from infrastructure facilities. Further restrictions concern the protection of infrastructure and facilities of public interest as well as the protection from potentially dangerous situations threatening the safety of people and goods (European Commission, 2000). By designating zones and areas, it may control building heights, building densities and constructional typologies, i.e. types of buildings. It indicates the main transport routes, areas for public use, areas for public buildings as well as certain restrictions which should help protect the environment and the landscape. It also appoints those buildings which should be preserved as well as exact locations of supply

[138] Due to the fact that the municipalities in the Italian case study site are not yet covered by an inter-municipal master plan, this particular planning instrument will not be further presented at this point.

and infrastructure facilities (Cremaschi, 2003; European Commission, 2000). Provisions of the plan are rather general, requiring the preparation of executive planning instruments for an actual implementation of the provisions (European Commission, 2000). This is usually done by the so-called PRPC, i.e. the detailed general plan.

The old planning law of 1942 is still in force and despite constant changes, it does not correspond to the idea of a more governance-related policy making. Once a PRGC is approved, it stays in force until a new PRGC is prepared. It can be updated as often as required (European Commission, 2000). As opposed to a German preparatory land use plan, for instance, the PRGC attempts to be a detailed, global plan, but represents in fact a rather static instrument that defines a desired and targeted final state. Consequently the plan is subject to constant changes and adjustments (Cremaschi, 2003). Municipalities often are not capable of updating their urban master plans and other plans at the local level. Colavitti et al. (2013, p. 174) point out that only 49,2 % of the total number of Italian municipalities have an urban master plan that has been approved after 1998. This conforms to as little more than half of the total surface of the Italian territory.

The PRGC needs to verify, specify and develop the indications of the regional territorial plan. According to Article 29, comma 3, Regional Law 5/2007 it is aimed at ensuring *"a balanced development of settlements, particularly with respect to present economic activities or those to be developed within the municipal area"* (own translation). It also aims at the *"protection and rational use of natural resources and the preservation of cultural, scenic and environmental assets as well as the satisfaction of housing needs"* (own translation). More precisely, the plan contains the objectives and strategies that the local authority intends to pursue with the plan, the definition of actions for the protection and enhancement of natural and environmental resources as well as an analysis of the geological, hydrological and avalanche situation of the territory in order to assess the environmental compatibility of the previsions of the plan (Article 63 bis, comma 3, Regional Law 5/2007). It may divide the communal territory in different zones (historic centre, completion, expansion, agricultural, industrial, public areas), which by law must cover the entire territory under the jurisdiction of the municipality. The PRGC is composed of graphical tools and norms. Graphical illustrations show the current state of the territory and the updated building stock as well as limitations of those areas exposed to natural hazards. They also provide a schematic presentation of the plan's strategy. The regulatory part includes, in particular, the technical norms to be implemented ("norme tecniche di attuazione"). An example of a PRGC is shown in Appendix 2, Figure 13).

According to Cremaschi (2003) the urban master plan constitutes an insufficient tool for regulating urban development under current urban conditions. While it used to be an appropriate tool during the time of the urbanisation boom and urban growth, it does not quite satisfy the requirements for urban development and conversion. Colavitti et al. (2013) explain that if municipalities have no readily implementable land use plan available, uncontrolled urban development and unauthorised building activities might be the result, as currently being observed in many regions. Such consequences might hamper institutional programmes as well as efforts aiming at promoting urban sustainable development.

In addition to the mentioned local land use plans there are also sectoral plans at the local level. These mainly address issues such as environmental protection and restoration, soil and water management and protection (basin plans) or urban mobility and transportation etc. The development of sectoral plans is accomplished by the respective sectoral authorities, i.e. river basin authorities for water related issues and environmental agencies for environmental protection policies, for instance (Galderisi and Menoni, 2006).

Detailed general plan

The Italian legislation offers several kinds of different planning instruments at a more detailed planning level. Only one of these plans is general in its planning purpose, which is the so-called "piano regolatore particolareggiato comunale" (PRPC). The PRPC finds it legal basis in Article 42, Regional Law 52/1991, which determines that in order to facilitate a coherent implementation or realisation of the provisions of the PRGC, municipalities foresee the preparation of appropriate detailed general plans. The PRPC determines the intended use of single areas as well as the types of buildings in terms of construction and use to be applied in the interventions. It also identifies those areas and buildings to be expropriated in order to ensure an achievement of the objectives of the plan. It is adopted by the municipal council.

The PRPC is comprised of an illustrative report that determines the objectives, gives an estimate on the necessary expenses needed for the realisation of the plan and provides a timetable for the implementation of the plan. Furthermore, there are graphic representations, norms for an exact implementation as well as a cadastral list of the areas and buildings to be expropriated (see Article 44, Regional Law 52/1991). The normative part of a PRPC, including the zoning maps, is legally binding for the population and third parties. From a legal point of view it has the same legal status as the PRGC and also follows the same process of adoption and approval (Galderisi and Menoni, 2006).

Informal planning

Defining the state of informal planning activities in the Italian case study site is not a simple task. Similar to France and Poland, there is no such term or exact translation for informal planning in the Italian language. In fact, the actual, literal translation, "pianificazione informale" refers to unauthorised building and "informally" constructed settlements and buildings (Sept, 2008). In addition to the missing terminology for planning practices which can be characterised as "informal" there is also no description or mentioning of informal planning approaches in the Italian planning system.

The problem is that formal planning alone does not always meet the requirements of urban reality. Public authorities are often little assertive and in many cases private investors are the drivers of certain developments and projects. Similar to France, public participation plays a subordinate role. "Participation" is often limited to "information", i.e. involving the public by giving information. Although citizens may take a stand on current planning processes and give their opinion or objections, a weighing up of these objections does not take place (Sept, 2008). Solving and tackling urban problems and deficiencies with solely formal planning instruments is therefore difficult.

This holds particularly true for an urban development aimed at sustainability and resilience. As Diamantini and Zanon (2000) explain, it is quite a challenge to connect traditional, formal planning instruments, decision-making processes and legal responsibilities with a sustainable development process. Since sustainable development intends to improve current conditions by means of diverse instruments, ranging from the application of better technologies and a better coordination of resources to public involvement, the use of formal instruments does not seem to be sufficient. Instead, institutional responsibilities for a more sustainable development have to be connected to a variety of actors by applying both formal and informal procedures and practices.

The European Union has been highlighting the importance of public participation for many years. As De Marchi (2003, p. 173) notices, *"virtually all EU documents regarding the environment, health, risk and safety issues are permeated with a constant and insistent call for public participation in their management, as well as their detection and definition"*. Accordingly, the simple provision of information is not considered sufficient, but actual public participation is essential for successful decision-making. Missing public participation can therefore hamper the outcome. Moreover, Diamantini and Zanon (2000) point out, that in terms of solving environmental problems such as environmental protection and disaster risk reduction often a sectoral approach is assumed, while comprehensive spatial planning plays a minor role or no role. In this context urban planning may be a decisive tool to promote the interaction among sectoral planning experts and the local community. While public participation represents an important step for constructing a shared vision of certain problems and affects economic activities, its crucial role is often neglected in Italian planning processes.

6.3 SEA practices and characteristics in France, Poland and Italy

In addition to the above introduced country-specific characteristics of the planning systems, it is equally important to have a closer look at the SEA practices and characteristics in each of the three countries. Since SEA requirements of the EU Directive are adjusted to national conditions, SEA practices differ across the EU. Moreover, different attitudes towards SEA as well as a differing progress in SEA application result in country-specific characteristics for SEA.

6.3.1 SEA practices and characteristics in France

France has a long tradition of environmental assessments. Starting from the 1970s already there was an obligation for the consideration of environmental aspects in planning documents. In 1983 a government decree introduced the requirement to prepare a preliminary report on the state of the environment and potential effects of the spatial plan on the environment. It has to be noted, however, that in practice environmental assessments were not completed in a rigorous way and that judicial checks on finalised planning documents did not take place (Dalal-Clayton and Sadler, 2005). The country transposed the EU SEA Directive into national law by a framework established through a special Ordinance (489/2004) as well as several regulatory decrees. The latter determine specific regulations of assessment and implementing measures for spatial plans and other PPPs[139] (Sadler and Jurkeviciute, 2011, p. 133). In 2010, the so-called "Grenelle environment", and in particular the respective "Grenelle Law", introduced important amendments to the Urban Planning Code, especially in regard to the SCoT and the PLU. More precisely, on the basis of amendments made by the "Grenelle Law 2", the Decree n° 2012-616 of 2nd May

[139] While Decree 608/2005 amended the Urban Planning Code and the Code of Territorial and Local Authorities with respect to spatial plans, Decree 613/2005 amended the Environmental Code with respect to other PPs (Sadler and Jurkeviciute, 2011, pp. 133–134). The SEA Directive therefore finds its legal basis in the Urban Planning Code (Article L. 121.10 and Article R. 121-14ss) as well as the Environmental Code (Article L. 122.4 and Article R. 122.17ss) (Sutter et al., 2014, p. 42). Just like the Urban Planning Code, the Environmental Code is constantly being amended. The version used for this work is the version last modified on December 22, 2014.

2012 regarding the assessment of certain plans and documents having an impact on the environment[140], has extended the scope of application of SEA in France and introduced some innovations. This reform entered into force on January, 1st 2013 (CGDD and CEREMA, 2015; Rich, 2012). Among others, the decree lists plans, programmes and other planning documents that are subject to an environmental assessment. A distinction is made between documents for which an SEA is obligatory and documents which have to be assessed on a case-by-case basis (the so-called "examen au cas-par-cas"). The obligatory assessment includes 43 plans and programmes of spatial and sectoral planning, e.g. the SCoT and the PLU as spatial planning documents or the flood risk management plans and the regional scheme for climate, air and energy as sectoral planning documents. The "examen au cas-par-cas" addresses 10 plans and programmes such as the PPRN ("Natural Risk Prevention Plan") and the PPRT ("Technological Risk Prevention Plan")[141] (Decree n° 2012-616 of 2nd May 2012). Although the PPs that have to be assessed on a case-by-case basis may influence the environment, they are not systematically subject to an environmental assessment. For all these PPs the environmental authority decides whether it is necessary to carry out an environmental assessment or not. Moreover, the decree arranged that aspects such as climate change adaptation, conservation of biodiversity, control of energy consumption etc. became major objectives of urban planning documents (CGDD and SEEIDD, 2011, p. 6). Due to the long history of French environmental assessments, the application of SEA today is comparably far developed. However, only after the introduction of the Law Grenelle 2 smaller communes are now equally subjected to SEAs of spatial and sectoral plans, which before they were not.

The authority responsible for preparing the (spatial or sectoral) plan or programme in question is also responsible for carrying out the environmental assessment, while the environmental protection authority has the responsibility for the final evaluation of the environmental report. The latter is also involved in the actual SEA process in terms of methodological standards, for instance (Sutter et al., 2014, p. 43). The SEA process follows the basic standards provided by the EU SEA Directive. Figure 40 illustrates how the SEA process is integrated into a common planning process in France.

As shown in Figure 41, the SEA process in France emphasises the iterative nature of the assessment procedure. SEA is seen as a decision-aiding tool, which is supposed to improve the plan or programme. In this context, the SEA procedure aims to determine the alternative that least effects the environment in a negative way. This is also why the comparison of different alternatives plays an important role (Sutter et al., 2014, p. 43). In this regard, it also needs to be pointed out that environmental reports in France are legally required to provide more information than actually required by the EU SEA Directive in Annex I (European Commission DG Environment, 2009, p. 84).

140 "Décret n° 2012-616 du 2 mai 2012 relatif à l'évaluation de certains plans et documents ayant une incidence sur l'environnement"

141 Sutter et al. (2014, p. 45) learned from group interviews about SEA experiences in France, that for plans and programmes subjected to the case-by-case assessment an environmental assessment is hardly completed (about 10% of such PPs). The authors reckon that the benefit of such a divided list consists in clear standards regarding which plans and programmes necessarily have to undergo an environmental assessment. Besides, by setting such standards the decree also ensures a countrywide equal treatment of the listed plans and programmes. The downside of the case-by-case regulation consists in possible oppositions towards decisions that favour/decline an assessment (Sutter et al., 2014, p. 45).

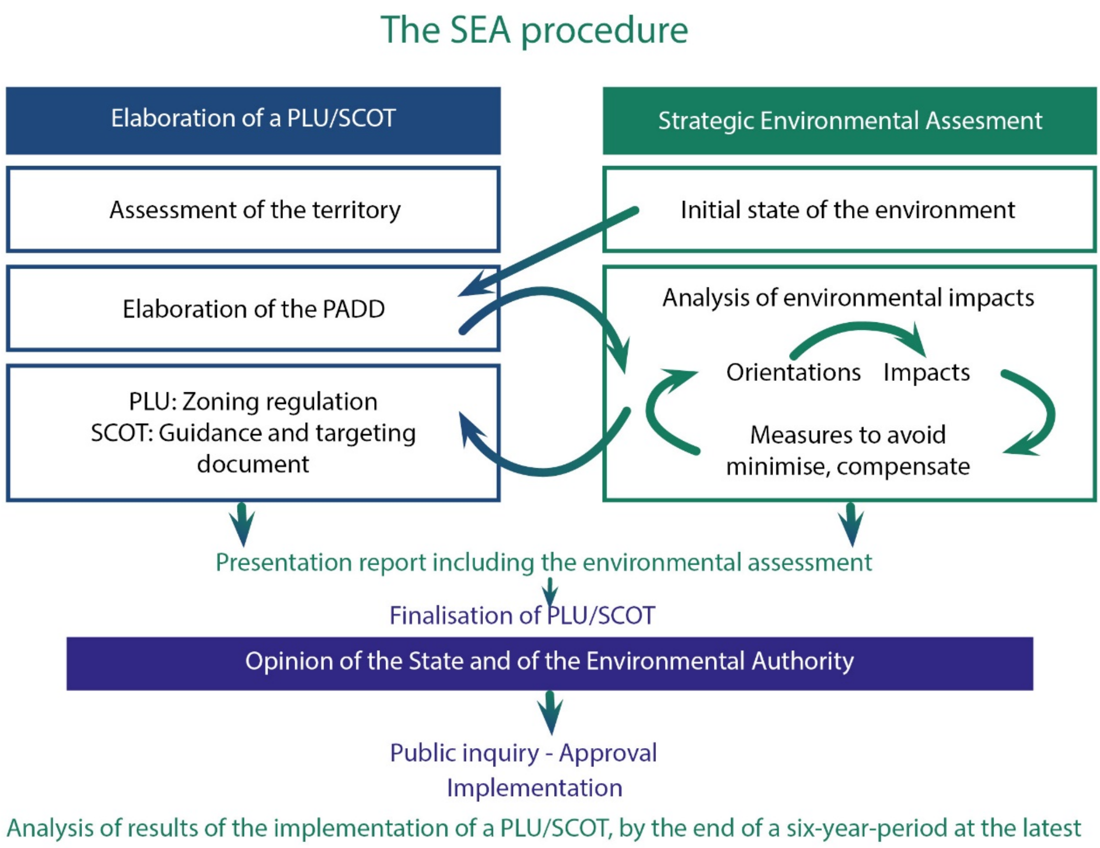

Figure 40 Integration of the SEA procedure into the elaboration of a PLU or a SCoT (Source: recreated and slightly altered from CGDD and SEEIDD, 2011, p. 13, own translation)

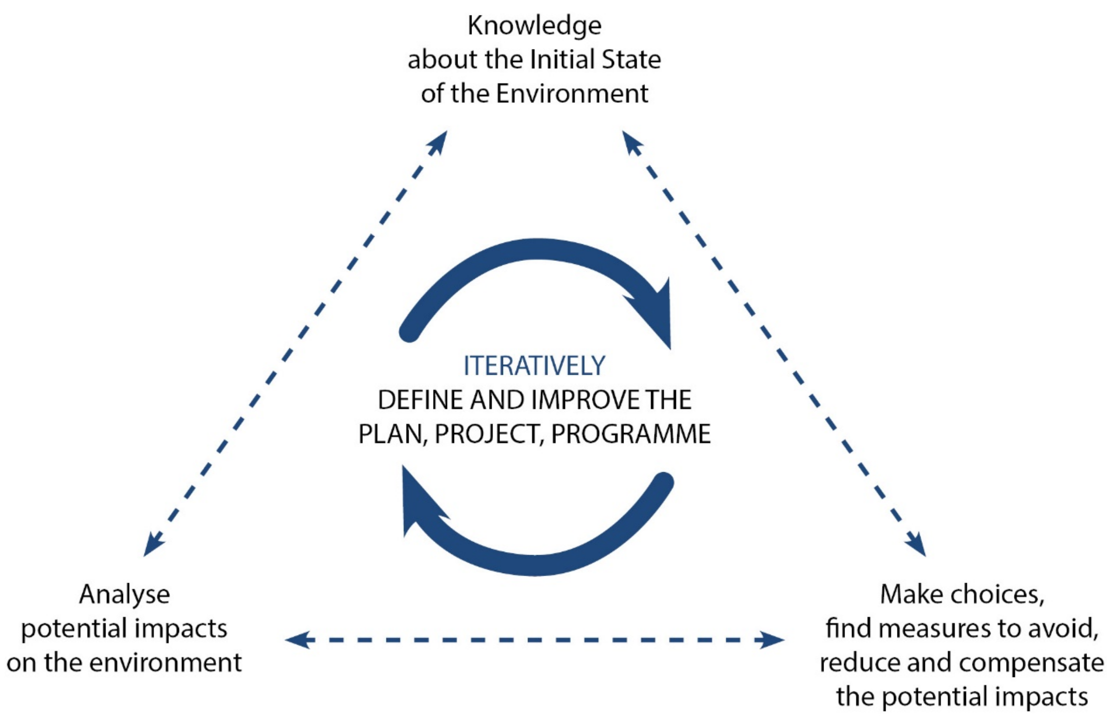

Figure 41 Iterative approach of defining and improving the PPP (Source: recreated from CGDD and CEREMA, 2015, p. 8, own translation)

When referring to the benefits of SEA in France, a distinction is made between different types of plans (European Commission DG Environment, 2009, p. 126):

- PPs with a direct relation to environmental policies (e.g. plans for water or waste management, etc.) benefit from SEA. An environmental assessment process helps to comply with according policy requirements as well as to examine coherence with other relevant and related environmental policies. As the nature of such PPs implies an improvement of the environmental conditions, SEA is not necessarily directed towards defining and eliminating negative impacts of the PP, but to strengthen the determined measures.
- PPs with no direct relation to environmental policies can more easily identify the most relevant environmental issues and stakes of a territory with the help of an SEA. In this regard, the sharing of knowledge about environmental issues between different stakeholders as well as ensuring transparency and public participation are major benefits. In this respect SEA may help the responsible authorities to better justify their decisions.

However, there are also a number of problems related to the process as such. One aspect relates to the fact that SEA is used as both an integrated planning tool and an assessment tool (European Commission DG Environment, 2009, p. 124; Sutter et al., 2014, p. 45). While both versions have advantages and disadvantages, the latter is often perceived as a supplementary exercise (Sutter et al., 2014, p. 45), without any valuable contribution to the quality of the plan. The role of the environmental protection authority within the process has been discussed and adjusted recently. While until 2012 the environmental protection authority was not only responsible for evaluating the assessment process and the environmental report as the final outcome, it was also directly involved in the process by providing important data and information for the assessment. However, today the environmental protection authority is not directly involved in the process any longer. It only intervenes at the beginning during the screening in order to help determine whether an SEA has to be carried out and at the end of the process when it comes to the evaluation of the environmental report. The provision of data and information now lies in the responsibility of the respective relevant sectoral planning authorities (Sutter et al., 2014, p. 46). A further procedural problem pertains to the parallel elaboration of a plan and its environmental report, mainly completed by two different bodies. Instead of a more integrated process, this way of completing a plan and the corresponding environmental report make the whole procedure more complex and time-consuming (Sutter et al., 2014, p. 46).

Regarding public participation, the French legislation goes beyond the requirements of the EU SEA Directive. The French law foresees a more comprehensive information basis to consult the public than the SEA Directive asks for. Besides, an independent third party in the form of an “inquiry commissioner” guarantees the quality of public consultations (European Commission DG Environment, 2009, p. 29). Experiences with public involvement are mixed, however (Sutter et al., 2014, p. 43). In most cases public involvement in SEA processes is low. One reason can be seen in the long and technical reports that discourage participation because they are difficult to understand (Sutter et al., 2014, pp. 46–47).

A number of guidance documents are available, including for spatial planning at the local and regional level. One extensive guideline has been prepared by the Service for Economy, Evaluation and the Integration of Sustainable Development (“Service de l’Économie, de l’Évaluation et de l’Intégration du

Développement Durable") of the General Commission for Sustainable Development ("Commissariat Général au Développement Durable"). The guidance document titled "Environmental Assessment of urban planning documents" ("L'évaluation environnementale des documents d'urbanisme") provides a detailed description of how to carry out an environmental assessment of urban planning documents and is accompanied by 21 "sheets" of information[142] ("fiches").

There is no overall guidance document for SEA application, however. Instead, separate guidelines exist for different PPPs (Sutter et al., 2014, p. 42). There is also no national guidance on how to determine monitoring indicators (European Commission DG Environment, 2009, p. 82). While authorities responsible for SEA can make use of sustainable development indicators for monitoring purposes, the main problem consists in selecting the most relevant indicators for the PPP at hand (European Commission DG Environment, 2009, pp. 82–83). Moreover, in many cases the provision of relevant environmental data and information is encountered with difficulties. Required data is not always available, as data provision is often complex and difficult (Sutter et al., 2014, p. 47).

It can be concluded that the level of SEA application is estimated to be generally high (Sadler and Jurkeviciute, 2011, p. 134). However, acceptance is not necessarily equally high. Those involved in any kind of SEA-subdued planning often perceive the SEA process as compulsion and imposed task they have to fulfil in order not to violate the law. Yet, in spatial planning acceptance for SEA is still higher than in environmental planning (Sutter et al., 2014, p. 47).

6.3.2 SEA practices and characteristics in Poland

Formally, the SEA procedure was introduced in Poland only at the end of 2008 by implementing the EU SEA Directive into national law. It was legally introduced on the basis of an amendment of the "Act of 3rd October 2008 on the access to information about the environment and its protection, on public participation in environment protection and on environmental impact assessments" as well as the "Act of 27th April 2001 on Environmental Protection". However, a requirement for the preparation of environmental reports for local land use plans already existed since 1995 (Sommer, 2005, p. 74). In the years 2000 and 2001 this requirement had been extended and subsequently addressed a wider range of plans, policies and programmes. More precisely, an initial SEA provision was made through the former "Act on the access to information about the environment and its protection, on public participation in environment protection and on environmental impact assessments" from the year 2000. This development happened in relation to Poland's preparations to join the European Union and aimed to already pave the way for the formal adoption of the SEA Directive a few years later (Sadler and Jurkeviciute, 2011, p. 136; West et al., 2011). Polish authorities and practitioners had been monitoring the evolution of the SEA procedure and SEA practices in other EU Member States in order to determine, how to deal with SEA in Poland in an optimal way. Hence, the Polish SEA law continued to evolve and adjust to ensure full and adequate implementation of the SEA Directive (West et al., 2011). Finally, the SEA Directive was also transposed in several legal acts. In addition to the above named two acts, this includes the Spatial Planning and

[142] There are three types of "fiches": Some illustrate and describe a certain part or step of the methodological approach, others clarify the regulation and again others give specific examples from selected case study sites. Both the guideline and the sheets of information will be referred to in Chapter 9.

Management Act (2003), the National Development Plan Act (2004) as well as the Development Policy Principles Act (2006) (Sadler and Jurkeviciute, 2011, p. 136).

The fact, that the initial implementation of environmental assessments into Polish law in 2001 was enacted before the official introduction of the EU SEA Directive was not entirely beneficial, but also implied difficulties related to the implementation of SEA from a legal point of view (Sommer, 2005). Furthermore, there were also methodological problems related to SEA practice at that time. Maćkowiak-Pandera and Jessel (2005, p. 213) explained that *"the lack of methods suitable for the strategic level may be one reason that so far SEA is not used in Poland in the majority of cases to make substantial inputs to decision-making processes, but is dealt with just as a formal prerequisite that has to be added to the documents for the approval of the project"*. The authors also criticised the lack of methodological approaches to SEA of PPPs. Hence, they demanded the provision of specific methods for SEA procedures that would enable public participation and introduce standards for the preparation of the environmental report (Maćkowiak-Pandera and Jessel, 2005, p. 213). However, West et al. (2011) observed, that over the years and after amending respective acts, the practice of carrying out environmental assessments for PPPs emerged from a mere fulfilling of formal and legal requirements to a more practical, useful tool. A guidance on SEA methodology was issued for spatial plans and strategic documents (Sadler and Jurkeviciute, 2011, p. 136), thus helping to solve the problem of methodological approaches. In the study of COWI for the EC DG Environment (2009, p. 120) Poland stated that the SEA requirements have influenced the process of PPP preparation in a positive way. Today, SEA is supposed to decisively contribute to the integration and consideration of environmental aspects in planning processes. Hence, it is not surprising that by now the level of SEA application is assumed to be moderate to high (Sadler and Jurkeviciute, 2011, p. 136).

Figure 42 illustrates the SEA process in Poland. According to Article 47 of the Act of 3rd October 2008, all spatial planning documents are subjected to an SEA (e.g. the concept of spatial development, the study of conditions and directions of spatial management, the local spatial development plan etc.). Therefore, these plans do not require a screening step. For the Małopolska region it was confirmed in an interview, that in case of spatial plans it happens very rarely that the regional environmental directorate decides that there is no need for an SEA. Usually even amendments of a local spatial plan require an environmental assessment (Interview P-I, 2013). This is why many examples for SEAs in spatial planning practice exist. An SEA is regularly carried out, at least for spatial planning documents.

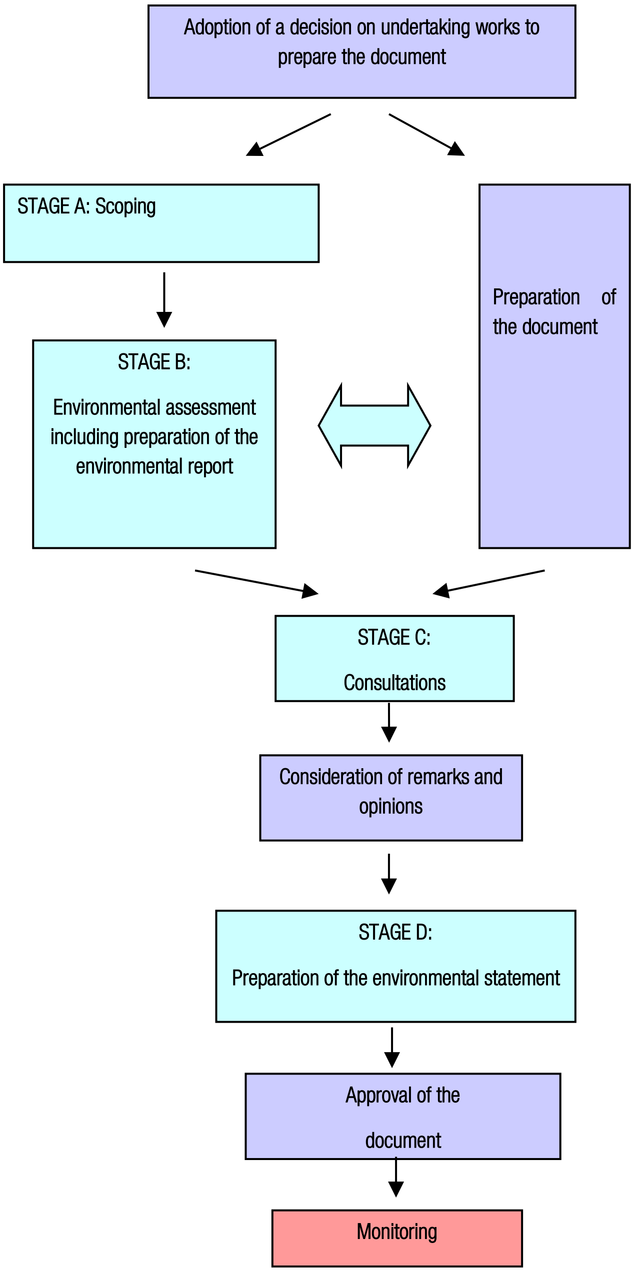

Figure 42 SEA process for spatial planning documents in Poland (Source: West, 2007)

Despite the positive development of SEA application and practices in Poland, there are still a few shortcomings: While many EU Member States prepared guidelines for scoping, in Poland scoping is carried out on an ad hoc basis, as no national guideline for scoping exists. This can be considered a downside, as proper and effective scoping at the beginning of each SEA process is crucial in order to determine what baseline information is needed. Effective scoping serves to guide and target the process and enable a facilitated decision-making. Furthermore, there appears to be no definition of "reasonable alternatives" in Polish laws (European Commission DG Environment, 2009, p. 76). While it is common not to provide a definition for "reasonable alternatives", the missing indication of what exactly constitutes a reasonable alternative has led to different interpretations of the term "reasonable" or to a non-consideration of any alternatives, even (West et al., 2011). In order to make use of the consideration of alternatives effectively, more guidance and definitions are needed. Besides, there is no national guidance on how to determine monitoring indicators (European Commission DG Environment, 2009, p. 82). In addition, problems exist regarding the preparation of environmental reports in terms of availability and access to data. More precisely, the country *"identifies the problem of generating and collecting data about the state of the environment in areas likely to be significantly affected by the implementation of the plan or programme in question in cases when location of planned projects is not settled or is only outlined"* (European Commission DG Environment, 2009, p. 86). This refers to large areas of several dozen square metres in particular. Poland also lacks a legal definition of the term "public" in relation to public participation. The Polish law does therefore not provide for a proper definition, but only states that "everyone" is entitled to submit comments and provide an opinion as part of the public participation procedure (European Commission DG Environment, 2009, p. 92). A further problem can be seen in the generally rather lengthy process of SEA. West et al. (2011) noted, that Polish SEA practitioners seemed to encounter problems with the short length of the time allowed for the assessment process as a whole. As a result, the environmental assessment was observed to be hustled, hence risking the quality of the process. Finally, Poland reported in 2009, that they apply SEA primarily as an assessment tool. This means, they rather focus on effects of the draft PPP after it has been prepared, rather than using it as a planning tool. When using SEA as a planning tool, the process focuses on an integration of environmental issues via SEA into the planning process, for instance. The EC DG Environment (2009, p. 124) points out that such an integration of planning and SEA *"can be regarded as a starting point to tackle one of the main challenges of all assessment procedures, namely that the results of the assessment are really taken into account in the final planning decision"*. Focusing more on assessment rather than on an integration of SEA and planning might be an indication for the fact that SEA is still considered more of an obligation than as a decision-aiding tool for planning purposes (European Commission DG Environment, 2009, p. 125). This is also in line with observations made by West et al. (2011), who state that in Poland environmental assessments are often based on a pre-prepared draft of the plan, instead of accompanying the planning process. This implies that no real coordination between the different relevant authorities took place and that environmental aspects have not been considered from the very beginning. In such cases, the value of SEA as a decision-support tool may not have been realised yet. However, no final statement can be made as this point, as SEA practices in Poland have evolved in the meantime and experiences with the procedure are likely to be further developed today.

6.3.3 SEA practices and characteristics in Italy

Although attempts to implement the SEA Directive in Italy initiated well before the deadline in 2004 (Gazzola and Caramaschi, 2005, p. 117), the EU SEA Directive was only officially introduced through the Environmental Code (Legislative Decree no. 152 approving the Code on the Environment) in the year 2006[143]. The actual entry into force was postponed due to discrepancies with EU requirements (Sadler and Jurkeviciute, 2011, p. 135), especially regarding a clearer definition of SEA phases. This lack of

[143] According to Gazzola and Caramaschi (2005, p. 117) the late implementation of the EU SEA Directive can be traced back to the fact that in general Italy has started to deal with environmental issues and problems rather late. Besides, the willingness of politicians of the central government at the time to initiate according changes to existing legislation was rather low.

accordance with EU requirements caused a longer legislative process and in the year 2008 the phases of the SEA procedure have finally been specified (De Montis, 2013, p. 53). The SEA implementation process was completed through Decree 4/2008, which separately prescribes the procedures of SEA and EIA[144] (Sadler and Jurkeviciute, 2011, p. 135). However, according to De Montis (2013, p. 53) this long process and delay in the adoption is a reason for the poor quality of SEA application and the integration of environmental assessments into spatial planning processes, respectively. Although in general the level of SEA application is estimated to be rather low (Sadler and Jurkeviciute, 2011, p. 135), the number of SEA procedures has at least increased over time.

Regions and autonomous provinces have introduced according laws integrating the provisions of the EU SEA Directive into spatial planning regulations (De Montis, 2013, p. 57). Since they are authorised to implement international treaties and EU Directives directly, SEA legislations differ from region to region (Gazzola and Caramaschi, 2005, p. 118). In Friuli Venezia Giulia the EU SEA Directive was transposed into law in the year 2005 by Regional Law 11/2005, i.e. even before the initial integration of the Directive into national law[145]. After the adoption of Decree 4/2008 regions that had already integrated the SEA provisions into regional law were given twelve months to adopt this legislative decree in order to be coherent with national and EU regulations. Further amendments were implemented through Regional Law 13/2009 and Regional Law 26/2012.

Two guidelines exist that support the SEA procedure for PPs. The first guideline has been elaborated during an INTERREG project in 2004, the second guideline has only been published quite recently in 2015 by the national institute for environmental protection and research. Both guidelines are valid for all plans and programmes that are subjected to an SEA. There is no separate guideline for spatial planning documents and there is no guideline for SEA practice in the Friuli Venezia Giulia region, either.

In Friuli Venezia Giulia, planning practice at the local planning level is characterised by mostly minor changes to local spatial plans which do not require an environmental assessment according to Art. 3, No. 3 of the Directive. There are only short studies on whether the amendment of the plan is subjected to SEA (so-called “relazione di verifica preventive degli effetti significativi sull’ambiente”), which determine whether the planned changes to the plan have any significant impacts on the environment (which is usually not the case, because they are only minor amendments). For instance, in the year 2013 only 10 environmental assessments were completed in the region for either local or for inter-communal land use plans (see Figure 43 and Figure 44). Many other Italian regions have an equally low SEA application. The only region with a high application of SEA procedures is Lombardy.

[144] More precisely, the decree introduces specifications in regard to screening, scoping and the determination of three authorities to be in charge of proposing, proceeding and controlling the SEA process (De Montis, 2013, p. 56).

[145] Regional Law 11/2005 states in Article 3 that, in order to promote a sustainable development and to ensure a high level of environmental protection, regional and local authorities as well as other public entities need to provide for a Strategic Environmental Assessment of plans and programmes which have significant effects on the environment.

Procedure di VAS concluse nell'anno 2013					
Regione / Prov. Autonoma	Piani fondi strutturali	Piani Territoriali Regionali/Provinciali e Paesaggistici	Piani Urbanistici Comunali/Intercomunali	Piani di Settore	Totale
Abruzzo					
Basilicata	0	2	1	0	**3**
Bolzano					
Calabria	0	1	1	0	**2**
Campania					
Emilia-Romagna	0	0	103	9	**112**
Friuli Venezia Giulia	0	0	10	3	**13**
Lazio	0	0	0	0	**0**
Liguria					
Lombardia	0	9	300	10	**319**
Marche	0	1	10	1	**12**
Molise	0	0	1	0	**1**
Piemonte[25]	0	1	0	0	**1**
Puglia	0	0	4	2	**6**
Sardegna	0	0	6	1	**7**
Sicilia	0	0	2	0	**2**
Toscana	0	2	37	8	**47**
Trento	0	1	30	9	**40**

Figure 43 Environmental Assessments completed in the year 2013 in Italian regions (Source: Ministero dell'Ambiente e della Tutela Del Territorio e del Mare, 2015, p. 77)

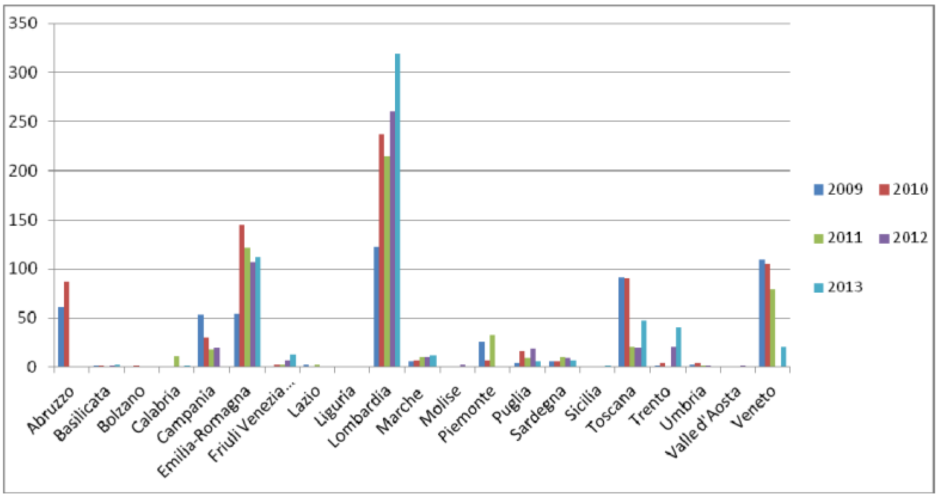

Figure 44 Environmental Assessments completed between 2009 and 2013 in Italian regions (Source: Ministero dell'Ambiente e della Tutela Del Territorio e del Mare, 2015, p. 78)

Fischer and Gazzola (2006, p. 407) determined a number of effectiveness criteria for the Italian SEA application. They state that a prerequisite for SEA effectiveness in Italy is the existence of both contextual and methodological aspects. Contextual aspects include a well-established legislative and sustainable development framework as well as a broad and close cooperation and public participation. These aspects seem to be underdeveloped. Due to the lack of environmental objectives and the existence of a planning culture that is highly politicised, a flexible application of SEA is not regarded as helpful. Instead, the authors suggest that *"an effective SEA system in Italy would need to be based on clear, rigid and prescriptive government provisions"* (Fischer and Gazzola, 2006, p. 407). Such specific government provisions, however, do not exist.

Just like Poland, Italy reported in the study carried out by COWI (see above), that the EU SEA requirements influenced and changed the process for preparing PPs. Likewise, SEA requirements prompted the modification of contents of PPs in favour of environmental issues (European Commission DG Environment, 2009, pp. 120–121). In particular, SEA procedures introduce relevant changes to planning processes in terms of preparation and approvals of plans and participation processes (De Montis, 2013, p. 53). In addition, the introduction of SEA seemed to contribute to an improved institutional cooperation, including a greater knowledge and information transfer between the parties involved (Rega and Bonifazi, 2013, p. 1345). The process of an SEA and its integration into the planning process is shown in Figure 45.

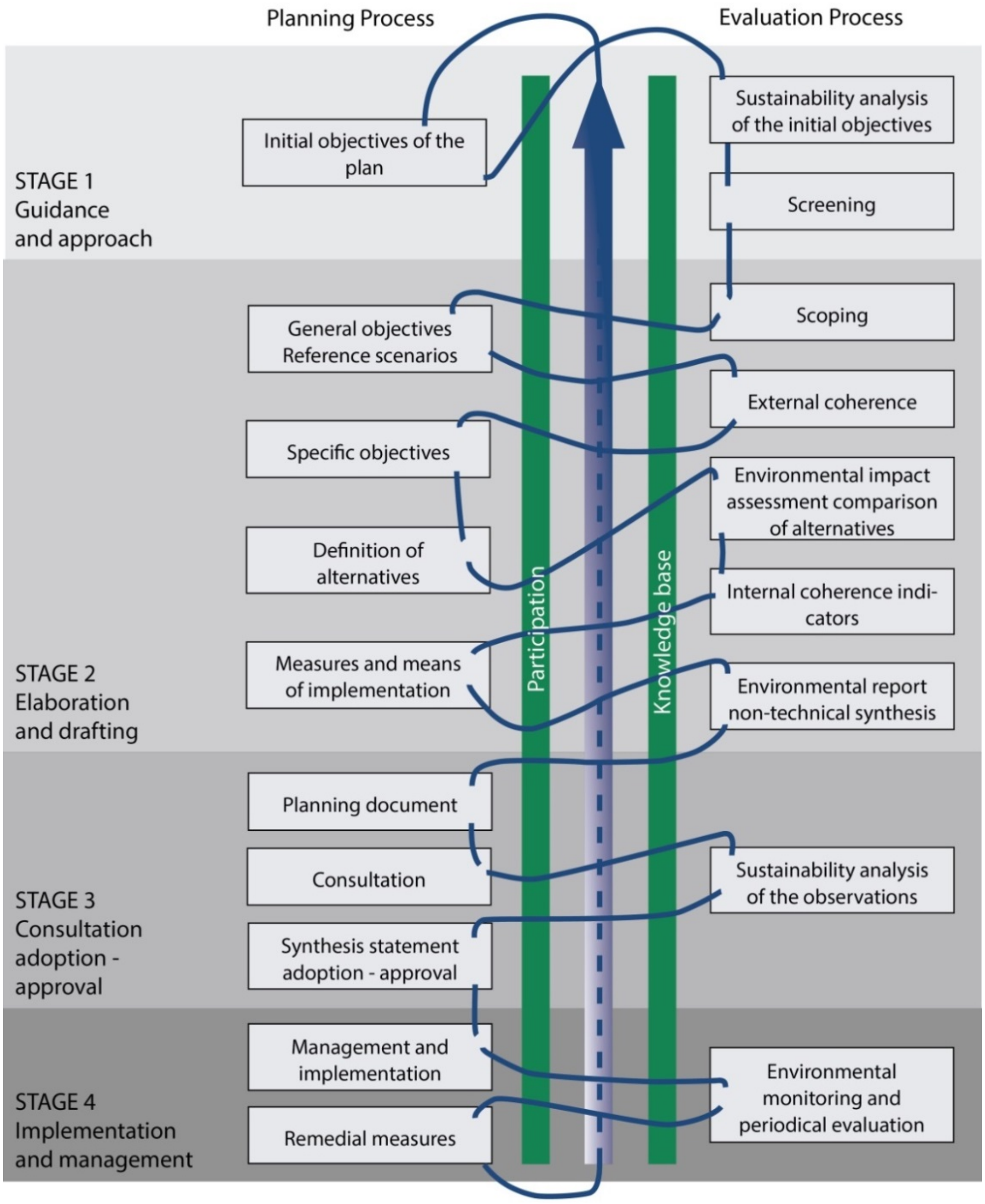

Figure 45 Integration of the SEA procedure into the elaboration of a PRGC (Source: recreated from ENPLAN, 2004, p. 45, own translation)

The Italian law defines what is meant by the term “public”, but like in France and in Poland it applies the widest possible interpretation of the term in its legislation by determining that “public” involves “everyone” (European Commission DG Environment, 2009, p. 92). Public participation in SEA processes is enabled to various extents. Often public involvement is restricted to a mere consultation of the public and the communication of results, thus conforming to the minimum legal requirements. This is also in line with the views expressed by Fischer and Gazzola (2006, p. 403), who acknowledge that the role of the public, including efforts to enable public participation, is rather limited in Italian public decision-making. However, it does indeed improve the whole planning and SEA process when carried out purposefully (Rega and Bonifazi, 2013, p. 1350).

SEAs are often shaped by a sectoral approach. Emphasising the interdependencies of its parts proves therefore difficult[146]. Besides, environmental reports often include lengthy deliberations of the environmental baseline, which outweigh the sections on the actual assessment of significant effects on the environment (Rega and Bonifazi, 2013, p. 1343). Fragmentation of competences and knowledge of environmental bodies is generally considered a problem. However, SEA is already viewed as beneficial in this regard, as it promotes institutional cooperation and knowledge sharing (see above) (Rega and Bonifazi, 2013, p. 1347). The assessment of reasonable alternatives seems to be a major problem in Italian regions. Again, the national legislation does not provide for a definition of what reasonable alternatives are (European Commission DG Environment, 2009, p. 76). As a consequence it comes as no surprise that environmental reports often lack a proper assessment of alternatives (De Montis, 2013, p. 60; Rega and Bonifazi, 2013, p. 1343). Another reason for the poor consideration of alternatives might be that SEA is regularly used as a mere justification of decisions and plan-proposals that have already been made (Rega and Bonifazi, 2013, p. 1345). In this context, Fischer and Gazzola (2006, p. 406) demand the introduction of formal requirements to take account of different alternatives, including the zero alternative.

A major aspect of the EU SEA Directive and national as well as local provisions concerns the integration of the SEA process into the spatial planning process. Such an integration is supposed to happen in a way that the environmental assessment accompanies the plan making process during all phases, from the preparation via the adoption through to the publication of the plan (De Montis, 2013, p. 57). At the same time, this is also considered a major challenge in SEA application. In fact, Rega and Bonifazi (2013, p. 1343) discovered that environmental assessments often seems to lag behind the planning process. Consequently, recommendations of the environmental report are not always fully translated into binding prescriptions in spatial plans. This is why in most cases SEA is not able to influence territorial development effectively. Instead, SEA is often considered as a constraint, by frequently hindering and slowing down the approval procedure (Rega and Bonifazi, 2013, p. 1344). In regard to environmental monitoring, Rega and Bonifazi (2013, p. 1345) conclude from their analysis that environmental indicators are mostly presented and explained in a transparent way. They acknowledge that *"a major weakness in monitoring provisions appears to be poor consideration of management aspects; none of the examined cases included an explicit budget allocation for monitoring, nor the identification of dedicated human resources"* (Rega and Bonifazi, 2013, p. 1345). It is, however, quite difficult to determine the effectiveness of monitoring at this point in time, as SEA practice and experiences are not developed enough. It general it can be expected that the more experience planners and SEA practitioners as well as evaluators gain, the more developed and effective the SEA procedure will become.

[146] In their publication on SEA and spatial planning in Italy, Rega and Bonifazi (2013, p. 1345) cited a planner who criticised evaluators for not combining or coordinating fragmented scientific knowledge effectively enough. SEA often lacks a synthesis of all environmental issues and an overall coordinative task that it is actually supposed to fulfil.

7. Preparing the empirical study for examining the use of risk information

In order to be able to assess how planning practices deal with disaster risk and the use of risk information, a method was needed that compared the status quo with desired conditions. To set the target for categories and indicators, information and facts have to be collected that help determine a desired state. In the present study, policy documents as well as other reports and EU communications and guidelines helped to set the baseline while conducted interviews supported the determination of the present state and furthermore provided hints towards a more desirable state. The expert interviews were complemented by a thorough literature study on risk assessment and planning practices in the study areas, or the respective countries, including legal documents.

Chapter 7.1 will first describe the derivation of categories and indicators. Chapter 7.2 will introduce the final set of categories and indicators that were used for an analysis of the status quo of spatial planning practices (including SEA) in the case study areas. Outcomes of the analysis are presented in Chapter 8 and 9.

7.1 Categories and indicators as a means of qualitative content analysis

As explained in Chapter 2.3, in this study data analysis was accomplished by means of qualitative content analysis. This analysing approach makes use of a category system in two ways: deductively and inductively. Based on a desktop analysis and on results gained from the informal interview rounds, relevant aspects with respect to the use of risk information in Strategic Environmental Assessment and spatial planning were identified and outlined in a category system. This means that in order to match the analysis with the research topic, a first set of categories and indicators was theoretically deduced and developed prior to conducting the expert interviews. Yet, not each of the chosen categories was applicable to interviews. Instead, some categories required further desktop research and an evaluation of relevant literature providing evidence for conditions likely to be encountered in the case study areas. The developed categories were defined in more detail and also expressed in indicators in order to turn the categories into examinable or measureable statements[147]. These categories and indicators were then used to analyse the interview transcripts. As mentioned in Chapter 2.3, some categories were also inductively developed while coding the interviews. Accordingly, both the development and the application of the category and indicator system followed an interpretative approach.

The developed categories and indicators are mainly related to actual planning practices in the case study areas, or in the according countries, respectively[148]. The question that primarily guided the analysis is whether the goals that are predetermined by the Directives, in particular, are attainable through “on-site” practices, i.e. by the type of risk information available, processes that lead to an integration of this information into spatial plans, knowledge of spatial planners about existing threats caused by natural hazards, the role SEA plays in this context etc.

[147] Indicators are directly examinable statements, activities or behaviours that refer to a specific category. Indicators can show the degree of goal attainment and can detect and visualise the gap between the examined status quo and desired condition.

[148] This predominantly corresponds to the third dimension (“planning practice”) of the analytical framework presented in Chapter 2.3.

Initially four broader, main categories were formed before conducting the interviews in order to structure the categories and indicators that were to be developed:

1. Risk information
2. Spatial planners as actors
3. Planning process
4. Communication

The choice for these four categories is derived from the following, basic deliberations:

1. Risk information as such is not prepared as an end in itself, but it needs to serve a particular purpose. However, in order to be used, risk information has to be made available first. Maps are the most common form of risk information. Availability of risk information in the form of maps is therefore a prerequisite.
2. Spatial planners are the main actors in preparing local spatial plans and thus main addressees and users of risk information. Spatial planners are therefore supposed to have particular demands on the way risk information is presented and communicated.
3. Planning process refers to the processes in spatial planning in which risk information is used and processed. A differentiation is made between methods, procedures and instruments. In this case:
    a. "methods" refer to assessment and decision-making processes and the balancing of different interests – including options of public participation and involvement;
    b. "procedures" refer to the Strategic Environmental Assessment procedure in particular;
    c. "instruments" refer to a differentiation between formal and informal planning instruments;
4. Communication refers to the links and relations between different entities and authorities that deal with risk information and that build the basis or framework for an effective use of risk information in spatial planning, with a focus on sectoral planning authorities. A differentiation is made between:
    a. Communication in the form of information exchange, addressing the question whether in addition to formal communication processes informal communication takes place between information providers and information users
    b. Communication in the form of stakeholder involvement, addressing the question whether spatial planners as one group of stakeholders are involved in (flood) hazard or risk mapping.

Based on these considerations a category and indicator system was developed which is presented in the following.

7.2 Categories and indicators for the use of risk information

The elaboration that follows presents both deductively and inductively developed categories and indicators[149]. While most of the developed categories were applicable for the interviews and assessable by directly addressing and consulting the respective experts, the category "risk information" rather required a literature study. Since this category refers to risk information as such, most questions can already be

[149] Some categories were dropped during the interviews after they turned out to be inadequate or irrelevant. Those categories will not be further explained.

answered by consulting legal documents, examining hazard maps, studying publications with specific examples from the case study areas or consulting project reports about the topic at hand.

The following elaboration consists of an explanation for each main category as well as main questions to be considered within each main category. The sub-categories outline goals and purposes, questions to be addressed, a further explanation for the choice of sub-category as well as indicators (when applicable).

7.2.1 Risk information

As explained in Chapter 4.2, the collection and an adequate presentation or illustration of data is a prerequisite. Ultimately, the use of data on disaster risks in spatial planning and SEA presupposes the existence or availability of such data and information. In cases of lack of data or when certain information is missing, spatial planning will not resort to a scientific evidence base and will thus have to base its decisions on experience, assumptions or local knowledge. This might hamper decision-making processes due to the missing scientifically founded and legal legitimation of the decision. Risk information therefore constitutes an important evidence base for planners in regard to the provision of essential support and legitimation for decisions in planning practice.

Consequently, when examining the use of risk information in SEA and spatial planning it is also necessary to look at existing information about risks. Addressing the first guiding question "How is risk information used?" involves an examination of available risk information that is currently used in spatial planning processes. Looking at risk information as such is a prerequisite for understanding the use of risk information in SEA and spatial planning. Moreover, in some cases legal regulations associated with risk information already require the planner to cope with disaster risks one way or the other[150]. Such regulations hence significantly influence the ways risk information is used and dealt with in spatial planning processes.

Main questions:

What kind of information is used in planning processes? Is risk information available and easily accessible?

Sub-Categories:

1. Availability and accessibility of risk information for spatial planning at the local planning level

This sub-category aims to assess if risk information:

a. Is available for both flood and landslide risks
b. Is easily accessible for spatial planners (for free and in real-time)

Explanation

In order to purposefully implement risk reduction measures or strategies in spatial planning, risk information needs to be made available for spatial planners, or municipal administrators responsible for spatial planning respectively, so that they can make use of and transform this information during the planning process. Many countries have established different national policies and legal frameworks for disaster risk reduction which determine how disaster risk should be assessed and managed. Some

[150] This is why Chapter 8 will first outline the legal basis for dealing with disaster risk in spatial planning and then present the most important maps that are used in planning processes to identify hazard-prone areas.

countries already have a well-elaborated framework for risk management due to the long tradition of hazard-mapping and risk management instruments (e.g. in France). Often the triggers for such autonomous and self-initiated acting and policy-making were disasters related to natural hazards that happened in the past and that urged the government to proactively react (e.g. in France and Italy). Other countries dispose of legal frameworks for dealing with natural hazards that are characterised by recent changes (e.g. in Poland). These changes are often consequences of subsequent natural events overlapping political transition which encourages continuous alteration of these frameworks.

Despite certain European (EU Directives) and national (national laws, decrees or ordinances) regulations, information is not always and necessarily available. This lack of information can cause serious problems when it comes to estimating and evaluating the best alternative and when trying to justify planning decisions towards the public. Therefore, the availability of information about hazards and risks is indispensable. The analysis conducted in Chapter 8 hence aims to assess, to what extent legal regulations exist that require the consideration of disaster risk in spatial planning. It also refers to already available risk information in the form of maps in the case study sites.

Information does not only have to be available, but it must also be accessible for end-users. Users have to be aware, where information can be found and how information or data can be retrieved. All necessary information should be easily accessible and retrievable without any additional efforts. This means in turn that information providers should make sure to provide important information on a platform that is accessible for all interested parties in real time and preferably free of charge. This way full consideration of important information can be ensured. Today, the internet enables a wide distribution and exchange of information. It represents a suitable means to collect, store and present information to end users. However, in some cases it is difficult to find information or to receive information, especially when data and information has to be paid for or when the required information has yet to be produced. Thus, besides the availability, the accessibility of information about hazards and risks is also an important prerequisite.

Indicators to be used in this context are the degree of availability and the degree of accessibility of risk information for spatial planning-related purposes.

7.2.2 Spatial planners as actors

The integration of scientific evidence into policy development and practical implementation is of great importance. This holds also true for spatial planning as one of the main actors in risk management. In this context the UNISDR (2009c, p. vii) underlines the need for *"diverse expertise from different fields of science"* as well as for better and faster interacting and communicating findings. Therefore, the sharing and dissemination of scientific information as well as its translation into practical methods is of great importance (see Chapter 4.2.2). Even though spatial planners are not necessarily required to have strong competencies in translating hazard or risk information into spatial planning, a good understanding of a) their role and responsibilities for risk reduction and b) the information about disaster risk provided is regarded as beneficial. After all, spatial planners are those who need to consider disaster risk in the first place. In this respect, it is also important that risk information exists in a form that is favourable for spatial planners. The best, scientifically sound information about risks is useless if in the end it cannot be appropriately used. This means that risk information needs to be communicated and presented in a form that can be easily processed by planners. The question is therefore whether risk information exists in a way that is easily understandable and interpretable.

The responsible planning authorities at local and regional level, or the planner respectively, have certain tasks to fulfil in terms of reducing risks. However, roles of actors involved in spatial planning and risk management vary from country to country and even between sectors and the administrative levels within one country (Fleischhauer et al., 2006). This means that each country has to adopt its own mandatory procedures. Planners are assigned with more or less responsibilities, depending on the planning level and the case study. In addition, the use of scientific knowledge to inform policy and practice depends on contextual differences between countries, including aspects such as political culture and social values and perceptions (Atkinson and Klausen, 2011; Nutley et al., 2010). Finally, spatial planners are not necessarily equally aware of all the natural hazards that menace a specific territory. This means that awareness can be greater for more frequently occurring natural hazards such as floods than for natural hazards with a comparably low probability such as earthquakes[151]. Existing awareness for a particular natural hazard is crucial, since a lack of awareness means that information about this particular hazard will neither be asked for nor used in planning practice. The assumption is that not only the roles and competencies of spatial planners will differ between the examined case study sites, but also, depending on the respective competences, their need for and their understanding of risk information.

When talking about the use of risk information in SEA and spatial planning it has to be considered that until today there is no specific, universally valid guidance on how to transform risk information into (legally binding) regulations within planning processes. It also needs to be considered that depending on the respective purpose, end-users of risk information have very specific demands on the exact content, the scale as well as the accuracy or readability, especially in regard to cartographic information in the form of maps (EXCIMAP, 2007, p. 13). This holds also true for spatial planners, who are expected to have specific needs for risk information as a basis for taking land use decisions. However, there seems to be little clarity as to what information exactly spatial planners need in order to purposefully deal with disaster risk in spatial planning (Prenger-Berninghoff and Greiving, 2015, p. 739) and how they use the information when preparing local spatial plans. Moreover, as already mentioned, existing information can only be as good as the requirements that were expressed and presented towards the information provider. This is why on the one hand there is a need for spatial planners to be able to express their needs towards the providers of information. On the other hand, information providers need to be aware of spatial planners as one of their target groups, including what information precisely this user group needs.

Finally, decision-making on local spatial plans is considered a rational process. This means that the final plan is a result of balancing all interests involved (van Stigt et al., 2015, p. 173). Such a rational process necessitates the consideration of multiple alternatives, which have to be weighed up against each other at an early stage of the planning process. Spatial planners should coordinate local preferences and/or contexts and stakeholder initiatives with existing sectoral policy objectives across different scales. What is needed for an effective risk management against the backdrop of a sustainable development is an

[151] For instance, the MOVE project (2011b, p. 73) revealed for the city of Cologne that *"the perception and the importance of the studied hazards is completely unbalanced"*. While awareness for flood hazards was high, awareness for earthquakes was low. Recommendations of the project therefore include that awareness for hazards other than floods should be raised within the city and the municipal authorities (MOVE, 2011b, p. 73).

integrated planning approach that considers different spatial demands. In order to ensure proper risk reduction, planners not only need to be aware of existing risks, but also of existing regulations for considering risks as one of many issues and elements within the planning process. This holds also true for the comparison of different planning alternatives or when choosing, for instance, low or no-regret measures (European Commission, 2013), which is fully in line with the requirements of the SEA Directive to *"prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme"* (CEC, 2001b, Annex I (g)).

In spatial planning, different concerns need to be considered. In particular planning systems which make use of hazard maps that consist of non-legally-binding provisions (see option 1, Table 4) require frameworks and methods that enable a proper comparison of different alternatives as well as a coordination of local preferences. The planner – having a comprehensive role – needs to have a minimum understanding of all different concerns and of the provided scientific input, respectively, in order to purposefully consider them. Considering and comparing various alternatives requires to be aware of all alternatives in the first place as well as the ability to assess respective consequences of all alternatives.

The situation is slightly different for planning systems which make use of a legally binding hazard map or plan, as the contents necessarily have to be considered by law. This in turn implies that spatial planners are aware of respective legal regulations as well as the existence of such plans.

Main questions:

What are the roles of spatial planners as one of the actors in risk management? What are their responsibilities? Do they use risk information at all? Are spatial planners able to easily apply and interpret available risk information at the local planning level? Are they aware of their specific needs? Are they able to express their needs?

Sub-Categories:

1. Awareness about the use of risk information

This sub-category aims to assess if planners are:

a. aware of the existence of regulations related to the application of risk-related information for preparing local spatial plans or know whether they have to consider risks, respectively
b. use information about risks in the first place

Results gained from the expert interviews should therefore aim to answer the following questions:

a) Does the planner know whether and how he has to take risks into account?
b) Does the planner use risk information as part of his planning practice?

Explanation

Within this category it should first be assessed, on a rather general level, whether planners are aware of existing regulations to consider risks. This means that by asking whether a) planners need to consider natural hazards in their work and b) they have specific information about these hazards, conclusions can be drawn about whether planners know if they have to take risks into account, i.e. if they are actually aware of the topic "risk reduction" as one of their concerns. Besides, more specific statements can be made about whether risk information is actually used.

An **indicator** to be used in this context is the degree of awareness of planners about existing regulations to consider disaster risk in spatial planning.

2. Usability, applicability and comprehensibility of risk information

This sub-category aims to assess if existing risk information is easily usable and applicable by spatial planners at the local level and if both visualised and non-visualised contents are comprehensible. In other words, it aims to assess if planners are able to use existing risk information.

The analysis is therefore geared towards the following questions:

a. Is the planner able to use and apply existing risk information for local spatial plans? (Is it useful to him?)
b. Is the planner able to comprehend and interpret existing risk information? (Does he understand the contents?)
c. Are needs of local planners for risk information especially in terms of spatial scale satisfactorily met?

Explanation

In principle, these questions are geared towards usability or applicability of risk information. In this context it should be clarified whether existing and provided risk information can be used by spatial planners or authorities responsible for spatial planning at the local planning level. Although risk information can be of high quality from a scientific point of view, it might still not meet the needs of the specific user group – or even be redundant. This may happen when the specific user needs are not taken into account and when authorities or individuals are provided with information they either do not actually need or cannot work with. As mentioned above, different user groups have different demands on content and readability of risk information (EXCIMAP, 2007, p. 13). Besides, depending on the need for information, different user groups require different scales or different resolutions, respectively (Meyer et al., 2011) especially in terms of details or contents displayed on a map.

The need for comprehensibility and clarity of provided information is a logic consequence of the defined requirements. Especially maps are essential tools to display information about hazards and risks. In order to be used in the most effective way, information on maps should be visualised in a way that is user-friendly and easily understandable and interpretable – also for lay persons. In the context of flood prevention, flood risk mapping is crucial to allow a clear understanding of flood risks, which may lead to (more) effective decisions on the type and scale of chosen measures to avoid, mitigate, transfer, compensate or even accept existing risks (EXCIMAP, 2007, p. 6). However, according to Meyer et al. (2012, p. 1702) *"in practice maps often fail to attain their potential to fulfil the needs of different users, to raise awareness and provide a clear and understandable source of information for planning"*. This stems from the fact that flood maps are often made by sectoral planning agencies, which have a specific, technical knowledge of mapping and flooding. Hence, the content is presented in a way, which sometimes cannot be understood or easily interpreted by lay persons and planners (Meyer et al., 2012, p. 1702). If responsible actors and authorities cannot appropriately understand and interpret the provided information, this may have significant consequences on the decisions taken and the measures planned.

Provided information must thus be usable, else there would be no reason for providing it in the first place. Comprehensibility and clarity of the information is just as important in this context. This has also been recognised within the ERA-NET CRUE funding initiative as part of their RISK MAP project[152]. One of the recommendations highlights, that *"end-users and map producers should be involved together to improve the usability and trust in the maps"* (Meyer et al., 2011, p. 287). The project identified the necessity *"to improve the contents of flood maps by considering user-specific needs"* (Meyer et al., 2012, p. 1702). Through participatory processes limitations but also the usefulness of maps could be discussed so that information users understand the content of the maps and how to interpret the mapped information.

This is why within this category it should be analysed, whether existing information satisfactorily meet the needs of spatial planners and whether planners are able to directly use and apply the given information. It should also focus on aspects which need improvement or alteration to ensure the comprehensibility of risk information.

Indicators to be used in this context can be:

- Degree to which planners are able to use and apply risk information at the local planning level;
- Degree to which planners are able to understand and interpret the information about risks at the local planning level without ambiguity.

3. Awareness of what risk-related information exactly to use

This sub-category aims to assess if spatial planners:

a. reflect upon what risk information they need or might need
b. are able to formulate demands on risk information towards information providers

Results gained from the expert interviews should therefore aim to answer the following questions:

a. Does the planner reflect upon what he needs or what he might need in terms of risk information?
b. Is the planner able to express his needs and to outline what information exactly he requires?

Explanation

As mentioned above, spatial planners use information and scientific knowledge as inputs when balancing different interests. It has also already been stressed, that such a balancing of interests requires a minimum understanding of all topics involved. In this context it is important that planners reflect upon the information they use und understand their rationale in order to more actively approach the problem of potential disaster risks. Simply taking the information for granted and applying it without really understanding the contents and coherences may result in unfavourable decisions. Therefore, within this

[152] The project RISK MAP "Improving Flood Risk Maps as a Means to Foster Public Participation and Raising Flood Risk Awareness: Toward Flood Resilient Communities" specifically addresses flood hazard and risk mapping. This means that recommendations are directed towards mapping flood hazards. This does not mean, however, that results cannot be applied to the handling of other types of natural or technological hazards.

category it should be assessed whether planners reflect upon the information they use and consider whether they need or might need different or additional information.

Moreover, this analysis will allow further conclusions on the ability of planners to express their needs. If sectoral planning authorities which produce the information are asked to consider user-specific needs, it needs to be clear what the user-specific needs are. When claiming the usability or non-usability of risk information it is not enough to merely express criticism towards the existing information. Planners are also required to be able to state what information they might need instead or in addition. In this context, it is important that spatial planners are aware of their own requirements so they can formulate demands towards information providers. Information of sectoral planning authorities can only be satisfactory once they know what they are supposed or expected to provide. This category therefore also aims to examine whether planners are able to express their needs.

Indicators to be used in this context can be:

- Degree of awareness of planners of what kind of information they need and what might be helpful to them;
- Degree of ability of planners to formulate demands for information towards information providers.

4. Awareness of different response options promoting the management of risks

This sub-category aims to assess if planners are:

a. aware of different strategies to deal with risks
b. capable or able to choose between different strategies to deal with risks

Results gained from the expert interviews should therefore aim to answer the following questions:

a. Is the planner aware of different strategies to deal with risks?
b. Is the planner capable and able to choose between different strategies to deal with risks or is he restricted in these choices?

Explanation

Sustainable development is one of the main principles of spatial planning. The Strategic Environmental Assessment promotes the notion of sustainable development by providing for a high level of protection of the environment. In the face of conflicting development goals and external pressures, it is often quite difficult to reconcile new development with contradicting concerns such as environmental protection and risk reduction. Rajvanshi (2008, p. 167) points out, that *"in order to encourage sustainability of development projects and to maintain current levels of natural capital, among other things, it is necessary to innovatively use planning and decision making tools"* and names SEA as one important tool. The author continues to explain that SEA (or environmental assessment in general) pursues to avoid negative environmental effects and promote positive ones. However, its actual role consists mainly in reducing, mitigating and sometimes compensating negative environmental impacts (Rajvanshi, 2008, p. 167). In order to choose the best planning alternative, different options have to be compared with each other (see above). The planner should hence use a holistic knowledge to enable different solutions to respond to existing societal risk problems. By being able to apply the different strategies of avoidance, mitigation and compensation, new development does not have to be prohibited a priori[153]. Although the chosen alternative might not necessarily be the most environmentally friendly in the end, it might still be the most sustainable of all options possible in the long-term. Considering the medium- to long-term planning horizon of land use plans, planning decisions should be future-oriented and take account of potential future changes which might impact the plan.

However, it is essential to keep in mind that it is not only important to consider negative impacts of the plan on the environment, but also the impact of a changing environment on the proposed plan. This does also include climatic changes and climate change-induced natural risks. By implication spatial planning should be able to apply different strategies for a more sustainable and resilient future-oriented development. This in turn requires that planners are aware of the different alternatives. It also requires that they are able to make use of all of these strategies and are not restricted in certain development choices beforehand.

This category therefore serves to assess, to what extent the current planning systems allow for or foresee the consideration of measures to avoid, reduce or compensate significant negative impacts and/or to what extent spatial planners are even aware these different alternative strategies can be applied.

An **indicator** to be used in this context can be the degree of awareness of spatial planners of different risk management options.

5. Adoption of a future perspective

This sub-category aims to assess if planners adopt a future perspective

Results gained from the expert interviews should therefore aim to answer the questions:

a. Does the planner develop and compare alternatives, including the zero alternative, to be able to choose the most resilient option?

Explanation

Spatial planners are involved in activities related to managing natural risks and therefore need to be aware of their potential contribution to a successful long-term risk reduction strategy. The existence of legal regulations alone is not sufficient. Spatial planners may indeed understand and use risk information in planning processes. However, they also need to be aware of the long-term consequences of the planning decisions. They should evaluate different options and alternatives and then choose the best option available, which also includes options to promote risk reduction. This requires holistic knowledge of the territory. Even if spatial planners are no experts in risk assessment, ideally they have a comprehensive understanding about the functionalities of the territory and can provide for an appropriate balance between land use needs of a commune and its needs for security against adverse impacts caused by disaster risks – today and in the future (Jha et al., 2013).

Again, this is in line with the objectives of the Strategic Environmental Assessment, which – in order to provide for a high level of protection of the environment – demands *"an outline of the reasons for selecting*

[153] According to Rajvanshi (2008, p. 167), mitigation and compensation aims *"at preventing adverse impacts from happening and keeping those that do occur within acceptable levels"* by *"developing measures to avoid, reduce, remedy or compensate significant adverse impacts of development proposals on environment and society"*.

the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information" (CEC, 2001b, Annex I (h)). After all, not only the likely significant effects on the environment of the envisaged plan have to be assessed, but also reasonable alternatives need to be identified as part of an environmental assessment. When aiming to identify the most resilient alternative, spatial planners necessarily need to analyse the evolving environmental baseline trends. In this context the European Commission (2013, p. 11) suggests to use *"vulnerability assessments to help assess changes to the baseline environment and identify the most resilient alternative(s)"*. Hence, an adoption of a future perspective is needed in order to evaluate different alternatives and to consider a possible future change in vulnerability with the prospect to identify the most resilient alternative.

An **indicator** to be used in this context can be the degree of assessed alternatives in the environmental report – including the zero alternative.

7.2.3 Planning process

As mentioned above, the main category "planning process" deals with how risk information is used and processed in SEA and spatial planning in general. It therefore more specifically focuses on actual ways of how risk information is transformed into legally binding planning regulations during the planning process. Since there is no real guidance on how to transform risk information into planning regulations within the planning processes, actual practices in the case study sites are expected to differ. This holds also true for the identification of unforeseen adverse effects. As required by the SEA Directive, Member States shall monitor environmental effects of PPPs in order to identify at an early stage unexpected and unpredicted adverse effects and be able to appropriately react by taking remedial action (Article 10). In this respect, disaster risks should be considered during the monitoring process as one of the aspects that might envoke unforeseen adverse effects. According to that, risk information also needs to be applied during the monitoring stage. Monitoring activities are expected to equally differ among case study areas, however.

The problem of uncertainty and the question how planners deal with uncertainties and how they take into account future changes is an important aspect to consider. Uncertainty can be a major drawback for decision-making and may provoke hesitation. It can also necessitate to build in safety margins and to implement additional protection measures. Due to potential disasters and resulting damaging effects there is a clear need for no- or low-regret measures (van Buuren et al., 2013, p. 32). Other issues to be analysed are ways of public participation and involvement related to risk reduction aspects. Furthermore, examining the use of risk information in SEA also plays an important role. SEA is a suitable tool for both incorporating an analysis of impacts of planning decisions under uncertainty (Zhu et al., 2011) and including risk assessments (European Commission, 2013). Although the potential relevance of SEA for risk reduction and the need for SEA to consider risks has already been highlighted by the DG Environment, disaster risk has not yet gained a prominent role within SEA (see Chapter 5.2). Concerning planning instruments, main information about the characteristics of formal planning instruments, including their application, can be derived from literature. Moreover, both literature study and expert interviews will help identify informal planning instruments that involve risk information. However, in order to receive personal opinions and attitudes, expert interviews will also refer to existing planning instruments.

Main questions:

How is the problem of risk and risk reduction actually dealt with in the planning processes? How is risk information processed in planning practices? How is risk information turned into legally binding planning regulations at the local planning level?

Sub-Categories:

1. Communication and handling of uncertainties in risk information

This sub-category aims to assess how uncertainties are dealt with in spatial planning and how spatial planners deal with uncertainties in risk information.

The analysis is therefore geared towards the questions:

a. How is uncertainty communicated?
b. Are spatial planners aware of uncertainties?
c. How do spatial planners deal with uncertainties?

Explanation

Hazard and risk mapping can never be exact and there is a certain level of uncertainty in every modelling approach. This level of uncertainty *"dictates the accuracy of mapping products, and needs to be understood in order to know how closely the mapping represents what users would see as an accurate representation"* (EXCIMAP, 2007, p. 42). Hence it is essential that uncertainty factors are made transparent to the end-users, as *"decision-makers need to be aware of the degree of uncertainty attached to the results of the evaluation of the available scientific information"* (CEC, 2000, p. 3), which holds also true for spatial planners as one of the main users of risk information. This means that in the context of risk reduction it is important to consider the uncertainties connected to risk assessments and predictions of future developments, especially related to climatic and socio-demographic changes.

It is crucial that spatial planning addresses uncertainties and that both uncertainties in scientific information and in future developments are dealt with in spatial plans and planning processes. When referring to climate change, van Buuren et al. (2013, p. 32) point out that *"taking decisions about how to adapt to climate change in the face of uncertainty is very difficult. After all, we don't know whether adaptation is necessary, whether it is enough and whether it does generate the intended results"*. This holds also true for risk reduction strategies and taking decisions about how to cope with possible future disasters. In this context, strategies or principles are needed that guide spatial planning decisions towards implementing the most purposeful measures in the face of uncertainties.

Problems related to uncertainty can partly be avoided by gathering sufficient knowledge through closer collaborations with experts and scenario development (Pütz et al., 2011, p. 52). One option to handle uncertainty related to modelling approaches is to make this uncertainty visible. In this context, maps and explanatory texts can support the communication of methodological uncertainties as well as uncertainties in hazard and risk mapping in a clear and transparent way (EXCIMAP, 2007, p. 43). By using classes and intervals, uncertain information can be adequately expressed (EXCIMAP, 2007, p. 42). For flood maps this could be a presentation of different return periods and thus different flood extents. A second option is to build in more regular updating of hazard maps. Since hazard maps serve as the basis for spatial planning a regular updating of such maps could ensure the consideration of evolving hazard profiles (OECD, 2007, p. 81). One way of dealing with or responding to the communicated uncertainties *"consists of accepting the remaining uncertainty and including it as one more factor into the decision making process"* (EEA, 2009, p. 8). This could lead, for instance, to implementing no- or low-regret measures.

The analysis related to uncertainties in risk information is directed towards identifying how uncertainties are communicated in the case study sites, detecting whether spatial planners are aware of such uncertainties and recognising how they deal with these uncertainties.

Therefore, an **indicator** can be formulated as follows: Degree to which spatial planners are aware of uncertainties in risk information.

2. Public involvement when handling risks in spatial planning

This sub-category aims to assess whether any kind of public involvement or participation is considered useful for risk-related decisions in spatial planning.

The analysis is therefore geared towards the questions:

a. Is public involvement or participation considered useful when it comes to dealing with problems related to disaster risks?
b. To what extent does public involvement related to problems of disaster risks in spatial planning take place?

Explanation

Any decision on implementing a local spatial plan requires public support. Van Stigt et al. (2015, p. 170) explain that *"an urban plan that lacks public or stakeholder support may be abandoned by the decision-makers, although expert knowledge is available that, in the experts' view, renders a decision to go ahead with the plan fully rational from a technical perspective"*. This means by implication that spatial planners or local administrators responsible for spatial planning use expert knowledge mainly to balance all interests to the end of achieving a decision which can count on public support. After all, sometimes it can be important to be able to explain certain decisions to the public (van Stigt et al., 2015, p. 171). In order to avoid public resistance, continuous involvement and participation of the public can be an asset. Otherwise local administrators risk that due to a lack of public support or due to public resistance a plan could be abandoned.

In the face of uncertainties in risk assessment it will become harder for public authorities to reach justifiable planning decisions. This is why a justification of actions and the reaching of a consensus about thresholds for acceptable risks become even more important (Greiving et al., 2013, p. 3). Public involvement can support a consensus, especially when the affected population is involved early in the process.

The role of the public in urban planning and the question whether urban planning is a public issue depends on the according planning system. At the same time, the attitude of the public towards planning decisions related to disaster risk depends on the according cultural context. It is therefore interesting to assess, whether and to what extent public involvement and participation takes place when dealing with disaster risk in spatial planning.

An **indicator** for this category can therefore be: Degree to which public involvement or participation takes place when dealing with disaster risk in spatial planning.

3. Use of risk information in SEA

This sub-category aims to assess whether risk information is used in SEA, i.e. whether natural risks are mentioned and considered as a topic within the environmental report.

Explanation

The main role and characteristics of SEA have already been discussed in detail in Chapter 5. Chapter 5 also explained why SEA is a suitable tool for including risk assessments and for adequately informing the planning process. An advantage of using SEA as a basis for providing information about risks is the fact that SEA is an already existing instrument which provides a common procedural basis for conducting risk assessments in spatial planning processes (European Commission, 2013). It therefore constitutes an already defined procedure which promotes the consideration of hazard or risk maps at an early stage of plan development. Ultimately, risks should be integrated from the very beginning of the planning process and the elaboration of a document. SEA therefore allows for an early assessment of assets at risk and potential consequences of the plans' implementation (European Commission, 2013, p. 16). Furthermore, multiple alternatives are supposed to be considered at an early planning stage. These alternatives should be balanced using scientific knowledge and information. The consideration of alternatives and their weighing ensures the selection of the best option available[154]. Hence, by including risk assessments into SEA it can significantly contribute to a more effective risk management. It also conforms to the requirements of the SEA Directive to prevent, reduce and offset significant adverse effects.

However, as already mentioned, the topic of disaster risks is often neglected in SEA. Overall efforts should be taken to strengthen the role of SEA in dealing with disaster risk. In order to determine the status quo of the use of risk information in SEA – both from a regulative and practical point of view – the conducted analysis involved the study of legal documents as well as the interviewing of SEA experts. The latter could be either spatial planners that are responsible for also producing the environmental report or separate SEA consultants and representatives from local and regional authorities. These experts were supposed to provide knowledge and experiences from a practical point of view. Both literature study and expert interviews aimed to identify theoretical and practical handling of risk information in SEA.

An **indicator** for this category can be: Degree of the use of risk information in SEA.

4. Risk information in informal planning instruments

This sub-category aims to assess whether informal planning instruments play a role in planning for disaster risk reduction.

The analysis is therefore geared towards the question:

- Do informal plans exist in the case study sites that deal with risk information?

[154] It needs to be acknowledged, however, that *"not all alternatives are being considered, not all consequences of each alternative are known and the consequences that are known do not bear equal weight to all stakeholders"* (van Stigt et al., 2015, p. 175).

Explanation

As outlined in Chapter 4.2, apart from formal planning tools spatial planning can also make use of informal planning tools. A complementary application of informal planning instruments can play a significant role in identifying and evaluating diverse relations and connections, involving further actors and initiating important and necessary activities (Birkmann, Böhm et al., 2013, p. 12). Urban planning normally has a wide range of both formal and informal instruments at hand, in order to implement a sustainable urban development for preventing potential risks of disasters (Schauber, 2003, p. 3). Although formal instruments are necessary to help enforce required measures, they are not the solution to every problem.

One of the reasons for shortcomings in planning and implementation of planning measures are often lack of knowledge, uncertainties and prejudices towards new developments and changes. Other reasons are lack of motivation, misunderstandings and problems in communication among stakeholders and the actors involved (Schauber, 2003, p. 4). Discourse-oriented approaches will become more important, since different interests and values can be considered so that stakeholders can define a common line of approach (Greiving, 2010, p. 30). Furthermore, resilience of a society in terms of climate and natural risks depends on the levels of comprehension, acceptance and participation of the general public in political discussions (Greiving, 2010, p. 30). In this context acceptance of decisions among stakeholders regarding preventive and adaptive planning is extremely important. Since decisions are usually made under great uncertainties, they lack a convincing and justification giving evidence base.

Accordingly, informal instruments such as informal plans and programs, participatory instruments, socio-political approaches, voluntary communal commitment etc., will have to gain more importance and play a bigger role in the future. By more regularly applying “soft” instruments, acceptance can be fostered and voluntary commitment strengthened. This would help make adaptive and preventive planning more effective and successful in the long term. This category therefore intends to evaluate, whether and to what extent informal planning instruments already play a role in planning for risk reduction.

An indicator for this category can be: Degree to which informal planning instruments exist that include risk information and/or deal with disaster risk reduction.

7.2.4 Communication and consultation

Communication of disaster risk is an important aspect of risk management or risk governance in general. In fact, *“a good risk governance calls for an efficient risk communication that fosters an interactive process of exchanging information and opinions about risk-relevant issues among individuals, groups and institutions”* (Zeidler and Siegel, 2011, p. 17). This statement already hints at the importance of information exchange and of fostering understanding. Risk communication has been enshrined as a fiduciary responsibility of official entities in different EU policy documents such as the Aarhus Convention, the Seveso II Directive (Directive 96/82/EC), the Water Framework Directive and the Flood Risk Directive (Höppner et al., 2010, pp. 8–9). Today there is an emphasis on two-way communication and knowledge transfer, in which all actors – both members of the public and risk managers – should engage, be involved in and learn from each other (International Risk Governance Council, 2006, p. 54). By combining a bottom-up approach with a top-down approach consensus-building among all involved and affected stakeholders can be ensured and decision-making can be facilitated[155] (Zeidler and Siegel, 2011, p. 17). In this context, one of the main objectives of risk communication is building mutual trust. The IRGC (2006, p. 54), while referring to the OECD (2002), explains that *"the ultimate goal of risk communication is to assist stakeholders in understanding the rationale of risk assessment results and risk management decisions, and to help them arrive at a balanced judgement that reflects the factual evidence about the matter at hand in relation to their own interests and values"*. Hence, building mutual trust and a common understanding of the situation at hand is essential for taking appropriate spatial planning decisions.

This is an important aspect to consider by spatial planning authorities. When aiming to involve the public and to promote public participation to gain both useful and accepted outcomes, spatial planning needs to be fully aware about the message they are conveying. In order not to receive irrelevant, worthless reactions from the public during processes of public involvement, planning authorities not only need to explain the meaning behind their messages well but they also need to be able to justify decisions and the results of the weighing up process. Hence, all planning processes require transparent plan- and decision-making. This means that the planner himself has to understand the topics at hand. Otherwise consensus building might be hampered by the lack of credibility of decisions and management measures. In fact, when referring to assisting stakeholders in understanding the rationale of risk assessment results (see above), this holds also true for spatial planners as one of the groups of stakeholders.

Risk communication generally serves different purposes, depending on the respective topics, audiences and messages. Höppner et al. (2010, p. 56) list different purposes and functions of risk communication which can be summarised as follows:

- Provide information to improve knowledge on disaster risk and foster acceptance of selected measures;
- Raise awareness;
- Determine perceptions of risk, needs and knowledge;
- Enable mutual information and knowledge exchange as well as mutual understanding and learning;
- Improve relationships and coordination between different stakeholders and actors in order to promote cooperation and efficient coordination of tasks.

All these purposes are equally relevant for the public and for spatial planning actors. Consequently, using risk information in SEA and spatial planning requires risk communication that ideally meets these purposes.

Risk governance and communication usually involve the coordination of various sectors at horizontal and vertical scales as well as the communication with, and the involvement and participation of, different stakeholders and the public (Zeidler and Siegel, 2011, p. 17). In this respect, communication can be regarded as the key element between providers and users of risk information. There are different existing forms of communication and consultation. In this study communication refers to rather simple "informing",

[155] Especially in the light of growing uncertainties, consensus building becomes more and more important. Due to the fact that legally binding land use provisions and designations become hardly justifiable under uncertain conditions, stakeholder and public involvement and sufficient communication are keys to enable consensus and a better acceptance of decisions and measures.

i.e. the provision of information, as well as to processes of information sharing and exchange. Consultation means asking stakeholders for their opinion and views on a particular topic. It is furthermore complemented by stakeholder involvement and participation.

As explained in Chapter 3.2.4, communication can be based on either formal or informal approaches, whereas both forms of communication are needed in risk governance processes. This holds also true for consultation processes. Opening a risk management process to informal participation is a crucial element for a successful procedural approach. In flood risk management processes, for instance, informal participation can improve efficiency and acceptance of decisions and measures (Fleischhauer et al., 2012, p. 2787).

Main question:

Is information communicated in formal procedures only or also in informal discourse processes (e.g. to provide useful data and information, offer early feedback, abbreviate the consultation stages, seek clarification and focus on the most relevant issues)?

Sub-Categories:

1. Informal communication in the form of information exchange (2-way-communication)

This sub-category aims to assess whether an informal information exchange between spatial planners and information providers (e.g. sectoral planners) takes place with the aim of increasing the spatial planners' knowledge.

The analysis is therefore geared towards the question: Is information and knowledge transferred towards spatial planning authorities or consultants by informal communication processes?

Explanation

In spatial planning processes, planning-relevant risk information necessarily has to be conveyed to spatial planners. Likewise, spatial planners need to collect relevant risk information to base their decisions on. This type of "simple informing" rather conforms to a one-way communication process. However, as noted by several authors (e.g. DeGraff, 2012; Jha et al., 2013; Sapountzaki et al., 2011) successful risk reduction necessitates an interdisciplinary, cooperative approach. This means that the mere provision of information is not sufficient. In order to convey information in a comprehensible way, two-way communication is crucial. This way contents can be explained, understanding can be improved, misunderstandings can be eliminated and demands can be formulated. As mentioned above, the UNISDR (2009c, vii) highlights the need for diverse expertise from different actors as well as for better and faster interacting and communicating findings. This statement underlines the need for stronger interacting and information exchange.

Since formal communication processes are often limited, informal communication is needed in order to provide for sufficient interacting and a mutual communication of relevant risk information. Only when cooperation between different actors takes place, an effective risk reduction strategy can be ensured. This is also a relevant aspect to be considered for SEA processes. The SEA Directive requires the consultation of authorities with specific environmental responsibilities. However, as mentioned in Chapter 5.1.2, these consultations are often not carried out thoroughly enough, since environmental authorities are not always sufficiently consulted on the content and/or the results of the SEA process. Hence, this formal consultation of environmental authorities does not always seem to be effective. Informal discussions and discourses are likely to help clarify the situation, offer early feedback, raise awareness or suggest amendments at an early stage of plan development (The Scottish Government, 2013, p. 7). Plan makers should take the opportunity for a continuous dialogue with those authorities to be consulted. This dialogue should start at an early stage, as this may help identify key issues at the beginning of the process (The Scottish Government, 2013, p. 48). Considering the fact that spatial planners have to consider many different aspects when preparing a plan and that opportunities to discuss the findings from an environmental assessment might be rare, an informal dialogue can be supportive of the SEA process in terms of helping to achieve better environmental outcomes (The Scottish Government, 2013, p. 12). In addition to the formal consultation phases, SEA should therefore also promote an early informal communication as this may help avoid lengthy responses by the consulted authorities. Ultimately, *"informal contact, either through meetings or workshops, can provide real benefits and identify key areas of interest prior to the main consultation*" and may "*improve mutual understanding of the plan and its effects"* (The Scottish Government, 2013, p. 48). Such informal dialogues can prove particularly supportive when dealing with topics as complex as climate change or disaster risks. Moreover, these subjects are difficult to capture in their entirety, which is why informal dialogues can help establish what is important, focus on relevant issues and help collect and consider useful data and information about risks.

As explained in Chapter 3.2.4, cooperation involves an alignment of interests. Thus, different concerns can be expressed and be mutually considered. For instance, effective cooperation would involve a mutual revealing of interests as well as respective needs. In this context, spatial planners should be able to formulate demands towards sectoral planners – or information providers in general. When considering the problems of scale and fit, existing information may be hardly applicable. This is why spatial planners should be given the chance to also express what they need, instead of simply accepting what they receive. Moreover, an alignment of interests can only be achieved when enabling or ensuring a proper understanding of the topic at hand, which in turn presupposes both formal and informal communication. In particular, spatial planners and sectoral planners need to cooperate in order to achieve a common goal, i.e. the reduction of flood and landslide hazards. In this context DeGraff (2012, p. 58) suggests, that *"the incorporation of (…) landslide hazard information into the planning process is improved by a continuing interaction with geological professionals"*. Wein and Bernknopf (2007, p. 1660) point out that the assessment and management of societal risks require a multidisciplinary team involving actors from different scientific disciplines.

Finally, cooperation between different authorities and entities can foster awareness raising and enhance knowledge, which is both crucial for an appropriate consideration of risks in decision-making and planning processes. Cooperation can promote mutual understanding, which might significantly contribute to choosing the most appropriate planning measures.

An **indicator** for this category can be: Existence of informal communication processes and information exchange between spatial planners as users of information and sectoral planners as providers of information.

2. Communication in the form of stakeholder involvement (2-way-communication)

This sub-category aims to assess whether (informal) stakeholder involvement or participation takes place.

The analysis primarily addresses the question: Are spatial planners involved in hazard and risk mapping processes?

Explanation

Fleischhauer et al. (2012, p. 2787) stress that *"participation and information support in most cases a higher quality of decisions, help to reach an agreement on open questions or help to effectively implement decisions that are made by public as well as private actors"*. Stakeholder participation should be considered a two-way communication process which aims to develop a well-informed basis for risk management and planning processes. Due to elements of codetermination, participatory approaches are supposed to yield more success. This can also hold true for the links established between sectoral and spatial planning authorities, i.e. spatial planners or planning authorities may be involved in hazard and even more so in risk mapping.

Different sectoral planning entities and spatial planning authorities need adequate coordination mechanisms, so that urban and regional planning can fully exploit their potential in risk management. The WMO (2008, p. 14), for example, points out that although the need for a closer coordination between (flood) risk management plans and spatial planning has long been identified, it is not particularly easy to facilitate such integration. Respective policies and planning practices are implemented and realised by different stakeholders and authorities. Consequently, it is of great importance to foster a mutual understanding of risk management and spatial planning. Efforts should therefore be directed towards enabling interaction between such actors.

In regard to flood risk management the EU Flood Risk Directive explicitly asks in Article 10 to encourage *"active involvement of interested parties in the production, review and updating of the flood risk management plans"* (CEC, 2007b). In spatial planning practices this active involvement should ideally be extended towards the production of hazard and risk maps. In this respect, Meyer et al. (2011, p. 287) explain that *"participation should also aim to include professional stakeholders with different but related responsibilities"* because *"a participatory process that involves both end-users and those producing the maps can raise trust in the accuracy and credibility of the maps and those producing them"*. Furthermore, information providers, or map producers in this case, could explain the content to improve understanding and interpretability of the maps. Project results of the RISK MAP project revealed that participation in mapping is quite important: *"Participation in mapping enables and facilitates a two-way learning process, network building and improved understanding of maps and their interpretation both on the side of produces as well as users"* (Meyer et al., 2011, p. 5). Although the main user group of the RISK MAP project included strategic planners, this statement can be extended for spatial planners alike. This means that both legal provisions and practical experience suggest a stronger involvement of information users, including spatial planners, in the mapping process.

Indicators for this category can be: Existence of participation processes or degree of involvement of spatial planners in preparing or developing hazard and risk maps.

7.3 Summary

The categories and indicators outlined in Chapter 7.2 suggest good practices in dealing with risk information in SEA and spatial planning. Evidence for these categories and indicators was taken from literature study. This means they represent selected examples of how risk information should be used. Four main categories were chosen in order to narrow down possible categories and indicators:

1. Risk information
2. Spatial planners as actors
3. Planning process
4. Communication

Sub-categories were formulated referring to specific problems and difficulties in dealing with risk information or prerequisites that promote a good handling of risk information in SEA and spatial planning. Certainly, further categories are conceivable. The listed categories and indicators were selected under the premise that they can be examined either by literature study or expert interviews.

Accordingly, the categories are the basis for the contents of Chapters 8 and 9 and structure the results of the analysis. Chapter 8 and 9 also aim to answer the research questions that were formulated in Chapter 1. While Chapter 8 refers to the planning process of spatial plans as such and how risk information is used in spatial planning in general, Chapter 9 refers to SEA practices for spatial plans in the three case study sites and how risk information is used in SEA in particular.

8. Dealing with disaster risks in spatial planning in the case study areas

In each of the case study areas, the use of risk information in spatial planning follows certain provisions and is always embedded in a specific cultural context. After an explanation of the characteristics of planning systems and SEA practices in France, Poland and Italy in Chapter 6 and highlighting the main disaster risk conditions of the communes concerned, the focus of this chapter lies on the combination of these aspects. Accordingly, this chapter will highlight how spatial planning – or spatial planners respectively – deals with disaster risk in the planning process. Special emphasis is therefore placed on questions or topics concerning the disaster-risk-related legislative framework as well as the use of risk information in spatial planning processes and problems persisting in this field. In particular, first the legal basis for dealing with natural hazards in spatial planning will be presented, including (legal) obligations for the preparation of risk information in the form of maps (Chapter 8.1). Then the planning practices will be examined and ways identified in which risk information is used and presented in different planning instruments and transformed into (legally binding) planning decisions with a particular focus on local level planning instruments (Chapter 8.2).

8.1 The legal basis for dealing with disaster risks in spatial planning

Before presenting in detail the current planning practices in the case study areas in regard to the actual use and application of risk information (Chapter 8.2), it is important to look at and explain the existing legal basis for dealing with natural hazards in spatial planning. Taking into account the legal framework and existing laws and (legally binding) regulations with an influence on spatial planning is vital, as *"the legal regime governing land use planning frames the effectiveness of using it as a tool for reducing risks"* (RCC, 2011, p. 24). Therefore, in the course of this chapter planning systems and policies will be examined regarding those legal bases that influence the handling of risks.

For each case study, first the general legal basis for dealing with natural hazards in spatial planning will be presented. Subsequently a particular focus lies on the legal framework for preparing hazard and risk maps for floods and landslides, considering the fact that maps are one of the most important sources of information for spatial planners (see Chapter 4.3). Consequently, special attention will be given to the legal basis regarding the preparation of these maps.

8.1.1 France

Risk prevention in France has always been treated with great concern. Already at the beginning of the 1980s, the French government chose a legal path. It decided in 1982 to put into place a prevention system which combines land use development control in hazard-prone areas with a payment of compensations by insurance companies in case of a damage caused by a hazard (Dubois-Maury, 2002, p. 637). In general, the legal basis for dealing with disaster risk in France has a long history and is therefore quite elaborate (see Box 3). Several codes and acts refer to the handling of disaster risk in spatial planning and indicate the importance of risk prevention for the French state[156].

Box 3 Relevant laws and acts for dealing with disaster risk in the French planning system (Source: own elaboration adapted from European Communities, 2000)

Urban Planning Code
Code de l'urbanisme et de l'habitation

Environmental Code
Code de l'environnement

Decree no. 95-1089 of 5th October 1995 on prevention plans for natural risks
Décret n° 95-1089 du 5 octobre 1995 relatif aux plans de prévention des risques naturels prévisibles

Law no. 95-101 of 2nd February on strengthening the protection of the environment
Loi n° 95-101 du 2 février 1995 relative au renforcement de la protection de l'environnement (Loi Barnier)

Law no. 2000-1203 of 13th December 2000 on solidarity and urban renewal
Loi n° 2000-1203 du 13 décembre 2000 relative à la solidarité et au renouvellement urbains

Law no. 2003-699 of 30th July 2003 on the prevention of technological and natural risks and the compensation of damages
Loi n° 2003-699 du 30 juillet 2003 relative à la prévention des risques technologiques et naturels et à la réparation des dommages (Loi Bachelot)

Law no. 2009-967 of 3rd August 2009 for programming the implementation of Grenelle Environment (Law Grenelle 1)
Loi n° 2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement (Loi Grenelle 1)

Law no. 2010-788 of 12th July 2010 on the national commitment to the environment (Law Grenelle 2)
Loi n° 2010-788 du 12 juillet 2010 portant engagement national pour l'environnement (Loi Grenelle 2)

The natural hazard approach in the French spatial planning system finds its legal basis in Articles L110 and L121 of the legislative part of the Urban Planning Code. Article L110 foresees harmonised decisions on the use of land by local authorities. Besides, special attention should be paid to ensuring public security and public health. The Urban Planning Code further mentions the task of land use planning to contribute to the fight against as well as the adaptation to climate change. Article L121 refers to the task of spatial planning to prevent natural hazards. It stresses that the SCoT, the PLU and the "cartes communales" are supposed to determine the conditions which ensure the prevention of natural and technological risks, among others. Finally, in the regulatory part of the Urban Planning Code, Article R123b demands that the graphic documents which illustrate the areas U, AU, A and N (see Chapter 6.2.1) outline those areas where the likely occurrence of natural hazards such as floods, forest fires, erosion, landslides, avalanches or the occurrence of technological risks justifies that any kind of permanent or non-permanent

[156] One of the reasons for following a strong prevention-oriented strategy is the French system for loss or damage compensation in case of disasters. The French system foresees the payment of premiums by citizens and ensures the provision of compensations when affected by a disaster. Accordingly, it combines the idea of egalitarianism by demanding payments with the national principle of solidarity by guaranteeing indemnification granted by the national government (Consorcio de Compensación de Seguros, 2008). Consequently, the state tries to invest as much as possible into prevention.

constructions or installations, plantations, deposits, etc. are either prohibited or subject to certain requirements and conditions.

In addition to the Urban Planning Code, the Environmental Code plays an important role in regard to the consideration of natural hazards in spatial planning. In particular, Book V ("Livre V") of the Environmental Code of both legislative and regulatory parts includes many regulations on the prevention and the consideration of natural hazards in Title VI ("Titre VI") "Prevention of natural risks" ("Prévention des risques naturels"). Contents address aspects such as risk prevention plans and other prevention measures, evaluation and management of flood risks as well as prevention schemes for major natural risks. Apart from general provisions – encompassing all natural hazards – the Environmental Code also refers to tools that are specific to a certain hazard. This includes flood hazards, as the main natural hazard in France, but also mass movements, seismic risks and avalanches (Tifine, 2013).

Several heavy floods in 1993 and 1994 prompted the French government to react in terms of advancing risk prevention. As a response to these major floodings, the national government adopted a 10-year programme for the prevention of major natural risks ("Programme décennal de prévention des risques naturels majeurs") at the beginning of 1994[157]. A large part of this programme is directed towards the prevention of floods, with a special focus on the following three objectives: *"to prohibit any human settlements in the most dangerous areas, to preserve the flow and expansion capacities of rivers and to safeguard the equilibrium of natural areas and the quality of the landscapes"* (European Communities, 2000, p. 114). The European Commission (2000, p. 114) continues to explain that the legal and financial framework for the 10-year programme was later established by "Loi no 95-101 du 2 février 1995 relative au renforcement de la protection de l'environnement" (Law no. 95-101 of 2nd February on strengthening the protection of the environment), commonly known as "Loi Barnier". It was issued by the French congress and is codified in the Environmental Code. The Loi Barnier was supposed to improve the existing, rather unorganised handling of zoning instruments and thus introduced the "Plan de Prévention des Risques Majeurs", PPR (Risk Prevention Plan), replacing all former, discordant instruments[158]. The PPR is a plan designed for the prevention of ten different types of hazards. This includes avalanches and storms as well as floods, landslides, forest fires, earthquakes and volcanic eruptions (Law no. 95-101, Article 16). The PPR is a flexible instrument which can adapt well to the respective local conditions and needs[159] (European Communities, 2000, p. 114; Mancebo, 2009, pp. 220–221). The introduction of the PPR had essential consequences for and impacts on spatial planning instruments.

In addition to the "Loi Barnier", a second law plays an important role for risk management in France: the "Loi n° 2003-699 du 30 juillet 2003 relative à la prévention des risques technologiques et naturels et à la réparation des dommages" (Law no. 2003-699 of 30th July 2003 on the prevention of technological and natural risks and the compensation of damages)[160]. This so-called "Loi Bachelot" introduced innovations

157 It should be stressed that the programme does not only cover flood-prone areas but all areas exposed to natural risks.

158 A couple of zoning instruments has already been developed between 1935 and 1994. However, due to the complexity and diversity of the underlying policies as well as the lack of resources needed for the preparation of these plans, existing instruments were either difficult to implement, required a long procedure, or could not take full effect (Mancebo, 2009, p. 220).

159 See below for a more detailed description of the PPR.

160 The law was issued after the catastrophic event of AZF ("Azote Fertilisants") in Toulouse and legally required the consideration of technological risks within the PPR.

for a better disaster risk management and created the "Schémas de prévention des riques naturels" (natural risks prevention scheme) (Tifine, 2013). It involves provisions regarding the inclusion of risk information within the local land use planning documents, the SCoT and the PLU, in order to ensure that disaster risks are taken into account in local land use planning. The PPR serves as a "servitude d'utilité publique" (SUP), which means that the PPR imposes public utility easement status on areas at risk. Since it is legally binding, land use plans necessarily have to implement its regulations and have to adopt zones at medium and high risk as illustrated on the map of the PPR. The PPR is also attached as an appendix to the SCoT and the PLU.

As mentioned in Chapter 6.2.1, in December 2000 the parliament adopted the Loi SRU that significantly changed the French planning instruments and rules (Guet, 2005, p. 2). With the adoption of the Loi SRU, the French state confirmed its endeavour to ensure and enforce the consideration of natural hazard prevention as part of the PLUs (Dubois-Maury, 2002, p. 643). With the introduction of the new planning instruments, it was possible to have the PLU set the general rules, provisions and land use rights in terms of risk prevention. PLUs can clearly deny or accept construction permits in hazard-exposed areas under certain conditions.

The Laws Grenelle 1 and Grenelle 2 represent the latest amendments in legislation with consequences for the handling of risk information in spatial planning. Law Grenelle 1 is a programming law that involved 57 articles referring to the "Grenelle Environment" commitments, which include – among others – the mitigation of climate change, the prevention of risks to the environment and human health as well as the implementation of more ecological democracy through new forms of governance and better public information (MEDDTL, 2010, p. 5). In its Article 44, Law Grenelle 1 strengthens the risk prevention policy by aiming to reduce the exposure of people to flood risk by controlling urbanisation. Law Grenelle 2 was adopted one year after Law Grenelle 1 in order to implement the objectives of the latter. It addresses topics related to building/construction and urban planning, transportation, energy and climate, biodiversity, risk and waste management as well as governance (Tetzlaff and Malet-Deraedt, 2011, p. 400). In response to the devastating floods in 2010, the "Grenelle Environment" aims to bring together multiple competing stakeholders in order to coordinate various policies that can reduce flood risks in a coherent way (Deboudt, 2010; France, 2010 cited in Llosa and Zodrow, 2011, p. 4). In this context, Article 221 of Law Grenelle 2 implements the EU FRD[161].

The legal basis for hazard and risk maps

Each department is generally obliged to inform municipalities about all risks menacing their territory. There are different types of hazard and risk maps that can serve this purpose.

The EU FRD entitles Member States to use already existing analyses and maps, provided they satisfy the requirements of the Directive (CEC, 2007b). In France, the Ministry of Ecology and Sustainable Development creates and publishes the so-called "Atlas des zones inondables" (AZI) (Atlas of flood zones). The AZI comprises documents with information purposes that serve to illustrate and share knowledge about flood events likely to reoccur in the form of water overflowing the watercourse (see Figure 46). They are developed on the basis of the highest known flood waters ("plus hautes eaux connues"). AZI maps can

[161] However, the deadline for implementing the Directive into national law was already in November 2009 which means that in France the implementation of the FRD happened later than required.

then be used by municipalities in order to consider the illustrated flood hazard in a SCoT or PLU or to undertake more detailed studies in order to improve the knowledge about risks, especially in areas that are most endangered by floods (DREAL PACA, 2010).

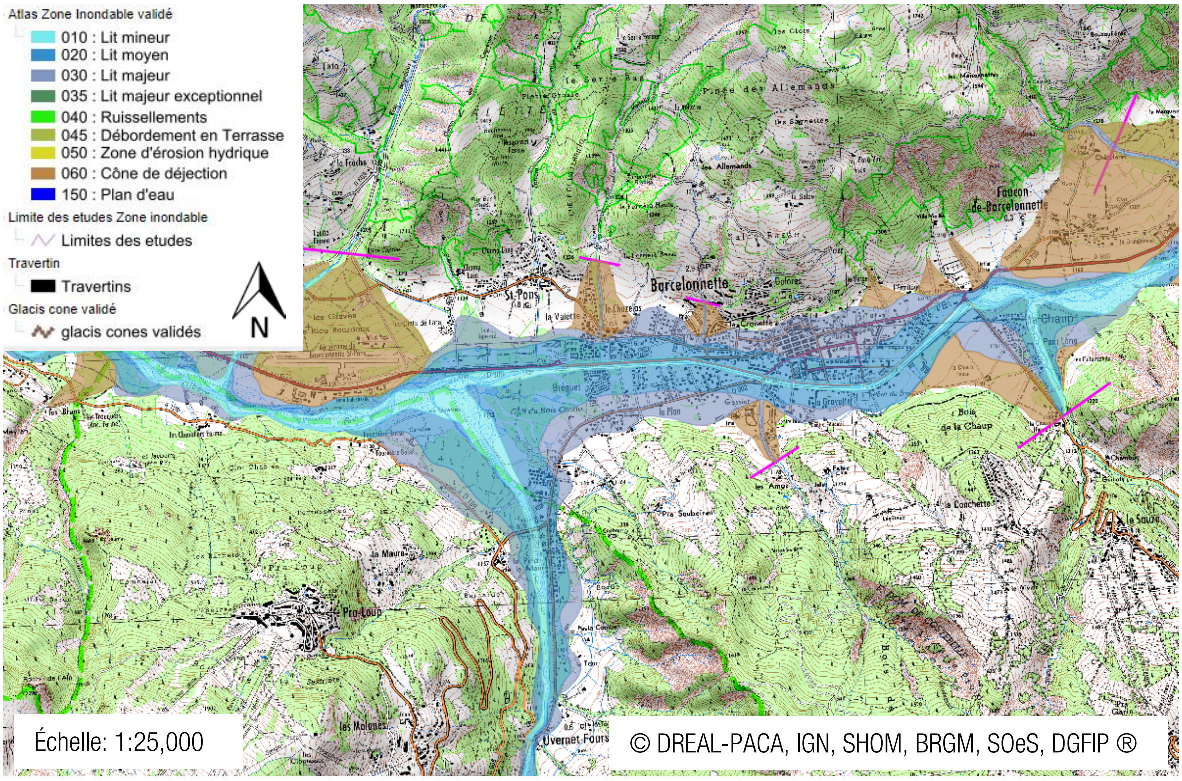

Figure 46 AZI Ubaye River, municipality of Barcelonnette; scale: 1:25,000 (Source: DREAL PACA, 2012)

However, AZI maps do not fully meet the requirements of the Directive. In particular, they do not represent risk maps, but solely display areas which have been flooded in the past and which most likely can be flooded again. They are based on one single return period only. Neither do they directly indicate water depth, water speed or the particular return period in order to specify the hazard, nor do they delineate the 100-year flood that commonly serves as a reference flood for flood risk management purposes (DREAL PACA, 2010). Since a lot of existing AZI maps do not correspond to the requirements of the Directive, flood hazard maps need to be redone in order to add information about extent, depth and speed. Furthermore, maps for two additional return periods need to be drawn. In addition, flood risk maps need to be prepared.

According to Teller (2010), the new flood hazard maps will play a vital role for the elaboration of the SCoT and the PLU. They allow an assessment of the actual hazard situation, even for a flood event with a very low probability of occurrence (extreme event). This is why it will be possible to also practice flood prevention in areas with a low probability of being flooded (e.g. through flood adapted building practices, by securing certain zones for retention basins etc.). Furthermore, they might serve as a useful basis for the elaboration of new flood risk prevention plans ("Plan de Prévention des Risques Inondations" (PPRI)) or for the PPR in general.

France has, as already mentioned, a long tradition in risk and hazard mapping (see Box 4). Besides the already mentioned AZI maps and the PPR, some informative hazard zoning instruments exist, such as the Department Report on Major Risks ("Dossier Départemental sur les Risques Majeurs" (DDRM)) at the departmental level[162], the Municipal Information Document On Major Risks ("Dossier d'Information Communal sur les Risques Majeurs" (DICRIM)) and the Synthetic Municipal Document ("Dossier Communal Synthétique" (DCS)) at the municipal level. Informative hazard zoning was introduced by the central government in 1987, after the need arose to provide information about risk exposure. The subsequent Law no. 87-565 from 22nd July 1987 on the organisation of the civil security, the protection of the forest against forest fires and the prevention of major risks laid the foundation for the development of the DDRM, the DICRIM and the DCS. The law also promoted the development of technical hazard maps ("cartes d'aléas") for different hazards, including the AZI maps. Although both regulatory and informative zoning instruments have different purposes they may complement each other (Nussbaum, 2005 cited in Fleischhauer, 2006b, p. 43).

Box 4 Legal basis for the production of hazard and risk maps for floods and landslides in France (Source: own elaboration adapted from European Communities, 2000; Fleischhauer, 2006b)

Law no. 87-565 from 22nd July 1987 on the organization of the civil security, the protection of the forest against forest fires and the prevention of major risks
Loi n° 87-565 du 22 juillet 1987 relative à l'organisation de la sécurité civile, à la protection de la forêt contre l'incendie et à la prévention des risques majeurs

Law no. 95-101 of 2nd February 1995 on strengthening the protection of the environment
Loi n° 95-101 du 2 février 1995 relative au renforcement de la protection de l'environnement (Loi Barnier)

The PPR is probably the strongest and most influential risk prevention instrument in France. The following main objectives of a PPR can be recognised (Fleischhauer, 2006b, p. 46; Mancebo, 2009, p. 221):

1. To define areas at risk where any kind of new construction and land-uses or activities are prohibited. This includes the construction of residential or public buildings, forestry, farming, commercial and industrial estates etc. These areas are called "danger zones" and appear as red zones on the map.
2. To define areas that are less exposed to risk, but where any kind of construction or development may cause new or aggravate existing risks and thus have to be regulated accordingly. These areas are called "precautionary zones" and depicted as blue zones on the map of the PPR.
3. To define prevention, protection and safeguard measures which the local authorities have to establish within the "danger zones" and the "precautionary zones".
4. To define measures which have to be taken by proprietors or operators of buildings, activities and services within the danger and precautionary zones that already exist the moment the PPR is being approved.

In addition to textual documents, a PPR consists of four types of maps:

- the informative map ("carte informative de l'analyse historique des événements");
- the hazard map ("carte d'aléa");
- the map showing major stakes and exposed elements ("carte des enjeux");
- the zoning plan ("la carte de zonage réglementaire").

[162] The DDRM summarises all risks known in the department. It gives an indication of the risk. It does not provide for a more detailed level of knowledge like the PPR does, however.

In other words, the PPR is composed of a hazard map, e.g. a map of the flood hazard, and it is combined with elements such as houses and other buildings, roads, human activities etc. to produce a risk map. In addition, there is the so-called “règlement”, which involves the textual provisions. The PPR is divided into single zones. Each zone has its own provisions. These provisions depend on the respective hazards they are exposed to. Hence, some provisions are directed towards flood hazards, while others are directed towards landslide hazards.

The informative map displays the known natural phenomena on a scale between 1:25,000 and 1:10,000. It is a descriptive map of past events or phenomena that have been observed in the past. In this respect it serves to inform and raise awareness of the public and decision-makers about areas that have experienced floods, mass movements, etc. in the past and provides information about the extent of past events (Ministère de l'Aménagement du Territoire et de l'Environnement and Ministère de l'Equippement, des Transports et du Logement, 1997, p. 25).

The hazard map is drawn on the same scale as the informative map and shows areas that might potentially be hit by a possible future event. The map is based on a qualitative approach and classifies the hazard in to three different levels: strong, moderate and low. If possible, it considers the probability of occurrence of the hazard as well as its intensity (Ministère de l'Aménagement du Territoire et de l'Environnement and Ministère de l'Equippement, des Transports et du Logement, 1997, p. 28). For flood hazards, the classification into strong, moderate and low depends, for instance, on the water level (i.e. the height) and the speed of the water.

The map that shows major stakes and exposed elements (scale: 1:25,000 and 1:10,000) identifies and displays all types of structures and functional facilities that either already exist or are planned, but also activities such as tourism and recreation, agriculture, forestry and industry. It aims to assess the population that is exposed to a hazard as well as vulnerable elements, evacuation and emergency routes (Ministère de l'Aménagement du Territoire et de l'Environnement and Ministère de l'Equippement, des Transports et du Logement, 1997, p. 30). It thus enables the selection of the best possible prevention tools and regulations.

In order to produce a zoning plan (see Figure 47), the hazard map is combined with existing and planned land uses and structures. However, it is primarily based on the three hazard levels. In this respect, the hazard levels already involve certain provisions. For instance, in zones for which the hazard is supposed to be strong, building is automatically prohibited (MEDD, 2006, p. 10). For the PPR of Barcelonnette, the different hazard levels were used to determine the three types of zones within the zoning plan (see Table 10).

Table 10 Transition from hazard levels to risk zoning for the PPR of the municipality of Barcelonnette (Source: recreated from RTM, 2006b, p. 6, own translation)

Strong hazard	Moderate hazard	Low hazard	Hazard considered zero
Zone is not buildable (red zone) except for particular cases	Zone is not buildable (red zone) or zone is buildable with restrictions (blue zone)	Zone is buildable with restrictions (blue zone)	Zone is buildable without restrictions (white zone)

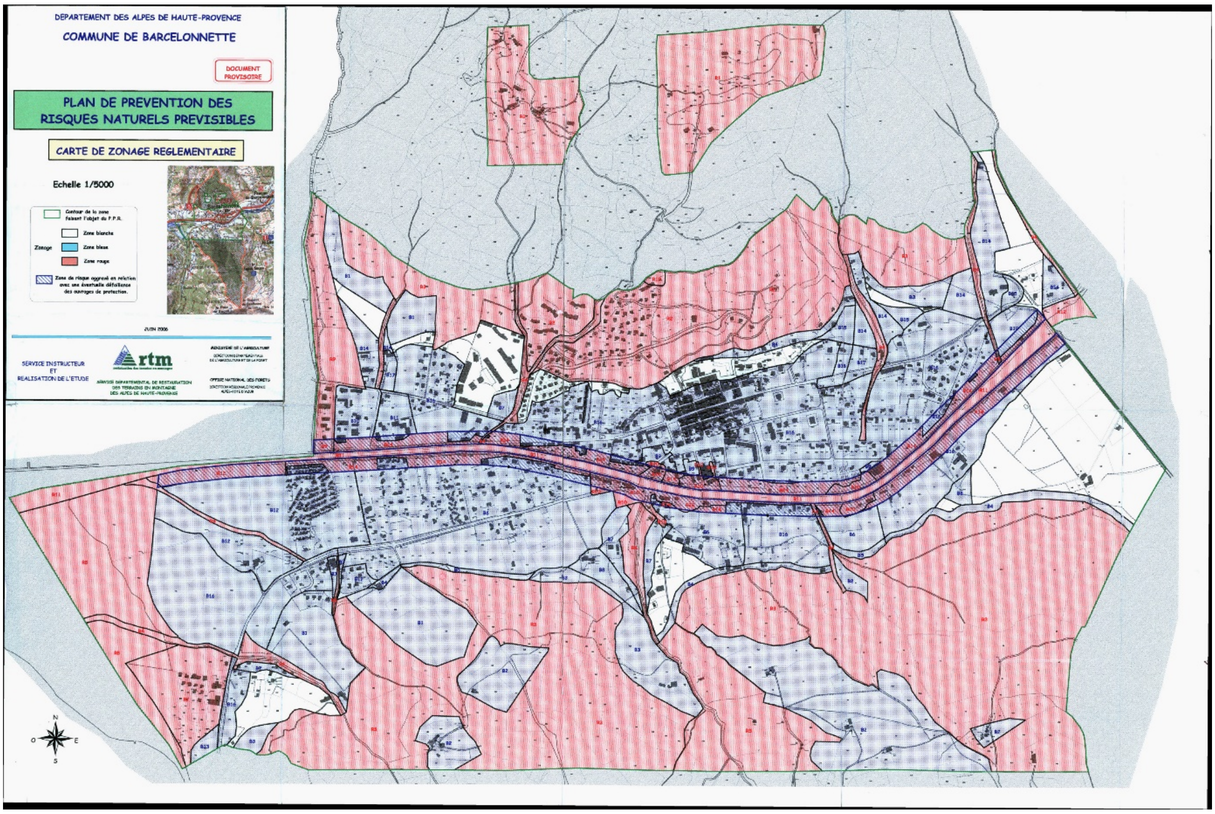

Figure 47 PPR (zoning plan) for the municipality of Barcelonnette (Source: RTM, 2006a)

The zoning procedure may also consist of the hazard levels as well as different land uses and elements at risk. It also offers the possibility to find an alternative development option for the zones at risk. It distinguishes in particular between (MEDD, 2006, p. 11):

- natural areas that need to be preserved, such as flood plains;
- urbanised areas and town centres;
- areas behind protective structures (e.g. dikes).

When combining hazards and land uses, the zones can be determined as outlined in Table 11.

It is important to point out that the PPR is legally binding for local spatial planning documents. Considering flood risks in particular, France is one of the countries where a binding legislation exists in regard to restricting or prohibiting building in areas exposed to floods[163] (Moel et al., 2009, p. 296). This holds not only true for flood risks and the PPRI. Ultimately, the PPRN, which involves several natural hazards including landslides, generally ensures the legally binding consideration of different types of risks in spatial planning.

[163] In this respect Moel et al. (2009, p. 296) point out that *"in spatial planning a distinction can be made between countries where flood maps serve an advisory purpose, and countries where there is a binding legislation to use flood hazard or risk information"*. While in Norway and Sweden, for instance, they serve as information tools, in other countries such as France, Germany and Poland there is a legal obligation to follow the provisions of such maps.

Table 11 Principles of zoning and development potential (Source: recreated and altered from Ministère de l'Aménagement du Territoire et de l'Environnement and Ministère de l'Equipement, des Transports et du Logement, 1999, p. 41, own translation)

Hazard	Non-urbanised areas/ natural areas	Urbanised areas	
		Not protected	Protected
Strong	Zone is not buildable (red zone)	Zone is not buildable (red zone)	Zone is not buildable (red zone) except for particular cases
Moderate	Zone is not buildable (red zone)	Zone is not buildable (red zone) except for particular cases	Zone is buildable provided there are protective measures (blue zone)
Low	Zone is buildable under the condition that prevention measures are considered (blue zone); zone is not buildable in case of threats to humans (red zone)	Zone is buildable under the condition that prevention measures are considered (blue zone)	Zone is buildable provided there are protective measures (blue zone)

The central government elaborates and implements the PPRN. First, the prefect issues an order that stipulates a PPRN and that designates the responsible department. Local authorities and establishments for inter-municipal cooperation are assigned the development of the plan. After a consultation with mayors and municipal councils and the submission to a public inquiry, the PPRN is approved by prefectural decree.

Although many studies on major risks exist, only few of them adopt a multi-risk approach. Most of them are mono-sectoral. Many PPRs therefore only address one single type of hazard, e.g. the PPRI for floods. Single-risk approaches seemed easier to implement, especially in case of the elaboration of PPRs. Yet it is necessary to take risks into account in a more comprehensive, integrated way, as domino effects can occur (BRGM and DREAL PACA, 2011). Besides, spatial planning has to consider all hazards threatening a territory and has to take cumulative effects into account. This is why a multi-risk approach is particularly important for spatial planning purposes (Greiving, 2006a; Greiving and Fleischhauer, 2006; Wanczura, 2006a). The mountainous areas in the PACA region (Hautes-Alpes and Alpes de Haute-Provence in particular) were among the first to incorporate a multi-risk concept. They realised that disaster risk could not be approached by addressing single hazards since natural phenomena are intertwined (BRGM and DREAL PACA, 2011). This is why the PACA region promoted the assessment of multiple risks by subjecting groups of municipalities to so-called “études multirisques” (multi-risk studies)[164].

[164] Such „études multirisques“ exist for the the Jabron Valley (“Vallée du Jabron”) as well as the “Pays Asses Verdon Vaïre Var” (BRGM and DREAL PACA, 2011; DDT 04, 2015).

8.1.2 Poland

In Poland the legal regulations for dealing with floods and landslides differ significantly. From a legal point of view, these two types of natural hazards are not dealt with in a similar way. An overview of the most important legal bases that determine the handling of disaster risk in spatial planning in Poland to some extent is given in Box 5.

Box 5 Relevant laws and acts for dealing with disaster risk in the Polish planning system (Source: own elaboration)

Law about the Self-Government of the Municipality of 5th March 1990
Ustawa z dnia 08 marca 1990 r. o samorządzie gminnym (Dz.U.01.142.1591 j.t.)

Law about the Self-Government of the Poviat of 5th June 1998
Ustawa z dnia 05 czerwca 1998 r. o samorzad powiatowy (Dz.U.01.142.1592)

Water Law of 18th July 2001
Ustawa z dnia 18 lipca 2001 r. Prawo Wode

Act of 27th March 2003 on Planning and Development
Ustawa z dnia 27 marca 2003 r. o planowaniu i zagospodarowaniu przestrzennym (Dz.U.03.80.717)

All laws and acts listed in Box 5 have a clear significance for dealing with floods. In the past, the Polish planning system *"had been criticized for a lack of concrete definitions"* (Wanczura, 2006b, p. 130) in its Water Law. However, the introduction of the EU FRD in 2007 required certain changes and adjustments in the handling of flood risks. The changes of the Polish Water Law from 5th January 2011 transferred the provisions of the FRD into national law, prepresenting the most important amendment,. Further changes aimed at validating and improving former provisions that were thought to hamper the correct application of the law (RZGW Gdansk, 2014).

The Water Law is one of the most important laws in the Polish legal framework concerning flood risks. As part of the amendment in 2011 Article 4a was inserted, which specifically addresses the handling of flood risks in local spatial plans. This article now regulates that the approval of the director of the respective "Regionalny Zarząd Gospodarki Wodnej" (RZGW) (Regional Water Management Board) is required for:

1) The Study of Determinants and Directions of the Local Space Economy and the Strategy for Regional Development regarding those areas at risk of flooding;

2) The Local Plan of Physical Development and the Regional Spatial Development Plan regarding those areas at risk of flooding (among others);

3) Localised decisions issued in case of a lack of a Local Plan of Physical Development.

Flood protection finds its legal basis in section Va "Flood Protection" ("Ochrona przed powodzią") of the Polish Water Law. This chapter adopts the provisions of the EU FRD. Among others, provisions regarding the preliminary flood risk assessment (Articles 88b and 88c), the preparation of flood hazard maps (Articles 88d and 88f) and flood risk maps (Articles 88e and 88f) as well as the creation of flood risk management plans (Articles 88g and 88h), all of which are a mandatory requirement of the FRD, were transferred into national law. The new flood hazard and risk maps, that are prepared according to the provisions of the FRD, substitute the former flood protection studies, which were prepared by the regional water boards according to requirements of the previous version of the Water Law.

In December 2015 the Water Law was amended again. In the former version of the law, Article 88f regulated that the flood boundaries presented on flood hazard and risk maps needed to be included into the Concept of National Spatial Development, the Regional Spatial Development Plan and the Local Plan of Physical Development within a period of 18 months after transferring the maps to the responsible authorities[165]. This means that municipalities were obliged to include the boundaries into the spatial planning documents. The amended version of December 2015 merely states that municipalities “can” take these areas into account in their spatial plans, i.e. it is not obligatory any longer. As a result, the original deadline of 18 months for adjusting local spatial plans is obsolete. The obligation to obtain an approval from the RZGW for spatial plans before their adoption remains in force. Due to the fact that the regional water management boards usually require flood information provided by the new maps to be integrated into the plans, spatial plans are still expected to be gradually updated according to the new hazard and risk information. However, as there is no deadline for adjusting the spatial plans, the process can be expected to take longer.

Moreover, section VI “Management of water resources” (“Zarządzanie zasobami wodnymi”) refers to water management planning in chapter 3 (“Planowanie w gospodarowaniu wodami“). Article 112 (Water Law 2001) refers to the improvement of flood protection as one of the tasks that have to be coordinated through water management planning. Together with the river basin management plan and a plan to counteract the effects of drought in the basin, the new FRMP forms an important part of water management planning (Water Law 2001, Article 113). According to Article 118 (Water Law 2001), the regulations of the FRMP have to be included in the Concept of National Spatial Development, the Strategy for Regional Development, the Regional Spatial Development Plan, the Study of Determinants and Directions of the Local Space Economy and the Local Plan of Physical Development.

Głosińska (2014, p. 133) highlights an important difference between old and new regulations: The previous version of the Water Law did not effectuate any legislative restrictions regarding the allowed or prohibited development of natural floodplains located on undiked rivers as part of the flood protection studies (see Appendix 2, Figure 8). Legal restrictions were only valid for the area between the embankments, where construction was prohibited. Floodplains situated next to undiked rivers did not form part of this regulation and were therefore excluded from said “automatic” building restrictions. A further problem relates to the fact that flood protection studies as such did not make any regulations legally binding. Only when the contents of a flood protection study were integrated into a Local Plan of Physical Development, restrictions became effective. However, local spatial plans did not necessarily include the extent of a flood hazard[166] (Głosińska, 2014, pp. 132–133). Furthermore, Local Plans of Physical Development are not mandatory and only cover the built municipal territory, while floods usually affect a

[165] The verified flood hazard and risk maps have been formally passed over from the central water board to all regional water boards in April 2015. In the Małopolska region, the RZGW Kraków passed the maps over to the municipalities in June 2015.

[166] This can be traced back to the fact that the elaboration of flood protection studies was not even obligatory in the first place. But even when they existed, the law did not specify the time that was granted for adjusting the local spatial plans to the floodplain areas defined in the flood protection studies (Głosińska, 2014, p. 133). In some cases, making according changes took a long time and in other cases changes were not made at all.

larger territory. Some zones therefore remained untouched by former legal restrictions. After the changes made in 2015, there still has been no clear regulation that demands a mandatory integration of limitations of floodplain boundaries and restrictions regarding development in floodplains into local spatial plans. The former unwillingness of some municipalities to include the floodplain boundaries presented in the flood protection studies in their spatial development plans (Głosińska, 2014, p. 139) is not expected to persist, however. Such unwillingness was based on the fact that an integration of the boundaries of a flood hazard into local plans also meant a limited possibility to build in flood-prone areas as well as an impact on private property rights (Głosińska, 2014, p. 139). When implementing restrictions that concern private properties, ownership rights are touched, which means that municipalities might be obliged to pay compensations due to possible losses in land value. As municipal budgets are usually tight, municipalities try to avoid paying compensations by not including according flood boundaries in the local spatial plan. Moreover, general building prohibitions limit or even hamper further municipal development. A main interest of communal authorities consists in social and economic development and growth, which is usually connected to the construction of new housing, industrial estates, commercial areas etc. Not being able to sell valuable land and allow the development of attractive areas limits the municipalities in their economic development and diminishes potential financial income through the sale of plots of land. However, the new regulations of the amended Water Law now help enforce provisions set up by the RZGW. Spatial planners are required by law to ask the opinion of the RZGW when preparing a local spatial plan. This opinion is legally binding for the Local Plan of Physical Development. This means that the RZGWs have to approve the legally binding land use plan. Consequently, it will be almost impossible to ignore the contents and provisions of the new flood hazard and risk maps. However, there is no legally binding approval for the Study of Determinants and Directions of the Local Space Economy (Interview P-VI, 2013).

As mentioned above, further laws addressing flood protection include the Law about the Self-Government of the Poviat of 5th June 1998 as well as the Planning and Development Act of 27th March 2003. The former law determines the county as the responsible entity for flood protection in Article 4, Paragraph 1(16). The latter points out in chapter 2 ("Spatial Planning in the Municipality"), Article 10, that the Study of Determinants and Directions of the Local Space Economy, i.e. the preparatory land use plan, takes into account conditions in particular arising from the state of spatial order and the need for its protection (Paragraph 1(2)), the security of the population and their property (Paragraph 1(6)), the occurrence of geological hazards (Paragraph 1(10)) as well as the requirements for flood protection (Paragraph 1(15)). Among others, the Study of Determinants and Directions of the Local Space Economy is supposed to determine areas exposed to flood and landslide hazards (Article 10, Paragraph 2(11)). When preparing the "Study" the mayor shall ask the director of the RZGW for opinions on solutions or provisions adopted in the draft study concerning the management of areas exposed to flood hazards (Article 11). The consultation of the director of the RZGW regarding decisions about land development and the localisation of any public facilities in flood-prone areas was made compulsory through the amendment of the Planning and Development Act in 2012 (Głosińska, 2014, p. 134) in combination with the above-mentioned Article 4a of the Polish Water Law. Furthermore, as stated in Article 15, Paragraph 2(7) of the Planning and Development Act 2003, the local land use plan is meant to compulsively show the borders and types of land use or objects to be protected from floods and landslides, determined on the basis of separate provisions. Finally, the Voivodeship Spatial Development Plan should take into account the areas exposed to flood hazards (Act of 27th March 2003 on Planning and Development, Article 39, Paragraph 3(6)).

Regarding landslide hazards the above-mentioned Law of the Self-Government of the Poviat of 5th June 1998 as well as the Planning and Development Act of 27th March 2003 apply equally. However, landslides are treated differently from flood risks (see above). While Article 11 includes a regulation regarding the consultation of the geological authority when preparing the Study of Determinants and Directions of the Local Space Economy, it does not specifically refer to landslides or mass movements. Article 17, however, specifically mentions the need to consult and ask the opinion of the relevant geological authority with regard to areas threatened by landslides or mass movements for the preparation of the Local Plan of Physical Development. Accordingly, a small distinction has been made between the preparation of the preparatory and the preparation of the legally binding land use plan.

When looking at existing laws, there are indeed some legal regulations regarding the identification and evaluation of areas exposed to landslide hazards as well as regulations regarding the preparation of landslide hazard maps (see below). However, very few regulations actually refer to the handling of landslide hazards in spatial planning more specifically[167].

The legal basis for hazard and risk maps

Besides the aforementioned acts and laws which legally require the consideration of natural hazards in spatial planning, there are additional laws which regulate the preparation of hazard and risk maps for floods and landslides. The most important laws in this regard are listed in Box 6.

Box 6 Legal basis for the production of hazard and risk maps for floods and landslides in Poland (Source: own elaboration)

Water Law of 18th July 2001, last modified in 2012
Prawo Wodne (Opracowano na podstawie tj. Dz. U. z 2012 r. poz. 145, 951)

Act of 5th January 2011 on the amendment of Water Law and some other acts
Ustawa z dnia 5 stycznia 2011 r. o zmianie ustawy – Prawo wodne oraz niektórych innych ustaw

Act of 27th April 2001 Environmental Protection Law (Official Journal of 2001, No. 62, item 627, as amended)
Ustawa z dnia 27 kwietnia 2001 r. Prawo ochrony środowiska (Dz. U. 2001, Nr 62, poz. 627, z późniejszymi zmianami

Regulation of the Minister of Environment of 20th June 2007 on information on the mass movements
Rozporządzenie Ministra Środowiska z dnia 20 czerwca 2007 w sprawie informacji dotyczących ruchów masowych ziemi (Dz. U. 2007, Nr 121, poz. 840)

The development of flood hazard and risk maps in Poland was regulated, as already mentioned, in the 2011 version of the Water Law. Main amendments consisted in the addition of Articles 4a and 88, which refer to the link between flood protection and spatial planning (Article 4a) and the provisions on the elaboration of flood hazard and flood risk maps (Articles 88d and 88f) (see above). As outlined above, the contents of Article 88 clearly refer to the standards provided by the EU FRD. Accordingly, Article 88d foresees the preparation of flood hazard maps ("mapa zagrożenia powodziowego") (see Appendix 2, Figure 9) made for the areas identified within a preliminary flood assessment (see Article 88b). They are

[167] This has also been pointed out by Wanczura (2006b, p. 130), who adds that until then spatial planning had not played a visible role in dealing with landslides.

supposed to show the extent of the flood and the water depth of the flood or the water level (in some cases also the speed or volume of the water). Article 88f regulates the preparation of flood risk maps ("mapy ryzyka powodziowego") (see Appendix 2, Figure 10) for the identified areas mentioned in Article 88d. Flood risk maps should show, for instance, the estimated number of inhabitants who might be affected by flooding, economic activities carried out in the areas mentioned in Article 88d, installations that may pollute the environment in case of a flood etc.

Aspects related to defining landslide hazards are mentioned in the Act of 27th April 2001 Environmental Protection Law. Landslide assessment is the responsibility of the county prefect, as regulated in Article 110a, Act of 27th April 2001 Environmental Protection Law. The same article also *"regulates the obligation to register the areas threatened by mass movements as well as the areas on which the movements have already occurred"* (Ćwiąkała et al., 2014, p. 1090), including a specification of methods, scope and frequency of surveying landslide-prone areas as well as assessment methods.

A legal basis for landslide hazard mapping was introduced in 2007 by the "Regulation of the Minister of the Environment of 20th June 2007 on information on the mass movements". The law defines, for instance, how to determine areas at risk of landslides or mass movements and areas on which mass movements occur (active landslides) as well as the methods, scope and frequency of monitoring areas exposed to landslides and mass movements (Paragraph 1). The preparation of landslide hazard maps is regulated in Paragraph 4(1), which demands the provision of *"graphical data in the form of maps of areas where landslides occur and of areas where landslides are likely to occur"* (own translation) and Paragraph 5(1), which foresees the preparation of maps using GIS, based on a topographic map at a scale of 1:10,000. According to the regulation, certain technical guidelines need to be followed. For instance, the surveyed areas should cover objects located within the landslide-prone area. Appropriately conducting such a survey will help determine the actual threat or damage potential that might originate from a possible future soil destabilisation (Ćwiąkała et al., 2014, p. 1090).

8.1.3 Italy

Like in France, the legal basis for dealing with disaster risk in Italy also has a long history. However, due to the regionalised structure of the Italian administrative system, approaches in dealing with disaster risk in spatial planning are different from those in France. The most relevant laws that refer to the handling of floods and landslides in spatial planning in Italy are summarised in Box 7.

Box 7 Relevant laws and acts for dealing with disaster risk in the Italian planning system (Source: own elaboration adapted from Bianchizza et al., 2011; Corominas and Mavrouli, 2010; Galderisi and Menoni, 2006)

National Urban Planning Law 1150/1942
Legge Urbanistica Statale 1150/1942

Law 183/1989: Rules for organizational and functional setting of ground protection, modified by Law 253/1990 and by Law 179/2002
Legge 183/1989: Norme per il riassetto organizzativo e funzionale della difesa del suolo

Regional Law 52/1991: regional norms on territorial and urban planning
Legge Regionale 52/1991: Norme regionali in materia die pianificazione territorial ed urbanistica

Law 180/1998 (Sarno Law) (converted into law 267/1998) on urgent measures for the hydro-geological risk prevention and for areas affected by landslides in the Campania region
Decreto-Legge 180/1998 (Legge Sarno) & Legge 267/1998: Conversione in legge, con modificazioni, del decreto-legge 11 giugno 1998, recante misure urgenti per la prevenzione del rischio idrogeologico ed a favore delle zone colpite da disastri franosi nella regione Campania

Law 365/2000 (Soverato Law) on urgent action for areas at high hydro-geological risks an in the field of civil protection
Legge 365/2000: Conversione in legge, con modificazioni, del decreto-legge 13 maggio 1999, n. 132, recante interventi urgenti per le aree a rischio idrogeologico molto elevato ed in materia di protezione civile, nonche' a favore delle zone della regione Calabria danneggiate dalle calamita' idrogeologiche di settembre ed ottobre 2000

Regional Law 5/2007: Planning reform and disciplining of building activities and the landscape
Legge Regionale 5/2007: Riforma dell'urbanistica e disciplina dell'attivita' edilizia e del paesaggio

Already at the beginning of the 20th century, geo-hydrological risks were indirectly addressed in various national regulations which had been adopted for the management of river networks and hydraulic constructions (Royal Decree 523/1904) and for the protection of soil and forests in mountainous areas (Law 445/1908; Royal Decree 3267/1923). Despite their specific focus, these regulations generally imposed land use restrictions for particular areas or activities (Corominas and Mavrouli, 2010, p. 31). After the devastating flooding in Florence in 1966, the national government realised the need for land planning at river basin scale to prevent future disasters by better and comprehensively managing geo-hydrological risks. This disaster was one of the reasons to later adopt Law 183/1989, which aimed at *"land protection, water resource reclaim, use and management of the water resources for the proper economical and social development, safeguard of the environmental issues"* (Law 183/1989 cited in Corominas and Mavrouli, 2010, p. 31). According to the original plans of the Italian government after the Florence flood, Law 183/1989 then established the "hydrographic basin" as the reference unit to which the contents of this law should be applied. The law first attempted the resolution of an existing fragmentation related to spatial planning caused by administrative units (Corominas and Mavrouli, 2010, p. 31) by introducing the basin plan. The law also determined that all planning instruments have to respect the provisions of the basin plans.

At the end of the 20th century, another important law was introduced which addressed the management of areas at risk. Ultimately, after the mudflow disaster in Sarno (region Campania) in 1998, the general need for a more efficient flood and landslide hazard and risk zoning became apparent. Only a few months after the event, the Italian government adopted Law 180/1998, converted with modifications into Law 267/1998 (known as "Legge Sarno")[168]. Law 180/1998 initiated a reform in order to deal more comprehensively with water-related matters. According to Massarutto et al. (2003, p. 12), the reform is closely related to the contents of the subsequent EU WFD, which implied the restructuring of former river basins into hydrographical district basins. In this respect, law 180/1998 required the adoption of river basins as planning and management units for flood risks and the establishment of river basin authorities for each of the river basins[169] (Mysiak et al., 2013, p. 2884). These river basin authorities are one of the most important entities dealing with natural hazards since they are responsible for the monitoring and the prevention of geo-hydrological events as stated by Article 12, Law 183/1989. Activities carried out by the river basin authorities involve the elaboration of river basin plans.

Law 183/1989 also demanded an identification of the existing geo-hydrological risk, the definition of exposed areas including infrastructure and buildings in areas prone to risk as well as the recommendation of programmes for relocation (Galderisi and Menoni, 2006, p. 112; Mysiak et al., 2013, p. 2884). In this context, the law introduced a stringent deadline to produce the so-called "Piano Stralcio per l'Assetto Idrogeologico" (PAI) (Extract Plans for Hydro-geological Setting), which are formally a part of the river basin plans and which can be understood as management plans for geo-hydrological risks. An assessment of flood risks is conducted at the level of each hydrographical basin (Bianchizza et al., 2011, p. 26). Therefore, in addition to being responsible for river basin plans, river basin authorities are also responsible for the production of the PAI[170]. The PAI is valid for a lower institutional level but depends on provisions included in the river basin plan. It represents an important instrument for spatial planning, since it consolidates and unifies planning activities within a river basin and coordinates regulations and decisions previously defined in other documents, such as the PS 267[171] (Autorità di bacino del fiume Po, 2016). PAIs contain legal provisions and prescriptions in regard to structural and non-structural risk prevention measures (Bianchizza et al., 2011, p. 26). This means that areas at risk are not only illustrated on maps, but defined hazard zones are connected to certain provisions and rules that either prohibit or allow the

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[168] In addition, the so-called "Legge Soverato" (Law 365/2000) was adopted shortly after the Soverato flood in 2000. This law ensured that hazard and risk zoning and the according maps were updated regularly according to the Prime Minister Decree-Law 20 September 1998. Furthermore Article 2 states that *"within 120 days from the date of entry into force of the law, exceptional monitoring and reconnaissance operations were to be carried out along waterways and relevant floodplains"* and that such inspections *"were to identify the areas prone to high hazard and to determine the most urgent risk mitigation measures to be put in place in order to safeguard life and property"* (Mysiak et al., 2013, p. 2884).

[169] The WFD was implemented in Italy in 2006 by setting up law-decree 152/2006 and asked for the division of river basins into hydrographical basins and districts. According to law-decree 152/2006, river basin authorities were supposed to be replaced by district basin authorities. However, due to the non-implementation of district basin authorities, a new law (L. 13/2009) transferred decision-making power back to authorities at the national level by giving them the responsibility to coordinate the elaboration of the district plans (Bianchizza et al., 2011, p. 26).

[170] Besides, river basin authorities also provide advice for flood prevention and mitigation.

[171] The "Piano Straordinario diretto a rimuovere le situazioni a rischio idrogeologico molto elevato (PS 267)" (Extraordinary Plan for very high hydro-geological risk areas) is a restrictive planning document, introduced by Law 180/1998. It defines specific land use regulations, which must be respected by local authorities and included into local planning documents. Furthermore, it determines structural measures as well as other mitigation measures, which reduce the risk in areas at very high risk. The PS 267 has been approved for the river basin "Alto Adriatico" (covering the rivers Isonzo, Tagliamento, Livenza, Piave and Brenta-Bacchiglione) in November 1999.

commune to develop an area one way or the other under certain conditions. The contents and prescriptions of any basin plan need to be considered in all planning documents, i.e. their provisions are legally binding for local authorities as well as for the private sector (Galderisi and Menoni, 2006, p. 101). The PAI therefore constitutes a main tool to incorporate information about risks into local spatial plans.

Moreover, with respect to dealing with disaster risk in spatial planning, the provincial coordination plans need to indicate guidelines for hydrological and hydro-geological settings and in general for the consolidation of soil and water drainage (Law 267/2000, Article 20). Besides, *"after 1995, some regional planning acts enlarged regional and provincial competences for risk management, setting the safeguard of human settlements from all natural and man-made risks as one of the main objectives of regional and provincial co-ordination plans and requiring them the identification of mitigation measures, too"* (Galderisi and Menoni, 2006, p. 107). However, regional planning acts do not mention specifically the types of mitigation measures to adopt. They merely demand coherence with the provisions of the basin plans. Hence, despite the fact that regional and provincial coordination plans have to define land-uses by considering all types of natural and man-made risks as well as to identify possible mitigation measures, the latter still only represent overall objectives (Galderisi and Menoni, 2006, p. 107).

As explained in Chapter 6.2 and according to the "Legge Urbanistica", since 1942 the PRGC has aimed to regulate building activities and determine the land use within each municipality. In 1968 the concept of zoning was implemented through the "Decreto interministeriale 2 aprile 1968, n. 1444". Possible zones to be identified include a zone (zone "G") which represented areas with land use restrictions due to exposure to either floods, landslides or avalanches (Corominas and Mavrouli, 2010, p. 57). Dealing with disaster risk in local spatial planning instruments in the Friuli Venezia Giulia region is regulated in Article 63 bis, Regional Law 5/2007. This article determines that the local spatial plan needs to contain an analysis of the geological, hydrological and avalanche situation of the territory in order to assess the environmental compatibility of the provisions of the plan.

In addition to the PAI, geological studies constitute another tool which ensures the consideration of risks in local spatial plans. Geological studies are prepared by geological professionals with expertise in aspects related to geo-hydrological hazards. The preparation and application of geological studies is based on Law 741/81, which has prompted many Italian regions to legally require detailed geological studies to be included in local spatial plans (Galderisi and Menoni, 2006, p. 108). This is also the case for the Friuli Venezia Giulia region, where geologists and hydraulic engineers are the responsible and competent actors for assessing disaster risk. As per Regional Law 27/1988 and Regional Law 52/1991 a geological report must be elaborated during the preparation of spatial plans. These geological reports have to examine and determine the compatibility of the provisions of the plan with the geo-hydrological conditions of the territory. Geological reports comprise a written statement as well as maps that take account of potential hazardous situations and the intended use that is permissible. Such reports represent an important evidence base for spatial planners, as they pre-set possible types and intensities of land uses.

The legal basis for hazard and risk maps

Hazard and risk zoning were first and foremost done for the areas "most at risk" according to Law 226/1999 (Corominas and Mavrouli, 2010, p. 33). Today, a great part of the Italian territory is covered by hazard and risk maps. Within the scope of the PAI, one map each for geo-hydrological (e.g. floods) (see

Appendix 2, Figure 14), geomorphological (e.g. landslides, debris flow, rock fall) (see Appendix 2, Figure 15) and avalanche hazards has to be prepared. Hazard maps are produced for the whole territory of a municipality at a scale of 1:10,000. The end-result that is handed over to the region consists of several technical maps and maps of areas that should be free from development. Furthermore, the maps show the protective measures that should be taken in each area. The PAIs of the Friuli Venezia Giulia region find their legislative basis in respective secretarial decrees (see Box 8).

Box 8 Legal basis for the production of hazard and risk maps for floods and landslides in Italy (Source: own elaboration adapted from Galderisi and Menoni, 2006; Gillet, 2009)

Law 183/1989: Rules for organizational and functional setting of ground protection, modified by Law 253/1990 and by Law 179/2002
Legge 183/1989: Norme per il riassetto organizzativo e funzionale della difesa del suolo

Law 180/1998 (Sarno Law) (converted into law 267/1998) on urgent measures for the hydro-geological risk prevention and for areas affected by landslides in the Campania region
Decreto-Legge 180/1998 (Legge Sarno) & Legge 267/1998: Conversione in legge, con modificazioni, del decreto-legge 11 giugno 1998, recante misure urgenti per la prevenzione del rischio idrogeologico ed a favore delle zone colpite da disastri franosi nella regione Campania

Law 226/1999: Urgent interventions in the field of civil protection
Legge 226/1999: Interventi urgenti in materia di protezione civile

Legislative Decree 49/2010 of 23 February 2010: Implementation of Directive 2007/60/EC on the assessment and management of flood risks.
Decreto legislativo 49/2010: Attuazione della direttiva 2007/60/CE relativa alla valutazione e alla gestione dei rischi di alluvioni.

The PAI usually shows areas exposed to risks evaluated from historical data, on-site studies as well as risk and hazard assessments[172] (Bianchizza et al., 2011, p. 26; Galderisi and Menoni, 2006, p. 105). Commonly, a PAI identifies four different classes of risk (Galderisi and Menoni, 2006, pp. 105–106; Mysiak et al., 2013, p. 2884):

- Low Risk (R1): Minor or limited risks which may cause marginal social, economic or environmental damages;
- Medium Risk (R2): Limited risks which may cause slight damages to the built environment and environmental heritage, but do not involve a direct threat to people and economic activities;
- High Risk (R3): Areas prone to risk that might induce harm to people, property and livelihoods in the form of loss of life, damages to the built environment, disruption of economic activities and environmental damages;
- Very High Risk (R4): Areas prone to risk that might induce serious impacts on human lives, socio-economic activities, built environment and environmental heritage.

[172] Regarding the methodologies for risk assessment it has to be pointed out that *"in Italy, even if it is widely recognized that risk assessment required an in-depth analysis of all hazard factors and of vulnerability of exposed elements, in many cases 'risk' is still interpreted as a synonymous of 'hazard'"* (Galderisi and Menoni, 2006, p. 104).

However, it has to be acknowledged that there are differences among river basin authorities in preparing and producing maps for geo-hydrological risks. There are also differences among single maps of the same river basin authority. This is the case for the Fella River catchment: The maps produced by the river basin authority "Alto Adriatico" (rivers Isonzo, Tagliamento, Piave and Brenta-Bacchiglione) are hazard maps and do not display the risk. In fact, it was highlighted in the general report of the PAI for the sub-basin of the river Fella that the plan does not illustrate areas at risk, since it is more important from a spatial planning point of view to consider hazard-prone areas, including those that up-to-date do not comprise any elements at risk (ADB, 2014c, p. 36). While an area at risk reflects the current situation, the identification of a hazard-prone area enables assessments on possible future uses. This is why the river basin authority specifically explains that the draft plan *"has deliberately omitted the identification of areas at hydrological risk and of areas at geomorphological risk"* (ADB, 2014c, p. 36, own translation). Consequently, the river basin authority "Alto Adriatico" considered it worthwhile, in particular from a spatial planning point of view, to assess and illustrate the hazard and not the risk[173].

As mentioned above there are also differences between single, sectoral maps. In case of the Fella River catchment, the map for geo-hydrological hazards displays four different hazard classes (moderate, medium, elevated, highly elevated). In contrast, the map for geomorphological hazards additionally shows the elements at risk, i.e. a parameter for vulnerability, and existing structural defence works (Prenger-Berninghoff and Greiving, 2015, p. 739).

Finally, Italy has flood hazard and risk maps available as required by the FRD[174] (see Figure 48 and Figure 49). The FRD was transferred into national law by Legislative Decree 49/2010 of 23rd February 2010. According to the FRD, Italian river basin districts prepare flood hazard and risk maps for three different return periods: events with return periods of 300, 100 and 30 years. In regard to flood risk maps, the FRD intends that risk maps are prepared for elements at risk such as the indicative number of inhabitants and the economic activity potentially affected. Legislative Decree 49/2010 states that risk mapping also foresees a representation in terms of risk classes (R1: moderate, R2: average, R3: high, R4: very high), in order to express the way in which the hazard (P1: extreme events – low hazard level, P2: events with greater return time or equal to 100 years – medium hazard level, P3: high probability – high hazard level) and the potential damages are combined in flood-prone areas in a single map (ISPRA, 2016).

[173] This assessment approach does not correspond to national law and contrasts the approaches of other Italian river basin authorities. The river basin authority of the river "Adige", for instance, applies a different approach and uses the above mentioned four risk classes.

[174] In contrast to France and Poland, the Italian government decided to prepare flood hazard and risk maps for all water courses across the Italian territory and therefore did not undertake a preliminary flood risk assessment (CEC, 2015, p. 23).

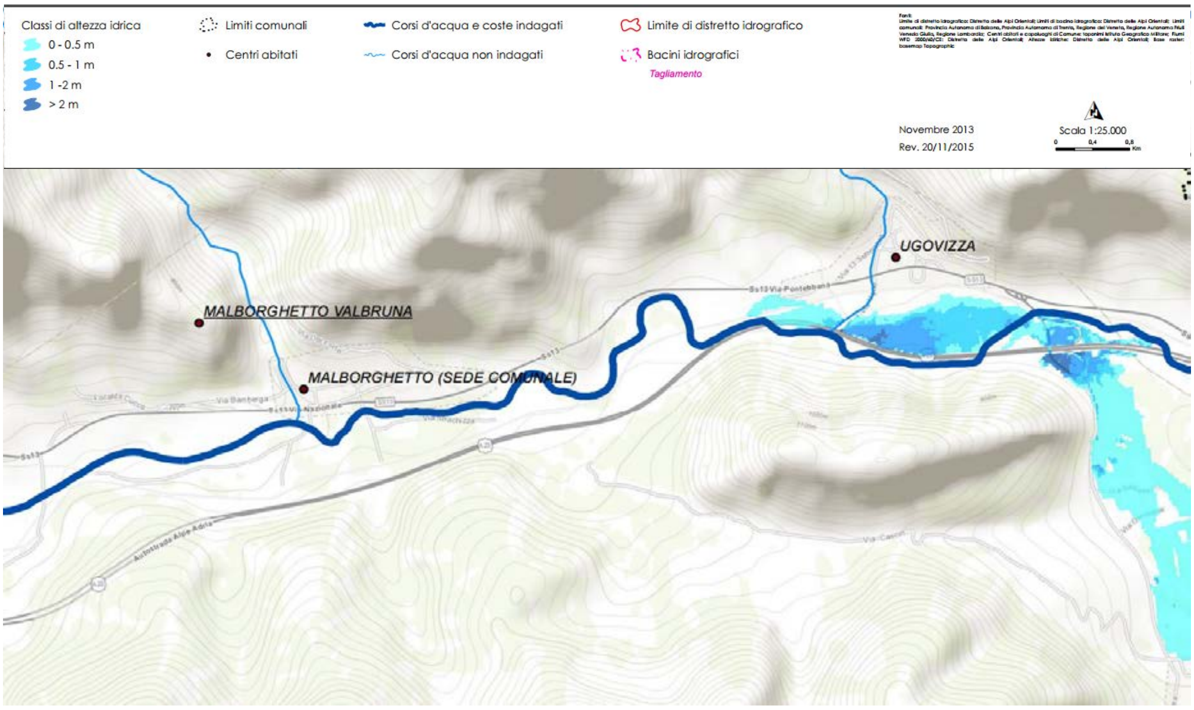

Figure 48 Extract from a flood hazard map (100-year return period), depicting the area of th e towns of Malborghetto and Ugovizza (Source: Distretto delle Alpi Orientali, 2013b)

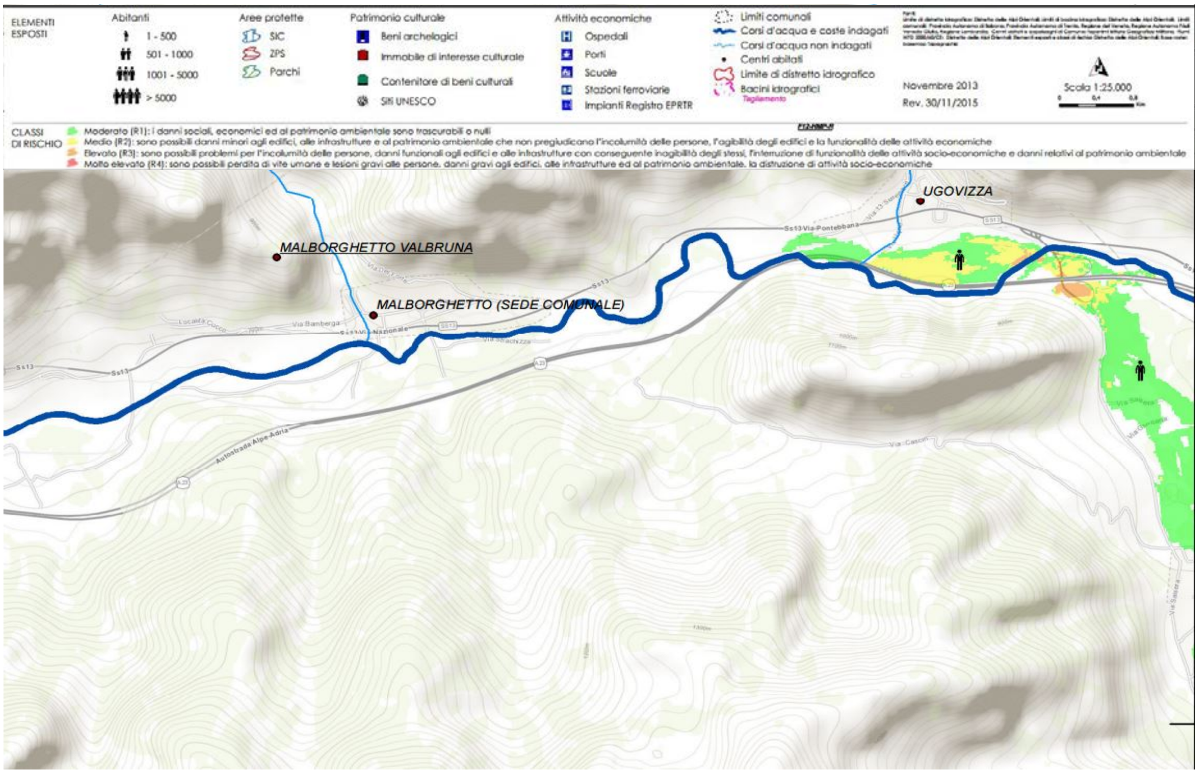

Figure 49 Extract from a flood risk map (100-year return period), depicting the area of the towns of Malborghetto and Ugovizza (Source: Distretto delle Alpi Orientali, 2013a)

Flood risk management is supposed to correct past mistakes in managing flood risk and to account for new challenges that global issues such as climate change pose. Mysiak et al. (2013, p. 2886) demand a new legislative framework in order to harmonise the existing legislation on water management, soil defence, territorial development and climate change adaptation and to make it internally and externally consistent. However, instead of reforming the existing flood risk planning instruments, Legislative Decree 49/2010 introduces yet an additional one, but provides little guidance for the harmonisation of existing planning and zoning instruments.

According to the report of the CEC (2015, p. 55), *"the potential effects on flood risk of spatial planning policies such as those on land use and infrastructure development have not been considered in Italy".* This means that there is no direct, policy-based link between the new flood maps and spatial planning practices. The report also states that climate change should be considered, but a lack of adequate hydro-geological data for climate change scenarios hampers the identification of potential future adverse impacts of flooding. Still, authorities have been advised to evaluate the situation as best possible and to consider possible future work in this field (CEC, 2015, p. 55).

8.2 The use of risk information in spatial planning in the case study areas

While Chapter 8.1 introduced the main sources of risk information for spatial planning, this chapter focuses on the actual use of risk information. This means it will address questions regarding the availability of hazard and risk maps as well as the ways in which risk information is applied and turned into final planning decisions and measures. Emphasis will be placed on spatial planners as actors as well as the processes and ways in which they use this information, including potential peculiarities or difficulties.

First, issues and questions raised in Chapter 7.2 will be examined. Accordingly, for each case study answers will be provided that concern:

- The availability and accessibility of risk information;
- The role of spatial planners and their awareness of prevailing risks and existing risk information;
- Opinions and personal experiences of spatial planners regarding the integration of disaster risk into the planning process – including their perceptions of usability, applicability and comprehensibility of risk information as well as their ability to reflect about and formulate demands on risk information;
- The communication and handling of uncertainties in risk information (e.g. by applying the precautionary principle);
- Public involvement;
- The role of informal planning instruments in handling disaster risk;
- Informal communication between spatial planners and information providers as well as participation of spatial planners in hazard and risk mapping.

There are some general remarks to be made regarding the interviewed spatial planners – those working as consultants and those working for public authorities: They were well aware of the existence of different kinds of natural risks. They knew exactly, which types of hazards constitute a potential danger for the municipalities they usually work for. Likewise, they were aware of existing regulations related to the application of risk-related information for preparing local spatial plans. They all regularly work on local land use plans for municipalities in hazard-prone areas. All of them are experienced planners that have already completed several planning documents in their professional life. Dealing with disaster risks is therefore not new to them. They have always considered the potential risks towards natural disasters in their daily work. Furthermore, they acknowledged the importance of integrating disaster risk in spatial planning documents.

Accordingly, the question raised in Chapter 7.2.2 about whether the planners knows if and how they have to take risks into account and whether they use risk information as part of their planning practice can both be affirmed.

8.2.1 The use of risk information in spatial planning in the French study area

In metropolitan France, the PACA region is the region most subjected to natural hazards. Hazards are omnipresent in this region, be it landslides, earthquakes, floods, forest fires or avalanches. Each of the 963 municipalities in the region is subjected to at least one natural hazard. The consideration of natural hazards in spatial planning has thus become inevitable. Due to the fact that the regional government is obliged to inform about natural hazards, great efforts are directed towards the provision of sufficient and adequate risk information. This requires continuous improvement of the state of knowledge on natural hazards and the necessary dissemination of this knowledge to policy makers, spatial planners and the general public. This way everyone can benefit from existing knowledge and use if for own purposes (BRGM and DREAL PACA, 2011). Today, many sources of information about disaster risk exist in the region, both regulatory and non-regulatory.

Prevention is considered the most effective way to avoid the potential impacts of a disaster. This is why PPRs play a crucial role in France's risk prevention strategy. A disadvantage of the PPR consists in the fact that it is an expensive instrument. It also implies a lot of work which is why it requires a long time to finalise all necessary documents that belong to a PPR (Interview F-V, 2013). Communes exposed to more than two types of hazards and communes with a comparatively high building and population density – and thus a high number of elements at risk – usually have a PPR available. Yet, there are exceptions to the rule: Not every commune in a risky area has a PPR available. On the other hand, there are also PPRs for municipalities only affected by one single type of hazard (Interview F-V, 2013). In fact, the geographical distribution of PPRs is rather unequal and *"evolves inversely proportional with a commune's population"* (Mancebo, 2009, p. 221). When no PPR is available, spatial planners and local authorities have to apply Article R-111-2 of the Urban Planning Code. This article is very vague, however. It entitles the mayor to refuse an authorisation to build, even though the risk is not a serious problem. The article merely states that mayors can refuse any kind of construction if there is a certain level of risk, while there are no further specifications. Hence, this provision is very different from the more specific designations provided by the PPR (Interview F-VI, 2013).

By June 2015 there was a total of 396 communes in the Provence-Alpes-Côte d'Azur region that had an approved PPR available (see Appendix 2, Figure 3). 461 communes did not have a PPR available, while many others were or are still in the process of elaborating a PPR.

In the Department Alpes-de-Haute-Provence, a total of 68 PPRs was approved by January 2015 (see Appendix 2, Figure 4). Most municipalities in the Ubaye valley have a PPR available, including the municipalities of Barcelonnette, St. Pons, Jausiers and Faucon de Barcelonnette. While a great number of municipalities in close vicinity is not covered by a PPRN, many of them are covered by a multi-risk study or by a "carte informative". 7 PPRs are currently in process and 4 more PPRs are approved and under revision[175]. There are 2 multi-risk studies. These studies, although they do not have the same fineness and the same level of detail as the PPR, give municipalities a good indication of the risks threatening their territory (Interview F-V, 2013). From the moment a municipality has information and knowledge about risks, it is obliged to integrate such knowledge into urban planning documents e.g. by establishing clear zoning designations.

As illustrated in Figure 46, there are also maps from the AZI available for the Ubaye river. All AZI documents were provided to the respective communes. Accordingly, communes in the Ubaye valley need to consider the mapped inundation zones. They are responsible for including these studies in their planning documents (Interview F-V, 2013). In contrast, the French case study area will not be covered by flood hazard and risk maps prepared according to the EU FRD. After the preliminary flood risk assessment, 31 areas were determined in the river basin Rhône-Méditerranée, the river basin which the Ubaye river belongs to. These are areas for which a potential significant flood risk exists (DREAL Rhône-Alpes, 2012, p. 10). According to Article 6 of the Directive, Member States are only required to prepare flood hazard and risk maps for areas identified as being significantly at risk. Since the Ubaye river was not identified as one of those areas, there will be no flood hazard and risk maps for this river basin.

Even though there are no separate flood hazard and risk maps, different sources of risk information exist in the Ubaye valley. In addition to the mentioned PPR and AZI, there are also informal, non-regulatory documents available in the different communes of the valley. Even if there is no PPR, municipalities have to at least integrate the information provided through the DDRM in their local planning documents. In general, availability of information is considered sufficient. Accessibility is ensured by responsible authorities – regional, departmental or local. For instance, it is the responsibility of the departmental authority to disseminate all information about risks and to ensure that all risks are known.

Moreover, even if there is a PPR, municipalities always have to consider the most recent information that exists. Strictly speaking, and although there is no particular regulation in terms of revision, PPRs need to be revised every once in a while. Along with climatic and demographic changes, the level of risk might change as well. Besides, technical and modelling progress might improve the knowledge about risks. This is why a red zone might turn into a blue zone and vice versa[176]. However, due to the fact that the central government finances and decides about a revision of a PPR, expectations for regular revisions are low (Interview F-II, 2013; Interview F-IX, 2013). In some cases, newly available information might contradict what had been known so far. For instance, an area that is not designated as flood-prone by the PPR might still be exposed to floods according to most recent studies. Even if this newly available information has not yet been translated into legally binding land use provisions, the municipality has to consider this

[175] One interview partner explained that it is not the aim of the department to provide all communes with a PPR. The department still has to elaborate a number of risk prevention plans, especially along the river Durance, but there is no need to cover all communes with a PPR (Interview F-V, 2013).

[176] A red zone might also be turned into a blue zone by implementing structural measures that aim to prevent or minimise the hazard. This way, the level of risk can be positively influenced and reduced. A red zone can never turn into a white zone, however (Interview F-V, 2013). Yet it was mentioned that even when new mitigation works have been implemented in or along the torrent, a red zone is preferably kept red in order to prevent authorities from adopting a false sense of security (Interview F-VII, 2013).

information when preparing a new local spatial plan[177] (Interview F-V, 2013). This means in turn that spatial planners and planning authorities cannot base their decisions on the provisions provided by the PPR alone. They always have to verify the current state by checking the most recent information available.

Spatial planners consider the PPR a crucial and ideal instrument for risk prevention. All interviewed spatial planning representatives (consultants and representatives from departmental authorities) confirmed that the PPR is particularly useful for local land use planning practices. For one, it provides exact information on where construction is allowed and where it is not. For another, it specifies which measures to implement[178]. The interviewed spatial planners asserted that they are able to understand the textual provisions and that they are also capable of interpreting the respective map. Due to the fact that there are only three different zones, development possibilities in each zone are very clear (Interview F-V, 2013). A PPR is usually prepared at a scale of 1:10,000 or 1:5,000, which is appropriate for planning at the local level. If more specific information is needed on a larger scale for planning decisions in the French case study site, advice can be provided by the RTM[179] (Interview F-VII, 2013). This means that in case of doubt, spatial planners working in one of the municipalities of the Ubaye valley may always consult the RTM for more detailed information on certain zones or plots of land.

The interviews with the spatial planning consultants revealed that in two out of the three interviews (i.e. Interview F-I and Interview F-II), the consultants did not pay attention to using the correct terminology. The term “risk” was also used when talking about hazards. For instance, when listing the ten different natural hazards that are considered by a PPR, spatial planners counted the different “types de risques” (types of risk) instead of the different “types d’aléas” (types of hazards). One interviewee asked what we mean by risk (“Mais qu'est-ce que vous entendez par risque?” (Interview F-I, 2013)). The third interviewed spatial planner was able to differentiate between the two terms hazard and risk and makes use of both terms during the interview (Interview F-III, 2013). One possible reason for the misuse of the term “risk” may be the fact that the main risk prevention instrument, the PPR, uses the term “risk”. The denomination of the plan might therefore lead to a general use of the term “risk” for PPR users.

The PPR also helps to fulfil the objectives of the new Loi SRU (see Chapter 6.2.1). This refers in particular to the preservation of agricultural land and the promotion of urban density. By limiting new construction on agricultural land, the PPR prevents land drawdown for settlements and infrastructure and compels local authorities to build more densely (Interview F-I, 2013).

As mentioned above, a few communes do not have a PPR available[180]. In such cases, it is more difficult for spatial planners to determine planning measures and to define legally binding regulations regarding the

[177] The same applies to the PPR: When being revised, the most current information and the latest studies have to be integrated and considered (Interview F-V, 2013).

[178] In one interview, a regional level representative mentioned that in France spatial planners tend to follow the rules, which is why they appreciate an instrument that tells them exactly what to do how (Interview F-VI, 2013).

[179] The RTM was responsible for the preparation of all PPRs in the Ubaye valley.

[180] In one interview the interviewee mentioned, that the municipality of St. Paul de l’Ubaye does not have a PPR; since the prefect did not accept to prescribe it. Although the municipality is at high risk there is no PPR available, as there are only about 200 inhabitants. Money for the elaboration of a PPR is mostly spent for municipalities with a higher number of inhabitants (Interview F-II, 2013). This number of inhabitants does not include the high number of tourists that visit the valley both in winter and summer season. This means that in fact many more people are exposed to hazards than just the official number of inhabitants.

use of land. One of the interviewed spatial planners simply summarised: *"When there is a PPR, there is no problem, everyone knows what to do. If there is no PPR, that is a debacle"* (Interview F-III, 2013, own translation). Planners working on plans in communes without a PPR need to resort to other available forms of risk information, like the AZI for flood hazards[181]. Other types of maps are not always easily applicable. Some interviewees stated that when there is no PPR, information about risks is only available on maps at a small scale (Interview F-II, 2013; Interview F-VI, 2013) which are basically "not usable" (Interview F-II, 2013). More precisely, these are geological maps of the territory. Due to the high costs, smaller communes in mountainous regions are less likely to be prescribed a PPR, although the occurrence of natural hazards might be just as probable as in communes with a larger population. Interviewed planners therefore argued that for such communes the existence of other, more quality maps at a larger scale would be highly appreciated (Interview F-II, 2013).

At times, when a commune does not have a PPR available, it might generally lack knowledge about existing risks. In the past, France has experienced many problems related to floods that occurred in zones in which a commune had authorised settlement development without having sufficient knowledge about flood risks. However, one of the interview partners pointed out that there is a higher chance of avoiding such mistakes, *"when there is a good environmental assessment"* (Interview F-X, 2013, own translation) (see Chapter 9).

Another difficulty related to the use of a PPR was mentioned: The challenge of determining the use of land in cases of a leeway in decision-making. This means, that to some extent planners will encounter exceptions. For some situations, the law specifies that people may not build unless a certain condition is fulfilled. At times it is difficult for spatial planners to determine whether such a specific condition is fulfilled or not, which is why these cases require a more subjective interpretation and analysis of the risk (Interview F-I, 2013). This may constitute a considerable challenge for planners as such a subjective interpretation requires knowledge more detailed information about the risk. For instance, it is not sufficient to just have knowledge about the potential occurrence of a flood and the possible extent. Knowing the delimitation of a flood plain is one thing. Having more precise information about the possible height of the flood waters and the possible force is another.

When looking at other types of maps, an acceptable alternative to the PPR are the so-called "cartes informatives", or CIPTM ("Cartographie Informative des Phénomènes Torrentiels et de Mouvements de Terrain") (Interview F-II, 2013). Such CIPTMs are special types of maps which are currently tested in the Department Hautes-Alpes [182]. The problems mentioned above related to costs and time for the elaboration of the PPR as well as the fact that apart from floods and avalanches, other types of hazards were generally hardly assessed, prompted the Departmental Directorate of the Territory of Hautes-Alpes (DDT 05) to react. In 2009, the DDT 05 decided to cover the whole territory of the department with "cartes informatives" of major mountain hazards that have not been mapped before. This involves four hazards

[181] In the absence of other, more specific or binding regulations, AZI maps can also be used to prevent new or further construction in hazard-exposed areas. However, one prerequisite is the fact that potential map users are aware of these maps and that AZI were distributed. This is not necessarily the case in all departments (Cour de Comptes, 2012, p. 14).

[182] The Department Hautes-Alpes (Department 05) is a neighbouring department of the Department Alpes-de-Haute-Provence (Department 04). The topographic and demographic situation in both departments is comparable and so are the natural hazard conditions.

that are very common in mountainous regions: landslides, rock falls, surface erosion and flash floods (DDT 05, 2013). In other words, those municipalities not covered by a PPR are to be covered by a "carte informative" (see Figure 50). This way the Department Hautes-Alpes solves the problem of a lack of PPRs in some municipalities by providing them with a different type of multi-hazard map[183].

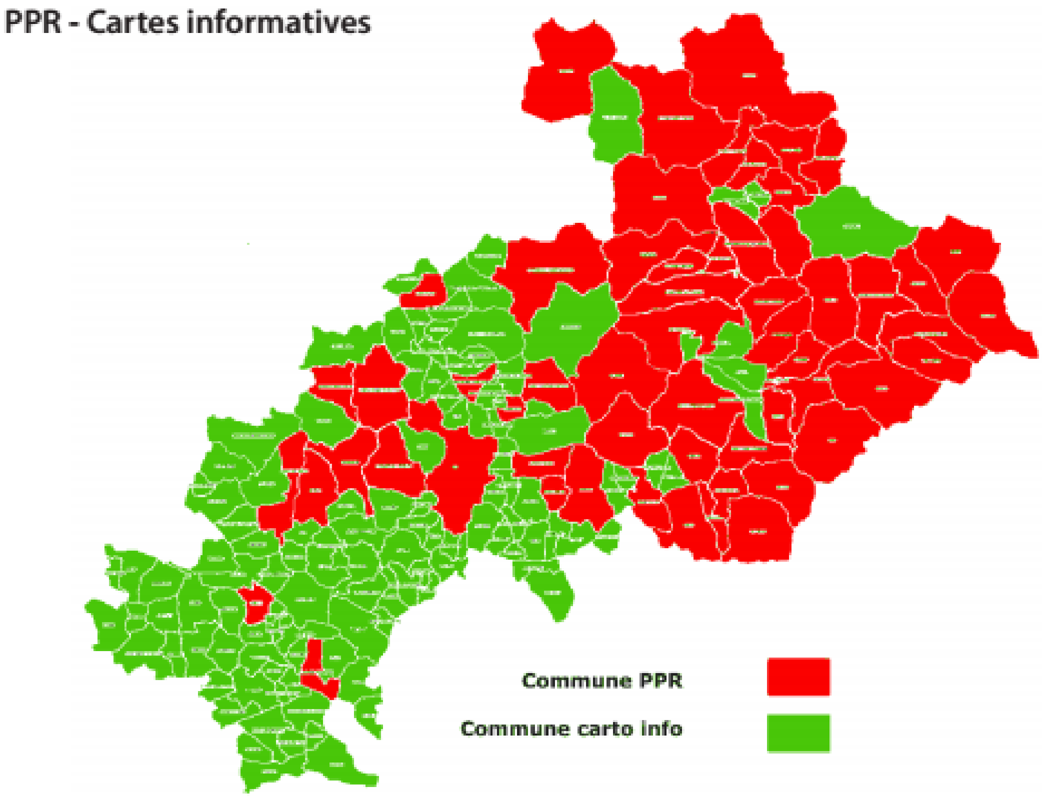

Figure 50 Distribution of communes covered by a PPR (red) or a CIPTM (green) in the Department Haute-Alpes (effective 2013) (not to scale) (Source: DDT 05, 2013)

CIPTMs are supposed to fulfil different purposes in different fields of action. Related to spatial planning, these maps have a triple benefit (DDT 05, 2013):

- Ensuring that the municipality addresses the issue of disaster risk;
- Providing an essential piece of information to the municipality without a delay and without costs;
- Reaching a common discourse between the central and the local level governments about a sensitive subject.

Such maps raise awareness and manage to put the public on alert. Even though at a scale of 1:25,000 they are certainly not as accurate as PPRs, they still provide more precise information than maps at an even smaller scale. With the help of a CIPTM, planners can more easily discuss matters with the local administration and convince them of prevailing risks. One interviewee suggested that CIPTMs should also be prepared in the Department Alpes-de-Haute-Provence, as they constitute an intermediate between the PPR and available geological maps at a small scale (Interview F-II, 2013). Since in the Department Alpes-de-Haute-Provence many smaller communes do not have a PPR, the availability of a CIPTM is considered a real asset.

[183] See Appendix 2, Figure 5 for an example of a CIPTM.

Regarding specific user needs, answers given by the interviewed spatial planners revolved around the perception that the PPR is most desirable, as it constitutes an instrument that is easily applicable and understandable. All consultants underlined the fact that they are no experts in disaster risk. Therefore, they appreciate a tool that tells them exactly what to do (Interview F-I, 2013; Interview F-II, 2013; Interview F-III, 2013). Provisions listed in the "règlement" of the PPR are clear for the most part. Moreover, since the PPRs are public easements, planners feel that legally binding land use plans can easily be enforced and decisions imposed on the population. In other words, certain planning regulations can be blamed on the PPR. However, the PPR was also criticised for not providing specific enough information, e.g. about the possible height of flood waters (see above). It has to be noted in this context that the risk culture in France is characterised by a high sense of security: The fact that mayors can be accused and brought before the court for taking irresponsible planning decisions usually prompts decision-makers to take maximum precaution. This means that when a mayor is aware of existing risks he usually prohibits any kind of construction as he does not want to be held responsible in the event of a disaster and possible adverse impacts. In order to avoid such restricting decisions, more detailed information about risks is needed. In this respect, *"PPRs are insufficient"* (Interview F-III, 2013, own translation).

As explained in Chapter 4, spatial planning promotes a precautionary use of land when consciously dealing with uncertainties. The French government has turned the precautionary regulation of land into one of its main premises. The former president Jacques Chirac has added an environmental charter to the French constitution, including the precautionary principle[184]. The definition of the precautionary principle in the charter states that *"even if scientific knowledge is uncertain where damages occur which could have serious and irreversible effects on the environment, public authorities shall within their own domains of competences, apply the precautionary principle through the implementation of procedures for the evaluation of risks, and the adoption of provisional and proportionate measures in order to prevent the damage occurring"* (Marrani, 2013, pp. 43–44). This precautionary principle remains both constitutional and theoretical and it cannot be very easily implemented (Interview F-X, 2013). Although rather vaguely formulated, this charter allows the public to bring legal action in cases where they feel the (local) government has not provided for adequate and sufficient protection. As local governments – or the mayor in particular – do not want to be held responsible for damages in case of a disaster, they usually always apply the precautionary principle. This holds especially true for municipalities that are highly exposed to one or more natural hazards. This is why municipalities take maximum precaution via planning documents and the PPR, which means that as soon as there is a risk, building is often completely prohibited (Interview F-III, 2013; Interview F-XI, 2013). One interview partner stated that *"when there is uncertainty, there is a presumption of risk; and when there is a presumption of risk, we must apply the precautionary principle"* (Interview F-V, 2013, own translation). Hence, this is a common way to deal with uncertainties in France:

[184] Marrani (2013, p. 43) explains that in addition to the precautionary principle, this charter was also supposed to include four other key environmental principles: prevention, responsibility, integration, information and participation. While the prevention principle is considered an objective of constitutional value, the precautionary principle was made a real principle of constitutional value.

Expecting the worst and take maximum precaution measures. This is usually effectuated by leaving areas free of development in order to completely avoid any damage or harm[185].

It is important to keep in mind that risk analyses are always imperfect. Nobody can predict when exactly a flood will occur with what power and what damages it might cause. The problem is, that while awareness among planners and decision-makers about uncertainty in risk information exists, this uncertainty is not quantifiable. This is why it is difficult to deal with (Interview F-V, 2013). Risks can only be considered based on the actual state of knowledge. This means that a regional authority may require the consideration of risks according to existing knowledge. While some local governments will choose a maximum interpretation of the risk, others will still choose a minimum interpretation. Hence, uncertainties are actually managed politically (Interview F-X, 2013). It is a political decision how to deal with uncertainties. Although there are different methods of addressing uncertainty, in the French case study area decision-makers *"seek to overestimate the risk for reasons of precaution"* (Interview F-V, 2013, own translation). Sometimes even in cases of a supposedly higher level of risk construction will not be permitted. This means that even a blue zone might be declared non-constructible if planners and decision-makers suppose that there is a higher level of risk than illustrated in the PPR (Interview F-II, 2013).

The PPRI, or a PPRN with provisions for flood-prone areas, employs the 100-year return period of a flood in order to calculate the flood extent and to assess areas at high risk of floods (red zones). While in other European countries they refer to more extreme flood events (e.g. the 300-year-return period), in France it is mandatory to take into account the 100-year return period when elaborating the zoning for the PPR (Interview F-VII, 2013). This means that building is usually permitted outside those areas and that the residual risk is accepted there. It is believed that – provided a flood event stronger than the 100-year event will never occur – construction outside of this area will never be threatened (Interview F-VI, 2013). It should, however, also be acknowledged that a "risque zero" (zero risk) does not exist. This means that the sole existence of a PPR will not prevent disasters and related damages from occurring (Interview F-V, 2013).

The implementation of participatory processes is still relatively recent in France. In the context of the Aarhus Convention and different European directives, the notion of public participation in decision-making has been incorporated into public policy-making. Especially with the Bachelot Law from 2003 developments in France have strengthened efforts regarding the information of the population, public participation and institutional dialogue in relation to risk prevention (IRMa, 2014). For the elaboration of a PPR, three different forms of consultation are identified (CERTU and MEDAD, 2007, pp. 10–11):

1. Continuous consultation ("concertation") of the population

There are three main stages at which a consultation must take place and that must allow enough time for the public to participate:

a) The launch of the reflection ("le lancement de la reflexion");
b) Studies for hazards, elements at risk and vulnerability ("les études d'aléas, d'enjeux et de vulnérabilité")

[185] According to one of the interviewees, *"in urban planning the precautionary principle consists in either denying construction or allocation of an area for urbanisation, or in authorising construction that is subject to certain requirements"* (Interview F-V, 2013, own translation).

c) The local prevention strategy and the draft of the PPRN ("la stratégie locale de prévention et le projet de PPRN qui en constitue une déclinaison réglementaire")

2. Mandatory consultation before the public inquiry

This consultation is carried out occasionally on a specific subject and must allow the collection of all the opinions of stakeholders affected by the draft plan.

3. Public inquiry ("enquête publique") on the draft plan

The draft plan is subject to a public inquiry that applies to all plans and projects that impact on the environment.

Consultations must take place as early as possible and throughout the process of developing a PPR. They address all those concerned by the PPR (i.e. local authorities, scientific experts, local population, etc.) and are an essential means for establishing ownership of the risk prevention strategy to be implemented as well as acceptance of the constraints that it determines. Public administrators responsible for urban planning as well as water management boards (in case of a PPRI) are necessarily involved in preparing the document (MEDDE, 2013). While a consultation appears early in the process, when decisions have yet to be taken and a public discussion and participation is still possible, a public inquiry appears later in the process when decisions have practically already been made. It is rather a matter of public information than of participation. Although the public is asked for an opinion and it can still submit their comments and opinions, a public inquiry happens too late in the process in order to still be able to contribute constructively. In contrast, consultations offer more chances for real discussions as they are organised during the whole process of elaborating a certain plan or project (MLET, 2014, pp. 1–2).

It was stated in several interviews that a PPR is very restrictive and sometimes limits a municipality in its development options – in both economic and social terms. This is why at the beginning municipalities did not necessarily approve of the PPR. However, over time mayors started to realise that a PPR can also serve as a basis for argumentation towards the public. Instead of having to explain their decisions, they can invoke the prescriptions of the PPR (Interview F-II, 2013) and impose the plan on the population (Interview F-VI, 2013). Especially in areas that are very restricted in terms of new construction due to their topography and hazard exposure, the PPR is suited to formally enforce a limited options for new constructions (Interview F-I, 2013). Still, a PPR is not always desired and supported by the public and imposing such a restrictive plan on the public may cause difficulties. This is especially the case when private property rights are touched. A problem in this respect could be the fact that sometimes the process of PPR elaboration lacks effective public participation. Two interviewees explained that despite the fact that a consultation should take place during the whole process of elaborating a PPR, it is often only done the moment the zoning regulation is presented (Interview F-VII, 2013; Interview F-IX, 2013). The zoning regulation is done by the contracting authority, which is often the DDT, i.e. the service of the state. It is presented after a consulting agency has produced the analysis of hazards and elements at risk. Accordingly, consultation takes place rather late in the process, when a preliminary decision on the zoning regulation has already been taken. Therein lies the problem: Consultations are considered very important, especially when imposing decisions on the public. In such cases, discussion with those affected is crucial in order to explain the meaningfulness of land use designations (Interview F-IX, 2013). Provisions enforced by the PPR might then be accepted more easily.

One reason for a late public involvement is the fact that the earlier in the process the public is consulted, the longer the process takes, as the more facts and results are presented to the public, the more questions and concerns will be raised. This will certainly prolong the process. This is why there are many contracting authorities that organise a public reunion only the moment they present the zoning regulations (Interview F-IX, 2013). Public “participation” during the elaboration of a PPR is effectively merely a public hearing. When considering the fact that consensus about thresholds for acceptable risks is essential and restrictions for property rights need to be justifiable towards the affected public, such late involvement of the population might cause problems of acceptance.

During the process of elaborating a PLU, public involvement is considered equally important. It is not only essential for achieving public acceptance for the plan, but public reunions may also serve educational purposes. During a public reunion, spatial planners present all the constraints that an area or a commune is restricted to. Inhabitants who might have ambitious plans for further developing their land and property will understand which constraints they are subjected to. Therefore, presentations during public reunions will also help raise awareness and understanding for existing risks and according constraints (Interview F-II, 2013). Conveying decisions related to urban planning is the responsibility of the commune. One of the interviewed spatial planners explained that since the contents are rather technical, it is difficult to communicate them to the public. When solutions were found for particular problems, these solutions need to be communicated within the commune. Ultimately there are always people who are not satisfied with a project, which requires someone to explain the legality of planning decisions. Sometimes this constitutes a big task (Interview F-I, 2013).

As explained in Chapter 6, the PLU includes the so-called “Project of development and sustainable development” (PADD). The PADD can be considered an informal planning tool as it involves a visionary element in addition to the regulatory provisions of the PLU. This visionary element in turn can be based on a separate study. For example, in the municipality of Barcelonnette, a “vision urbaine” was developed. This urban vision was elaborated in the context of a “compétition de l’urbanisme”, i.e. an urban competition. The competition “Mieux vivre à Barcelonnette” (Living better in Barcelonnette) asked for competition entries which would provide development objectives for the municipality. The elaboration of development objectives necessitated the consideration of various issues that characterise the municipality, including the notion of disaster risk. Due to the fact that the urban strategy was directed towards proposing development options in terms of urban extension and settlement development, a consideration of risks was required in order not to neglect building constraints. Hence the urban vision is also related to environmental and disaster risk aspects. Finally, the urban strategy was able to advance the local authority in producing the PADD (Interview F-XI, 2013). This means that the results of the urban vision are integrated into the PADD and consequently into the PLU. Informal instruments like the urban vision of

Barcelonnette might therefore be a supporting tool when it comes to the elaboration of strategic objectives while respecting existing development constraints[186].

Finally, in terms of communication, various links exist between spatial planners and other relevant actors. In France, planners elaborate a synthesis of all the information they have collected: Risk information as well as all other information of local interest. Therefore, they can be considered as the "chef d'orchestre" (conductor) (Interview F-II, 2013). As such, they have a great responsibility, as they advise the mayor where to allow new construction. This is why they must be certain about their advice. Although in the end the mayor is liable for the final decision, spatial planners are responsible for informing and advising him as best possible[187] (Interview F-II, 2013). Planners have to collect information on various topics and thus have points of contact with many different fields of expertise. When information on a particular topic in a certain zone is missing, spatial planners ask the local government to engage a consulting agency to provide the missing studies. It is the planner who in the end considers all available information – both binding and non-binding – and proposes whether and where to build and how. It is crucial for them to communicate with different actors, both formally and informally. By not considering certain aspects – intentional or unintentional – planners might be accused of being biased. This is why a constant coordination with other fields of expertise and sectoral planning authorities is important. This way, information from different subject areas can be gathered and a full consideration of all relevant topics can be ensured (Interview F-II, 2013).

However, it has to be pointed out that spatial planners are only experts in spatial planning. They have no specialist knowledge in ecology, risks or landscape. This is why every kind of planning-related information which is taken into account is backed by specialists in their field of expertise (Interview F-II, 2013). Especially when having a scope of action or a leeway in decision-making, e.g. when the law allows some room for interpretation, spatial planners and planning authorities require expert advice and support from respective consulting agencies (Interview F-I, 2013). Spatial planners therefore need to work with professionals from many different fields and then coordinate all information. When expert advice can be ensured, the planning process will allow for a strong and legitimate planning document, and a strong planning document is what the interviewed planners strive for. This is why they always try to ensure effective cooperation with all services involved, both public and private, as well as effective participation of the population (Interview F-II, 2013).

In contrast, communication with representatives from the DDT and the DREAL, i.e. governmental authorities at the regional level, takes place on a merely formal or "technical" basis at a certain point during the planning process (Interview F-I, 2013). Still it should be added that, although *"one should not bother them with anything, they are usually interested when being approached, as this makes them*

[186] The other municipalities of the Ubaye valley did not have an urban vision or a comparable document. A reason for the lack of such documents could be the small size of the neighbouring communes. As Barcelonnette is the seat of a sub-prefect and has a higher population number than the surrounding municipalities, it has more possibilities to initiate an urban competition. Still, every PLU must consist of a PADD, which is why any local spatial plan involves informal elements to a certain extent. Especially in areas that are obviously exposed to different natural hazards, an involvement of aspects related to disaster risk into the PADD makes sense.

[187] The interview partner pointed out that spatial planners must inform the mayor in case they have a justified reason for not allowing construction in a certain zone. If they have information about an existing danger, they must give advice accordingly. The interviewee stressed that he does not intend to designate an area as constructible in cases of doubt (Interview F-II, 2013).

understand the problems of the territory better" (Interview F-I, 2013, own translation). In fact, regarding the preparation of a PPR, the DDT manages the process. This means they can be understood as the "organisers" of the process by finding consulting agencies responsible for the risk assessment, organising public consultations and inquiries, managing the subsidies, i.e. the funding of the PPR, etc. They are not responsible for the elaboration of actual studies, but only guarantee a smooth process (Interview F-V, 2013). Therefore, the DDT cannot provide information regarding the content, but only regarding the organisation.

One interviewee stated that a two-way communication process between spatial and sectoral planners takes place. On the one hand, information can be easily collected from respective "bureaux d'études" (consulting agencies), but they also provide information themselves which is then used by other actors. Hence, usually information is exchanged and there is always a mutual trust (Interview F-II, 2013). Especially in cases where spatial planners know the territory well, they might be able to give valuable information regarding potential dangers which have not been considered before and which might prompt the mayor to order a detailed study from a sectoral consulting agency.

As mentioned above, public administrators responsible for urban planning are involved in the preparation of a PPR. This may be because of their role as representatives of the local authority. However, no evidence was given in relation to an actual involvement of spatial planners (consultants) for hazard or risk mapping. The impression that was gained from the interviews conducted with spatial and sectoral planners as well as representatives from authorities is that the mapping of hazards and risks and the elaboration of studies is a task for sectoral consulting agencies only and that spatial planners are not directly involved.

Finally, it has to be underlined that the use of risk information is pertinent to any spatial plan or planning project in the mountain departments in France. The mountain departments in particular are used to dealing with risks, which is why risk information is used in many different fields of activity. This is not necessarily the case for all the rest of France, however (Interview F-VI, 2013). Even within the French case study site there are differences: While in the communes of Jausiers and Barcelonnette decision-makers put socio-economic development on top of the agenda, the commune of Faucon de Barcelonnette considers risk management among the top 10 priorities (Interview F-XIII, 2013). In Jausiers and Barcelonnette, development decisions are more economy-driven: One of the main goals of the commune of Jausiers is to keep the economy alive and to maintain or even increase the number of inhabitants (Interview F-XII, 2013). The commune of Barcelonnette currently has more urgent problems to solve. After the army left the barracks in town, the commune is now concerned with stabilising the economy (Interview F-VI, 2013) by further developing tourist activities, for instance. Both Barcelonnette and Jausiers raised the embankment of the Ubaye river and improved the dike so that it can withstand a 100-year flood in order to protect existing development from future flood events. The commune of Faucon de Barcelonnette however, has not improved the dike yet, as the funding has not been cleared. The commune cannot afford the dike by itself but depends on financial aid from the state and the region (Interview F-XIII, 2013). This is why for now decision-makers need to resort to other solutions in terms of risk prevention.

Another feature of the culture in this valley is represented by attitudes of decision-makers (i.e. the mayors of the municipalities) towards inter-municipal cooperation. According to a representative of the regional authority (Interview F-VI, 2013), some municipalities within the CCVU are keen to cooperate, others are not and are hence rather trying to solve problems related to disaster risk individually[188]. This concerns flood risks in particular. An example was given by the representative of the municipality of Barcelonnette (Interview F-XI, 2013) who explained that the risk of flooding coming from the Bachelard stream, which runs between Uvernet and Barcelonnette, has to be addressed and prevented in a cooperative way by all municipalities subjected to this risk. However, the commune of Uvernet refuses to be involved in the financing of flood protection measures, as in reality only the other municipalities would actually benefit from such measures. The interviewee stresses that in situations like these, *"we must apply a collective vision"* and that *"it takes common measures effectuated by all municipalities"* (Interview F-XI, 2013, own translation). Such a common preventive approach can be supported by the CCVU: All 13 municipalities that form part of the CCVU need to work and provide common funding for protection works. Despite the existence of the CCVU, cooperation is hampered by tension between decision-makers and by asserting one's individual interests. Such an individualist dealing with the problem can detrimental to of the protection of the whole valley. Hence, future efforts should be directed towards strengthening inter-municipal cooperation and common problem solving.

8.2.2 The use of risk information in spatial planning in the Polish study area

In Poland, the Małopolska and Silesian voivodeships represent those regions in Poland that are at highest risk of river floods and flash floods as a result of extreme weather events. According to prognoses and development trends, there is a growing risk of flooding and heavy rainfall events in these areas in the next years and decades (Ministry of Infrastructure and Development, 2014, pp. 26–27). In addition, the Polish Carpathians in particular are at risk of landslides. According to the current legislation, soil landslides are in fact classified as natural calamities, while they turn into a natural disaster once their impacts threaten human life or property or important, large ecosystems (see Chapter 3). The number of registered landslides is gradually growing, which requires an adequate assessment and continuous monitoring of landslides and landslide-endangered areas (Szafarczyk and Kwartnik-Pruc, 2012). While the assessment and monitoring of landslides has started relatively recently, flood hazard assessment has been legally required since 2001, when the Water Law demanded the elaboration of flood protection studies (see Chapter 8.1.2).

Currently, the implementation of the EU FRD is an ongoing process in Poland. Most of the steps defined in the Directive were taken recently and some steps are still ahead. The adjustment of the legislative framework required amendments of those acts directly concerning the spatial development of floodplains (Głosińska, 2014, p. 127). In accordance with the amended act and the requirements of the Directive, a preliminary flood risk assessment was carried out in December 2011. Following this, flood hazard and flood risk maps at a scale of 1:10,000 were prepared and published by the time of the Directive's deadline in December 2013. Accordingly, the formal requirement of the Directive was fulfilled.

New maps published in accordance with the Directive cover only areas identified in the preliminary flood risk assessment. These can be found primarily in valleys of main rivers, whereas many mountain rivers, where the most violent flash floods occur, are not covered by the new maps. For these areas, only maps from former flood protection studies made in years 2005-2012 are available. Flood protection studies

[188] Apparently, the communes upstream of Barcelonnette are interested in a cooperation while the municipalities downstream of Barcelonnette are not (Interview F-VI, 2013).

were made according to requirements of the previous version of the Water Law. The old maps were also prepared at a scale of 1:10,000. They contain the extents of floods of the 500, 100, 30, 20, 10, 5 and 2-year return periods (see Appendix 2, Figure 8). Moreover, due to particular local needs, the RZGW have recently prepared new maps for some smaller catchment areas regardless of the maps that were already prepared by the KZGW for those areas identified in the preliminary flood risk assessment. For the Polish case study area such maps were prepared as part of the "Analiza Zagrożenia Powodziowego w Zlewni Skawy" (Analysis of Flood Hazard in the Catchment of the Skawa River) (RZGW Kraków, 2012). As a result, today three types of maps exist simultaneously: Flood hazard and risk maps based on provisions of the EU FRD are prepared for some limited areas mainly along main rivers. The Polish case study area is currently covered with maps of the former flood protection study (for now these maps are legally binding) and with the mentioned new maps made by the RZGW in Krakow. Consequently, spatial planning dealing with development in floodplains has to deal with the difficulty of determining which maps are going to be legally binding in catchments not identified in the preliminary flood risk assessment as areas for which a potential significant flood risk exists.

Regarding landslide assessment and mapping, the Carpathian Branch of the Polish Geological Institute has been working on the internet-based landslide information system "SOPO" (System Osłony Przeciwosuwiskowej) since 2006, with the main objective of creating a digital database of active and inactive landslides as well as landslide-endangered areas (Borkowski et al., 2011, p. 325). Although the whole project is still under construction, first results have already been made available[189]. The Polish Geological Institute offers a web application that can be accessed by everyone. By using the application, existing landslides in a specific area can be illustrated and detailed information about single landslides can be retrieved. For each landslide, a map is prepared at the scale of 1:10,000 (see Appendix 2, Figure 11).

Figure 51 shows the status quo of landslide analyses in the municipality of Stryszawa in the year 2016. As not all information can be presented on the map, a registration card containing detailed data is attached to each landslide designated on the map (PIG-PIB, 2016a). In the unified legend of the landslide hazard maps geologists distinguish between four types of areas with higher or lower landslide risk: permanently active landslides, periodically active landslides, non-active landslides and landslide-endangered areas. Moreover, the maps contain detailed information about the landslide relief, i.e. main scarps, trenches and thresholds, as well as their height (Borkowski et al., 2011, p. 326). The whole landslide-related content is displayed against the background of a topographic map. Additionally, administrative boundaries, lakes, rivers and wetlands are highlighted.

[189] The system "SOPO" is created within a long-term project that started in 2006 and will finish in 2022. Work has been divided into four stages: The first stage was completed in 2008 and it encompassed the elaboration of the methodology and pilot mapping of landslides in selected areas. The second stage (between 2008 and 2015) was essential for the successful implementation of the system. The main task for this period was to create detailed maps (scale 1:10,000) of all landslides and landslide endangered areas for 75% of the Polish Carpathians (PIG-PIB, 2016a).

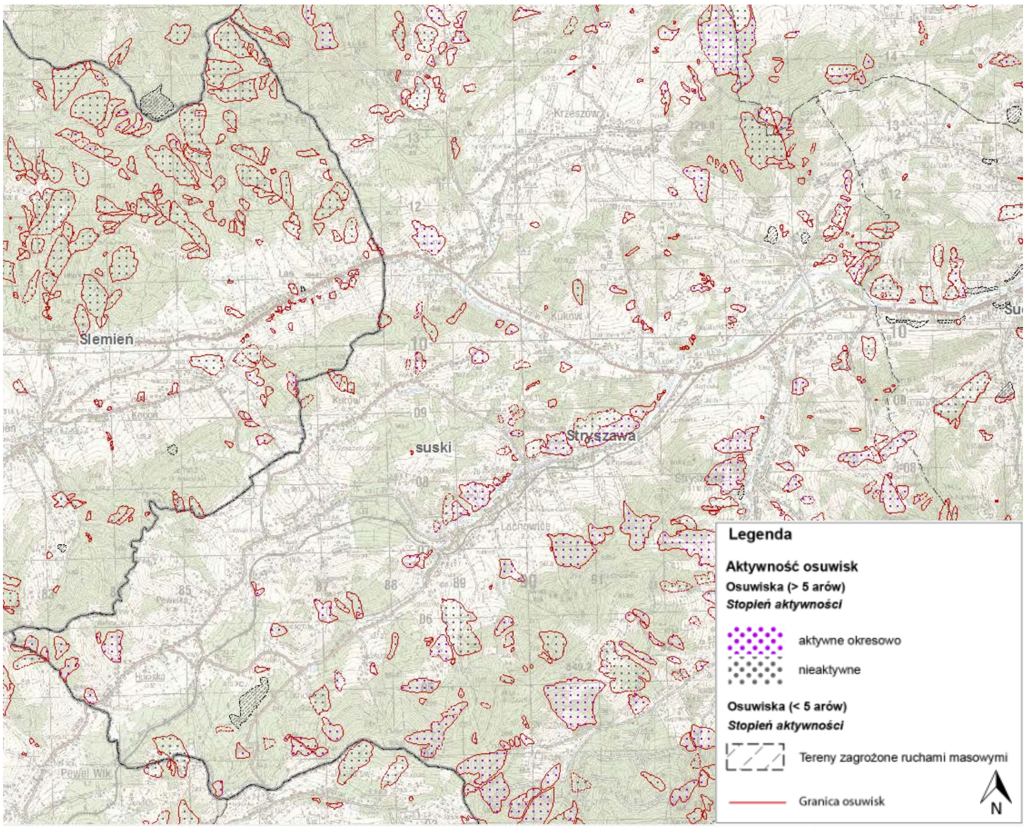

Figure 51 Status quo of landslide analysis in the municipality of Stryszawa (effective September 2016) (not to scale) (Source: PIG-PIB, 2016b)

SOPO also provides descriptive information for each municipality. It contains general geographical information about the municipality and a detailed description of the geological structure. Moreover, it offers a detailed description of landslides, an analysis of their further development as well as recommendations for their monitoring (PIG-PIB, 2016a). Spatial planners are among the main addressees and end-users of the system. Both Wieprz and Stryszawa are affected and exposed to several landslides. This is why considering the information provided by this database is crucial.

One of the major deficiencies in handling landslide hazards as compared to flood hazards is the fact that knowledge about landslides, i.e. their occurrence and impacts, is relatively recent. In Poland, landslides have not been considered a great threat until very recently. This is why the mapping of landslides and the provision of information about landslides has started comparably late. Although it has to be acknowledged that the first mapping of landslides already happened in the 1960s, a more extensive and comprehensive mapping of landslides in Poland has never been completed (Interview P-V, 2013). According to a representative from the Polish Geological Institute, in 1997 about 2,000-2,500 landslides appeared in the mountainous area of Poland, most of them in the Polish Carpathians. After this event, the Geological Institute prepared maps for about 20,000 landslides, which were later digitalised. By 2013, after two thirds of the maps had been prepared as part of the SOPO project, the Geological Institute had knowledge of about 30,000 landslides. By the end of the project, the Geological Institute expects to have a database including around 100,000 landslides (Interview P-V, 2013). Due to this late advancement in the field of landslide mapping and due to the fact that more detailed knowledge about the location and characteristics of landslides was missing, many houses were built on landslides during the 1960s, 1970s and 1980s. Around 30% of the buildings in the Carpathian Mountains are assumed to be located on old landslides

(Interview P-V, 2013). This happened not only because of missing knowledge but also because of missing regulations. Today, by being able to use the SOPO maps, spatial planners have at least a valuable, scientific evidence base which informs decision-making and serves as a basis for justified planning decisions. Still, the regulations are not very specific, especially regarding old landslides and potentially landslide-endangered areas. This is why some sort of solution is needed for such areas. In this context, the representative of the Geological Institute suggests that a special geological study should be prepared which would help spatial planners and decision-makers make adequate decisions in terms of building restrictions or conditions (Interview P-V, 2013).

However, even if knowledge about landslides and their location exists, it is still hard to convince the public not to build on certain plots of land. Especially in the rural parts of Poland, the population is very attached to their land. People want to live and stay close to their families, which is why sometimes they refuse to leave their property and insist on building on their plots of land (Interview P-V, 2013). This is a further difficulty to be considered when making local spatial plans for municipalities in rural areas: There will always be inhabitants who express their disagreement with building restrictions. Consequently, municipalities will often face a dilemma between enforcing building prohibitions and allowing building under certain conditions.

Interviews carried out in the Polish case study site confirm the problem of having rather ambiguous regulations. In general, the interviewed spatial planners criticise the multitude of information sources and information contents, the often fragmentary information as well as the lack of clear instructions. During the process of plan-making, spatial planners usually use different sources of information, i.e. different maps that contain different information (Interview P-I, 2013). Maps resulting from former flood protection studies were partially considered suitable by interviewed planners, since they showed the spatial extent of a potential flood (Interview P-I, 2013; Interview P-II, 2013). Knowledge about the spatial extent of a particular phenomenon is a prerequisite in spatial planning. Yet the difficulty remained to choose the one appropriate probability of occurrence from among the many flood lines (seven in total) determined in the maps of the flood protection study (Głosińska, 2014). However, maps of the flood protection study are considered accurate. In addition, there is always the possibility to contact the RZGW to receive more detailed information or advice (Interview P-III, 2013). Now that only three return periods are considered for the new flood maps, integration of the areas threatened by floods into both plans at the local level will be facilitated[190]. Besides, additional information like the depth and speed of water as well as the direction of flow might provide important input for the plan-making process. Such information could be important for situations when the director of the RZGW issues a special permission, i.e. when he allows construction in a flood-prone area. In such a case it is important to still build in a safe way, for example by elevating the first floor (Interview P-III, 2013). Furthermore, such information can also be of use when deciding on the use of land exposed to floods. As it is neither possible nor desirable to prohibit any land use in a flood-

[190] However, the positive effects of the new flood maps are ambiguous: Representatives of the RZGW Krakow pointed out that the new flood hazard and risk maps will soon be legally binding, whereas maps of the flood protection study will not. This may cause problems, especially in municipalities with floodplain areas that are not covered by the new maps. Since it will not be legally required to use the old maps, municipalities might be unwilling to integrate the floodplain boundaries depicted in the old maps into their spatial plans and thus avoid establishing building bans (Interview P-VI, 2013). Głosińska (2014), however, highlights the benefit of the new binding regulations, which may prompt a stricter prohibition of development along the water-courses.

prone area, more detailed information about possible flood depths and speed of water are useful to determine which land uses to choose, what types of structures to allow etc. (Interview P-III, 2013).

As mentioned above, a multitude of information sources causes difficulties – but so does a complete lack of information about flood hazards. For one thing, spatial planners often face situations when information is missing, so they usually have to collect the needed information for the respective plan in question from different sources (Interview P-I, 2013). For another thing, when there is no information about floods, the municipality cannot legally enforce building prohibitions. From one interviewee's experience, the local authorities usually care about the safety of the population. They would not put people at risk intentionally. Some municipalities even commission a proper, separate study to identify flood-endangered areas – just to have according information about floods available. However, sometimes even though the population is aware of a potential risk and knows which areas are endangered by floods, some inhabitants want to construct nonetheless in order to be able to sell the property at a higher rate. This is where it gets complicated for the municipality to enforce decisions and acquire acceptance for the plan (Interview P-III, 2013).

Regarding landslide hazards, spatial planners stated in the interviews that the new web-application provided by the Polish Geological Institute constitutes a real advantage. Having information about existing landslides, their location and state of activity is considered an asset. However, the information about landslides that is provided on the maps is not easily interpretable in any case. The legend of the map includes different levels of danger: permanently active, periodically active, non-active and endangered. When planners deal with an individual application or request of a landowner for the allocation of a plot of land for development, they need to decide whether this plot of land may be allocated for development or not. If the area in question is affected by an active landslide, the situation is obvious. The Geological Institute suggests prohibiting any kind of construction when facing permanently or periodically active landslides. When dealing with non-active landslides and landslide-endangered areas, construction is allowed under certain conditions (Interview P-V, 2013). However, if planners deal with endangered or potentially endangered areas, they do not feel competent or qualified enough to decide whether or not to allow construction on the site (Interview P-I, 2013; Interview P-II, 2013). In cases of doubt, different methods are used to solve the difficulty of having to interpret the map and take a decision, e.g. asking the Geological Institute for further advice, a desktop study, own investigations on the field etc. (Interview P-I, 2013). The problem is that the Geological Institute merely provides the maps. Spatial planners, however, have to interpret and apply the maps and turn them into legally binding planning decisions[191]. Therein lies the problem, if the provided information is rather ambiguous (Interview P-I, 2013).

The methodology of landslide mapping was introduced by the Polish Geological Institute. Initially, geologists responsible for mapping assumed that development could be prevented completely in any area they designated on the map. Currently there are discussions between geologists and spatial planners on what should be allowed in each category (Interview P-I, 2013). It appears that geologists need to gain a

[191] In this context it was also mentioned that the geological department of the district or regional authority have to give their opinion on the draft plan. The geological department applies equal information about landslides. These kind of maps are usually the most comprehensive available source of information about landslides. A question one of the spatial planners raised is how the geological department will interpret the different items of the legend. The interviewee reckons that there will be a need to translate the landslide map into planning regulations (Interview P-I, 2013). This means that the difficulty to interpret the different stages of activity is not only encountered by spatial planners but also by those bodies that give an opinion on the plan.

minimum understanding of planning at the local level in order to produce maps with clearer provisions, which in the end can be more easily applied.

In terms of user needs, especially information about the spatial extent of flood is considered essential for spatial planning purposes at the local level (Interview P-I, 2013). Knowing the relevant flood line(s) and the extent of a flood plain is basic knowledge that helps to determine areas which are designated as zones free of development, zones that only allow certain land-uses and zones that allow building under certain conditions. However, knowledge about the spatial extent of landslides and other natural phenomena is important as well. For spatial planning purposes, the spatial extent and intensity of a natural hazard may be even more important than the probability of occurrence (Interview P-I, 2013). Once the risk has been appropriately assessed and considered in spatial planning strategies, it is rather irrelevant how often an event occurs. In this context it also has to be noted that both interviewed spatial planners applied the terms "hazard" and "risk" and were aware of the difference between the terms (Interview P-I, 2013; Interview P-II, 2013). This knowledge can be traced back to the fact that they know about the newly developed flood hazard and risk maps. Consequently, spatial planners in the Polish case study are capable of using the terminology correctly.

It was also mentioned that data assessed by the National Institute of Meteorology and Water Management is often not freely accessible, but at high costs. This is why spatial planners usually do not have this data available. As one spatial planner explained, data from the National Institute of Meteorology and Water Management is useful for preparing the eco-physiographic study (Interview P-I, 2013). If according data is not accessible it might hamper the preparation of this study.

In Poland, the precautionary principle is not included in the constitution like it is in France. While three principles of environmental protection law have been included in the Polish constitution, namely the principle of sustainable development, the principle of the right to information about the environment, and the principle of responsibility of damage, the precautionary principle originates from the Polish Environmental Protection Law (Lew-Gliniecka, 2012, pp. 85–86). The precautionary principle is mentioned in the same article of the Environmental Protection Law as the prevention principle. Lew-Glienicka (2012, p. 93) explains that while prevention refers to actions that aim to avoid any negative outcomes, i.e. while actions are taken, precaution happens earlier during the planning process. Planning needs to ensure that an action to be implemented does not, at present, have any adverse impacts on the environment. Taking precaution, however, also means considering possible negative impacts in the future and anticipating outcomes which at present are not known. *"Since prevention means action which shall counterfight any known, negative effects, in case of precaution the goal is to take into consideration negative scenarios which are not yet known or even suspected to produce undesirable effects"* (Lew-Gliniecka, 2012, p. 93). Accordingly, the Environmental Protection Law requires an appropriate consideration of uncertainties by applying the precautionary principle in case potential negative impacts are unknown.

As far as human lives are concerned, the best way to deal with uncertainty is to expect the worst by anticipating the greatest and most probable danger. This is why it is beneficial to outline different return periods on flood hazard maps, for instance (Interview P-III, 2013). Different return periods have already been outlined in the former flood protection studies and are now legally required after the introduction of the FRD. Such maps give decision-makers the possibility to also consider extreme flood events, i.e. events with a low probability but a high impact. This way maximum precaution can be taken, if required.

Regarding landslides, taking decisions about the use of potentially endangered areas is most difficult. In such cases in particular, the Geological Institute expects spatial planners to use a buffer space between the landslide and the area where building can take place. This means that a buffer zone should be added to the landslide which is 3-4 times longer than the scarp of the landslide (Interview P-V, 2013). Using such buffers in already existing settlements is not realistic, however. According to an interviewed spatial planner (Interview P-I, 2013), it could be formulated to the property owners as an advice, but it cannot be turned into a legally binding regulation.

This precautionary way of handling uncertainties and ensuring environmental protection was one of the reasons for introducing the Environmental Impact Assessment into the Polish legislative system (Lew-Gliniecka, 2012, p. 93). The EIA but also the SEA are fully in line with this way of thinking: EIA and SEA represent both prevention and precautionary principles since possible future impacts will be assessed and prevented or reduced.

Public involvement in spatial planning is carried out by public consultations and public inquiries. When it comes to issues related to disaster risk, spatial planners consider public consultations rather as a hindrance. There is concern that the population that is directly affected by the plan might object and cause trouble if the plan is too restrictive. Furthermore, property owners often do not accept any restrictions regarding their private property, especially any prohibition of further development or of new buildings on their plots of land. When new information about risks, e.g. in the case of Poland the landslide hazard maps provided by SOPO, is available which concerns private plots of land, property owners rarely accept the fact that their property is supposedly located on a landslide. Sometimes they even commission private geological studies in order to disprove the information provided by the Geological Institute or other scientific studies. It was mentioned in one interview that after the communist times, single land owners even went to court to claim their right to build (Interview P-II, 2013). In such cases spatial planners find it hard to argue against private studies, as they can only base their decisions on the information they have available, i.e. information they have collected. They need to have strong arguments against such objections. These could be provided by additional studies ordered by the municipality. This means that municipalities could ask for special investigations in addition to those that already exist. However, special investigations are expensive and municipalities often cannot afford such extra studies[192] (Interview P-II, 2013). Finally, it should be mentioned that local councils and mayors have an interest in being re-elected. In small communes in particular, like those in the Polish case study site, people know each other and close relationships between the population and elected representatives may lead to a softening of regulations and building restrictions (Interview P-II, 2013).

A further downside of public involvement is seen in the extension of the planning process: Any additional adjustment of the plan requires an extra round of public consultation. This is why each adjustment will prolong the planning process. Reaching final decisions and finding a consensus become more complicated and challenging (Interview P-I, 2013). Consequently, spatial planners are not particularly supportive of public involvement in general. Often public involvement is detrimental to a smooth planning process. This

[192] It was also mentioned that some municipalities are aware of the risk they are exposed to and consider detailed studies important. An example was given of a municipality that was very concerned about the safety of the population and where the mayor was aware of the risk. Here, additional studies were conducted to properly inform decision-making (Interview P-II, 2013).

is why spatial planners rather perceive it as a necessary element of the planning process than a way to achieve a good decision and purposefully manage the public space in an accepted manner.

As outlined in Chapter 6, informal planning tools generally have a rather low priority in the Polish planning practice. Apart from the fact that spatial development in Poland is mostly economically governed and has great regulatory power, informal planning instruments were neither well known among spatial planning representatives nor considered practical from a disaster risk reduction perspective. Master plans were mentioned as well as projects that are directed towards urban revitalisation, for instance (Interview P-III, 2013). Regarding disaster risks, formalised plans are considered the only way to actually implement and achieve decisions related to risk reduction. Due to the fact that public involvement in general is rather low, informal instruments are not considered supportive in this regard.

Just like in the French case study site, urban planning as a discipline is considered very wide. Planners need different background information and a minimum knowledge in order to understand existing conditions and constraints (Interview P-III, 2013). Planners responsible for producing the plan often have to search for relevant information first. Already existing information is not always accurate or complete. If an aspect is not legally required, planners need to start looking for any available information on this topic (Interview P-I, 2013). This is why in the Polish case study site the existing information transfer between sectoral and spatial planning authorities and actors can be regarded as an asset.

Information and knowledge transfer exists in both formal and informal ways. For instance, the regional Environmental Protection Agency organises discussions with the heads of municipalities as well as those responsible for making local spatial plans. These meetings serve to better explain the professional opinion provided by the Environmental Protection Agency about the draft plan and to provide some additional information, input and advice (Interview P-VI, 2013). In contrast to the RZGW, the Environmental Protection Agency is not required to approve the plan, but to only provide an opinion. This means that their opinion is not legally binding. While the RZGW may directly influence the content of the plan, the Environmental Protection Agency gives an opinion about contents that should be reconsidered and gives advice on how to improve the plan from an environmental point of view. This seems a good way of treating the plan and of integrating and respecting environmental concerns. After all, there is a big difference between approving a plan and giving an opinion about a plan. An opinion provides expert knowledge and contains more detailed information, while an approval does not necessarily contribute to an improvement of the plan in a more integrated context (Interview P-VI, 2013). It has been clarified that if the Environmental Protection Agency was approving plans, their statement would be legally binding and they would only check the compliance of the plan with the law. By providing advice and giving suggestions, they can have a greater influence on the actual contents of the plan (Interview P-VI, 2013). The informal meetings mentioned above serve to inform the respective planning actors and help to make the plan more environmentally sound.

The Polish Geological Institute may also give advice on the draft plan, but they are not directly involved in the planning process. The institute only provides information about landslides. It also organises meetings with spatial planners in order to provide advice in case they encounter problems. Both the Geological Institute and the RZGW offer training sessions for spatial planners regarding new developments in hazard and risk mapping as well as new legal requirements on how to deal with floods and landslides and turn them into legally binding regulations. In addition to officially approving the plan, the RZGW also provides additional, more informal information. A representative of the RZGW Krakow who is responsible for spatial planning often provides an opinion on local spatial plans and helps find a solution if there are problems related to the use of land in flood zones (Interview P-VI, 2013).

In the Polish case study area the impression was gained that spatial planners and planning authorities are not directly involved in any hazard and risk mapping processes. The planning authority at the regional level, for instance, just verifies whether the content of the plan matches the provisions of the hazard maps. Although an interest exists in being involved, the interview partner did not consider his duties and daily work relevant to being involved (Interview P-III, 2013). According to the RZGW Krakow, however, spatial planners may always express their doubts towards mapped hazards and risks. In certain cases, spatial planners know the territory quite well, e.g. if they have a long planning experience in a certain area. Consequently, they might have some experience and local knowledge about floods that is sometimes not translated correctly onto the maps. If they feel the hazard has not been illustrated correctly, they may always express their concern and disagreement about the contents towards the RZGW. Provided they bring proof of their concern, the RZGW checks the information brought to them and decides whether their maps need to be adjusted (Interview P-VI, 2013).

Hence, there is indeed an example of a two-way communication transfer, although one-way information transfer from sectoral planning bodies towards spatial planners and respective authorities seems more common. The most important task is to ensure maximum security for the population (Interview P-III, 2013). The way this is done is considered less relevant, which is why spatial planners and planning authorities do not feel they should be involved in hazard and risk mapping or be asked for particular information.

8.2.3 The use of risk information in spatial planning in the Italian study area

Due to its location between the pre-alpine hills, the Friulian plain and the Adriatic Sea, the Friuli Venezia Giulia region is a diverse region with different topographic and climatic patterns. The Italian case study area, the Fella river catchment, is characterised by complex physical-geographic characteristics and is defined by steeps slopes, a dense river network and high precipitation levels, making it highly exposed to different types of natural hazards. These characteristics, however, are also the reason for quite noticeable limitations for human activities, including settlement development and economic growth. In the past, extreme rainfall has caused flash floods and landslides, which lead to human casualties and huge damages. Despite being a rural area, recent trends suggest that a future development characterised by touristic expansion could result in an increase of geo-hydrological risks. Urbanisation and further touristic development will lead to an increase in the number of elements at risk. Consequently, impacts of expected climatic changes could exacerbate with an increasing vulnerability of the area (Changes-ITN, 2011). The need for a precautionary planning of available space is apparent. Natural hazards necessarily have to be considered when planning the future development of space. Combining a further economic development of the area with the quest for safety of the population is one of the main challenges today.

The Friuli Venezia Giulia region has a long tradition of assessing hazards and producing according informative documents. After the earthquake in 1976, the region started to consider existing risks. In the 24 years between the earthquake and the decision to develop the PAI in the year 2000, each municipality has produced many documents on disaster risk, e.g. plans and maps related to single hazards. This information was then used as input to be integrated into the PAI. In this respect, the Friuli Venezia Giulia region was slightly more advanced than the neighbouring Veneto region. An according background for risk prevention was established early due to the prevailing risk culture in this region, which is characterised by a long tradition and experience with preventing disasters. This experience has been beneficial for achieving a more convenient elaboration of the PAI (Interview I-IV, 2013). Some of the old information was already available in a digital format and it was therefore easily geo-referenceable with a GIS system. Existing information was combined and updated with new laser scan data in order to produce the PAI. The old data was not based on hydrological models but on site visits, monitoring and historical data. It therefore already included valuable information.

In Friuli Venezia Giulia, the PAIs for the rivers Isonzo, Tagliamento, Piave and Brenta-Bacchiglione were adopted by a presidential decree in November 2013. The respective PAI for the Fella river catchment was adopted by a presidential decree of the council of ministers on 13 November 2015. The whole catchment of the Fella river today is covered by maps for hydro-geological (see Figure 52), geomorphological and avalanche hazards.

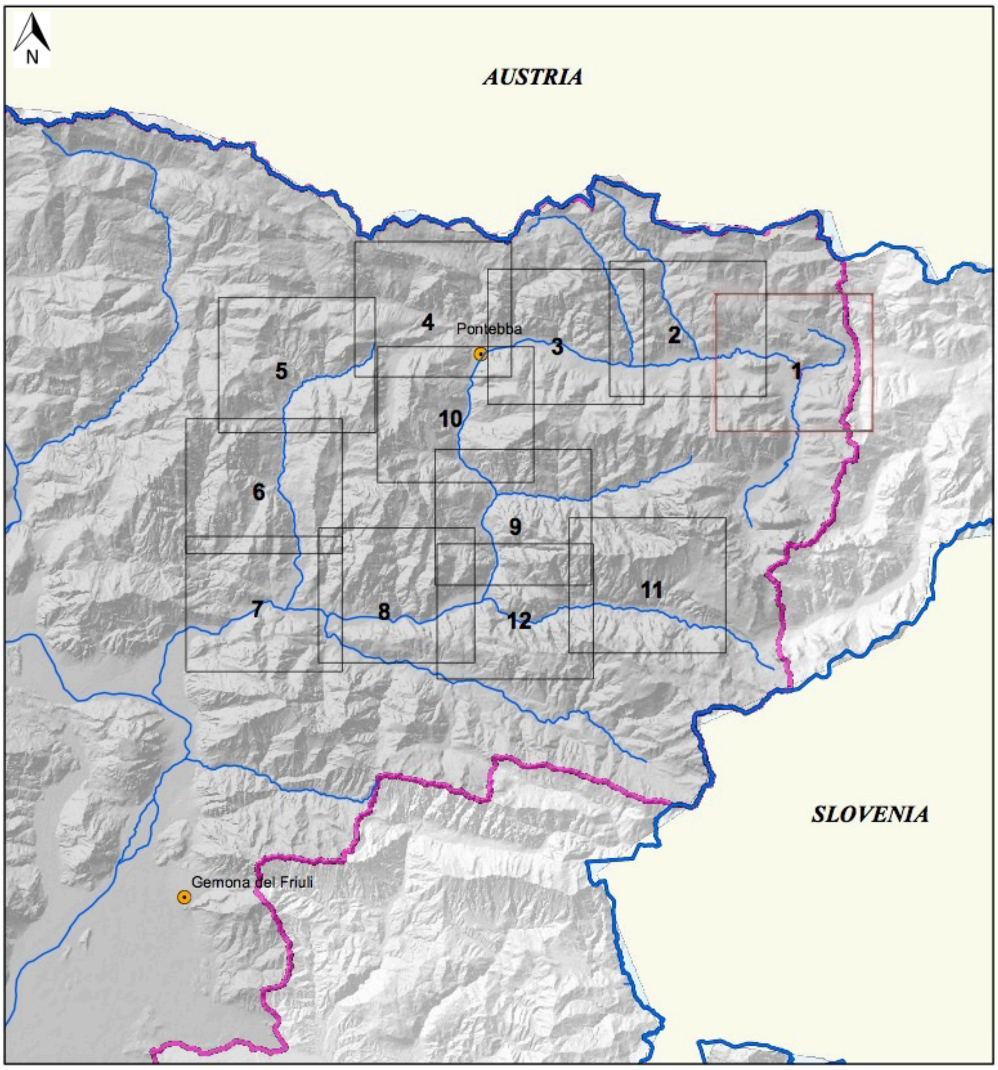

Figure 52 Area in the Fella river catchment covered by maps of hydrological hazards with each square representing an individual map (not to scale) (Source: ADB, 2015)

In the Italian case study, the PAI is generally considered an important risk prevention tool by various actors. Still, mayors consider the PAI very restrictive. The single maps do not necessarily reflect reality, but sometimes appear unreasonable (Interview I-IX, 2913): While the geomorphological map of the draft version of the PAI seems to be well done, the hydro-geological map includes mistakes[193] (Interview I-IX, 2013). Between the adoption of the PAI and the final approval of the plan, communes may examine all documents in detail and they may express their concern towards aspects they think are not correctly depicted. This is why the final version of the PAI is different from its draft version (Interview I-I, 2013). Municipalities therefore used the opportunity to point out mistakes, so that maps could be amended and corrected, especially those for hydro-geological hazards.

In fact, the PAI seems to have caused confusion and concern. It concerns and interferes with the whole territory of a municipality. Municipalities that worked with a 30 or 40-year-old land use plan now have to reconsider their spatial development strategy. The PAI requires municipalities to change their local land use plans[194] (Interview I-I, 2013). In the end, even though some municipalities might still feel limited in their choices regarding the use of their territory, an agreement has to be reached which reflects the provisions of the PAI. Such a regulatory approach was deemed necessary in order to deal with hazards in spatial planning more comprehensively and to ensure a maximum level of safety.

Due to the fact that the PAI demands adequate choices from spatial planners and provides a legislative basis for implementing such choices, it directly enforces risk prevention measures (Interview I-VII, 2013). Planners use the maps of the PAI to produce an overlay with the plan proposal. This way, the intended land use, including existing elements at risk, can be combined with the hazard. However, as interviews with spatial planners/architects revealed, this overlay is only done in order to make a pre-evaluation, but this “self-check” has no validity. Apart from the PAI there is actually little need for information about natural hazards. Interviewed spatial planners stressed that they do not have sufficient competencies and that in the end it is not the planners who take hazard-related decisions (Interview I-I, 2013; Interview I-II, 2013). One interviewee clearly pointed out that *“in the urban planning process of the Friuli Venezia Giulia region the assessment of risks is done by a geologist”* [195] (Interview I-I, 2013, own translation). The interviewee further explained that planning documents, prior to their adoption by the municipal council, are subjected to an evaluation by a geologist who assesses the compatibility of the provisions in relation to the geomorphological and hydro-geological risks. This means that the planner prepares a draft version and decides, for instance, whether a certain zone should be declared a residential area. This first elaboration of the plan is then sent to a geologist who checks whether the proposal is compatible with the risk situation. The geologist decides which provisions can be realised and which cannot. The outcome of this verification again is submitted to the competent regional authority who checks the contents of the plan. The adoption of a land use plan only follows after a favourable opinion by the regional authority. This means that *“all*

[193] At the time the interviews were carried out, only a draft version of the maps was available. In 2013, when the interviews were conducted, the PAI had already been approved, but it had not been adopted yet. This is why the interview partners refer to the draft version of the PAI and not the final version, which was only adopted in 2015.

[194] The interviewee believes that without the introduction of the PAI, municipalities would have continued working with their old plans “to infinity”, as there is no legal provision that demands any change (Interview I-I, 2013).

[195] It is important to mention that several spatial planners or “urbanisti” were contacted and asked for an interview. In the end, finding spatial planners that accepted an appointment was a challenge. Most of them declined by arguing they were not responsible for dealing with natural hazards and that geologists should be contacted instead, who are experts in this field. The fact that several spatial planners refused an interview because of this very reason shows that disaster risk does not seem to be an issue they have to deal with on a more regular basis. This holds not only true for consultants, but also for spatial planning representatives of local and regional governmental authorities.

aspects related to risk assessment are matters which specifically fall in the area of the geologists' competence and not of the planners' competence" (Interview I-I, 2013, own translation).

This statement was also shared by representatives from the Soil Defence Department at the regional level, who argued that spatial planners lack knowledge regarding disaster risk. They believe that spatial planners or local planning authorities as well as the general public have difficulties in understanding the contents of hazard maps. Flood maps, for instance, are not easily understandable or interpretable, since regulations are not necessarily written in a clear or transparent way (Interview I-IV, 2013). It was also mentioned that due to this lack of understanding, the work of spatial planners must always be accompanied and assisted by information providers and producers (Interview I-VII, 2013), i.e. sectoral planners or sectoral planning authorities.

This lack of competencies of spatial planners regarding a more direct handling of risks is a consequence of Law 741/81, which prompted many regions in Italy to legally require an integration of geological studies into local spatial plans (Galderisi and Menoni, 2006, p. 108). This holds also true for the Friuli Venezia Giulia region where the assessment of natural hazards falls under the responsibility and competence of geologists and hydraulic engineers. As stipulated by Regional Law 52/1991 and Regional Law 27/1988, a geological report ("relazione geologica") must be prepared for spatial plans. These geological reports check the compatibility of the provisions of the plan with the geomorphological, hydro-geological and avalanche conditions of the territory, as stipulated in Article 30, no. 1 (e) of Regional Law 52/1991. The studies come along with maps, graphic tables and protocols of geotechnical investigations which take account of the different geologic contents known as well as the opinions expressed by the Regional Geological Service. Qualified professionals are assigned the role of elaborating geological reports, since they have the according competencies. Consequently, it is not the spatial planners who examine the compatibility of the plan with the given hazard profile of the area in question but professional geologists who exert their expert knowledge regarding the feasibility of the plan. This means that geologists take the old geological maps provided by the region, use the maps of the PAI and preferably add field site visits in order to finally determine the degree of risk in the area[196] (Interview I-I, 2013). Due to the lack of specific guidelines, these geological studies are often merely attached to the plans, which makes their application rather ineffective (Fabietti, 2000 cited in Galderisi and Menoni, 2006, p. 108). In summary, spatial planners' need for adequate information is generally rather low, as no particularly deep knowledge is required.

Moreover, difficulties were encountered regarding the terminology used in the interviews with the two spatial planning consultants. In one interview, the meaning of the term "vulnerability" had to be explained and the difference to the terms "hazard" and "risk" established (Interview I-I, 2013). The second interviewee did not make use of the term "hazard" at all[197] (Interview I-II, 2013). Even when referring to the PAI of the river basin authority "Alto Adriatico", the geo-hydrological map at least cannot be declared a

[196] A geological report is also required for single building permits. This means that every new building must be verified by a geologist first. The fact that the region lies in a seismic zone alone makes such a selective geological report necessary. Thus, even when the area in not in a flood- or landslide-exposed area, the existence of seismic risks requires a verification of each construction by a geologist (Interview I-II, 2013).

[197] The term "hazard" was only used by the translator. Not making use of the term does not necessarily mean that the difference between the terms hazard and risk was not well-understood, but it could still be an indication.

risk map, because it only displays the hazard (see Chapter 8.1.3). This means that strictly speaking a differentiation should be made between hazard and risk maps regarding the PAI.

The fact that spatial planners do not deal with risk information in further detail in the first place suggests that spatial planners hardly reflect on particular information needs. However, one interviewed spatial planner expressed the opinion that there was a need for a different approach than the current way of dealing with risks. The planner suggested that maps were needed which give more information about the vulnerability of an area, i.e. maps that rather provide a synthesis of risk-related information (Interview I-I, 2013). In this respect it should be noted that spatial planners need to be encouraged to demand accurate and detailed information while at the same time involve data providers so they can deepen competencies in dealing with risks (Interview I-VII, 2013).

In addition, the handling of uncertainties causes problems in Italy. Taking precaution is a very recent matter in environmental law and policy. Although the Italian constitution states in Article 10 that *"the Italian legal system conforms to the norms of generally recognised international law"* (own translation), the precautionary principle, for instance, did not find an express reference and mentioning in the Italian law before the introduction of law 308/2004. The precautionary principle was mentioned in a number of sector specific norms before the year 2004, however. Article 2 of law 308/2004 introduced the obligation to explicitly include the principles of the European Union, including the precautionary principle. In 2006, progress was made in terms of advancing the precautionary principle with the adoption of Legislative Decree 152/2006 (Nespor and Cesaris, 2009, pp. 1826–1827). Applying the precautionary principle means taking protective measures even when there is uncertainty whether a particular event is harmful to the environment or not. In contrast to precaution, prevention measures are taken when the risk caused by certain actions or activities is known with certainty. This means that the precautionary principle strengthens the prevention principle in the sense that it justifies – or even necessitates – protection measures also in case of an uncertain situation. In other words, the existence of uncertainty in science cannot serve as a pretext to justify the lack of protection measures (according to the belief: "better safe than sorry") (Mancini Palamoni, 2014, p. 9). Hence, protection against disaster risk is also required in cases of uncertainty about the actual occurrence of a disaster. Strictly speaking, this also applies to spatial-planning-related decisions and measures.

Communication of uncertainty was also considered necessary by interviewed sectoral planners. For instance, in one of the interviews it was pointed out that *"uncertainty is an inevitable part of the risk assessment process, because of incomplete knowledge of both the probability of future events and their consequences"* and that *"all risk assessments should be supported by a clear statement of the uncertainties in order to inform all the parts of what is known and unknown"* (Interview I-VIII, 2014). When looking at flood maps, uncertainty is communicated by making use of buffer zones. The regional authority responsible for flood maps creates buffer zones of 50 meters next to the calculated boundaries of the flood. Mathematical models cannot predict the extent of a potential flood with certainty. This is why buffer zones are used to show that the danger might even exceed the indicated flood boundaries. The buffer zones are included in order to raise the awareness of end-users and to make them pay attention to a possible danger behind the flood boundaries (Interview I-IV, 2013).

Interviews in the Italian case study site revealed, that spatial planners cannot properly consider uncertainty. The final outputs spatial planners produce in the form of local spatial plans are fully based on predefined rules and laws. They are not able to evaluate and quantify uncertainty, which is why they are not able to integrate and consider any problems related to uncertainty into the local spatial plan (Interview I-II, 2013). As mentioned above, spatial planners do not have the respective competencies and responsibilities when it comes to the handling of disaster risk. Consequently, it is just as difficult for them to make decisions under uncertainty. Uncertainty can therefore not be taken into account, but only provisions already provided to them by different actors. In fact, they expect uncertainties to be dealt with by sectoral planning entities, i.e. by information providers, so they can use readily applicable risk information. This means that decisions regarding the possible use of land and land use restrictions should be made at sectoral scale. Accordingly, although spatial planners are aware of uncertainties related to future development and to scientific information about possible future risks, they are not able to further consider problems related to such uncertain situations.

As mentioned in Chapter 6.2.3, public participation does not play a great role and consensus-building is not as widely used as in other European countries (e.g. Germany and Scandinavian countries). In contrast, *"the Italian context does not seem very open to participatory institutions, if we intend with this term explicit and formalized requirements for the involvement of stakeholders in the policy process"* (Massarutto et al., 2003, p. 20). For urban planning documents, public participation takes place through a public inquiry ("deposito"), during which the plan is presented in the office of the city hall for 30 consecutive days (Article 9, no. 2 Legge Urbanistica 1150/1942). In this period of public inquiry, everyone can access the draft plan, make comments and express observations ("osservazioni") of public interest[198]. However, the public inquiry happens quite late in the planning process. First, different authorities and the public administration are involved. This means that a plan is first handed over to the mayor, geologists, different departments of the local administration etc. Only after its approval the plan is presented to the public so they can express their observations. Sometimes this process takes a very long time and a lot of effort is needed until the final approval and the adoption of the plan (Interview I-II, 2013).

The EU FRD legally requires public involvement. Consequently, the involvement of the general public has been integrated into the Italian flood risk legislation. Participation of the public should attempt to go beyond a mere information of the population and aim to raise awareness and improve knowledge of flood risks (Mysiak et al., 2013, p. 2890). When carried out effectively, public participation can promote the development of socially accepted scenarios and risk management measures. It is considered a key principle in flood risk management (Mysiak et al., 2013, p. 2886). In the according river basin district in Friuli Venezia Giulia, public involvement takes place in so-called "focal points". These focal points have been established in seven cities within the river basin district. The kick-off for the focal point meetings took place in the year 2012. By the time the interviews were conducted in April 2013, two rounds of consultations had taken place. Technically speaking everyone can take part in these meetings. Effectively, participants mainly consisted of technicians, politicians (of municipalities, provinces and the region) and other stakeholders such as fishermen and canoeists. Other interested stakeholders included professional associations of engineers, geologists, urban planners and architects (Interview I-V, 2013). During these

[198] The urban law foresees for a "piano particolareggiato" that in addition to the "deposito", oppositions ("opposizioni") may be presented after the expiry of the deposit period by property owners affected by the plan (Article 15, no. 3, Legge Urbanistica 1150/1942).

focal point meetings, everyone is entitled to provide opinions and feedback on the flood risk management plan.

The public is also involved in the actual hazard mapping – not only in the preparation of flood risk management plans. The regional authority that is responsible for making the PAI considers it important to also address the local public. The population often knows the territory very well, especially the older generation. This is why the population is addressed and asked whether they remember certain flood events from the past. Such local knowledge is helpful, as the regional authority does not have a lot of recorded data and therefore depends on experiences from the local population (Interview I-IV, 2013). This knowledge, however, is collected by local authorities. This means that local authorities are responsible for collecting and combining all available information, i.e. reports, documents, photographs etc. including knowledge provided by the general public. This information is given to the regional authority, which, based on their own models and the information provided by the local authority, produce their flood hazard maps. Historical information is also very useful for landslide hazard assessment. Geologists are not necessarily aware of all landslides that occurred in the past if there are no past records of such phenomena. Thus, it is crucial to obtain historical information about floods and landslides (Interview I-IV, 2013). The public is only directly involved the moment the draft maps are presented. This is when they may comment on the draft version of the maps. The regional authority does not actually produce these maps by involving the public through meetings or seminars (Interview I-VIII, 2014). Yet, a representative from the regional authority believes that in order to improve the risk reduction approach, more public involvement is required (Interview I-VIII, 2014). In the end it is the local public that needs to be mobilised and motivated.

A different opinion was expressed regarding public involvement for local land use plans. First, all details of the plan have to be discussed in meetings with the mayor and the responsible persons involved, e.g. hydraulic engineers, geologists, environmental experts etc. (see above). In the end, a draft version of the plan is presented to the public, which is when things often become difficult for spatial planners. Usually some people oppose to the draft plan and do not agree with and accept certain decisions. There are always different opinions and after the public inquiry planners have to reconsider the draft plan by taking account of all observations made by the public (Interview I-II, 2013). Especially in election periods the preparation of a local plan may turn into a difficult venture (Interview I-II, 2013). One interview partner (Interview I-I, 2013) held the opinion that the population in the Italian case study site – or people living in the mountainous area of Friuli Venezia Giulia in general – is not particularly concerned about disaster risks. The locals do not live with the perception there is a great danger and do not consider themselves at risk. The only hazard they are worried about are earthquakes. They are aware of the natural hazards that menace their territory, which is why most of them have learned to live with and accept them. It is quite clear to both the public and the mayors that you cannot build on a landslide-prone area. Some locals have good knowledge of the territory and its environmental signs, which has also been acknowledged by the CapHaz-Net project consortium (Begg et al., 2012, p. 24).

However, Begg et al. (2012, p. 24) also found that there is:

- A loss of traditional, local knowledge by the majority of residents;
- A low level of adoption of private precautionary measures;
- A low level of personal preparedness;
- Disagreement among citizens about the implementation of risk mitigation options.

All these aspects are possible reasons for why it might come to disagreements with provisions in local spatial plans. Lack of awareness about the actual danger people live in, lack of knowledge about possible consequences, and reluctance to take private preparatory measures are reasons for why a more restrictive urban development might not be easily accepted by the public. Consequently, spatial plans in these areas might meet stronger opposition by the local public when they limit development objectives and even touch private property rights. This is why public involvement and risk communication are crucial. Sufficient public involvement could not only serve awareness raising and knowledge transfer in this context – it could also foster acceptance of planning decisions and selected measures (see Chapter 7.2.4).

As explained in Chapter 6.2.3, informal planning instruments hardly play any role in urban development in Italy. The negligent role of informal planning instruments was also observed in the Italian case study area. Some interview partners underlined the importance of legally binding plans and cast doubt on the usefulness and success of plans that neither have a legal basis nor any legal obligation to be followed. Others, however, acknowledged the benefit of informal planning instruments. Informal planning can be advanced by promoting project-related planning. Projects can coexist with formal, regulatory planning tools. This has already been introduced into the planning law of the Veneto region (Interview I-VII, 2013). It was also suggested that a framework was needed which allows the integration of planning actions related to projects into formal plans that legally define structural actions. Such a framework might allow a quick and effective planning-related intervention which would not be possible today due to the required time needed to complete a whole planning process (Interview I-I, 2013). Informal instruments or plans related to projects may also more specifically address a certain problem. It was suggested that single modifications could be made by projects. This means that in addition to a formal plan which legally defines the outline of urban development, more specific measures and decisions could be taken at project level. This way, planning could even respond to the economic situation and directly address the issues that need adjustment and improvement. In addition, there should be a legally required revision or monitoring in order to determine whether the situation has remained the same[199] (Interview I-I, 2013). Despite the fact that informal instruments can support decision-making and complement existing formal instruments, the development of such instruments requires time as well as persuading decision-makers of their usefulness. This is why they may not exist and be applied any time soon.

When looking at the information and knowledge transfer onto spatial planners and planning authorities in more detail, it should be kept in mind that spatial planners generally argue that they do not require much information about disaster risks (see above). Hence, they also do not formulate any demands towards sectoral planners as information providers. Yet, a minimum understanding of all issues related to disaster risk is a prerequisite when attempting planning practice in a more comprehensive and integrated manner. Spatial planners are still those actors that have to consider various concerns. They have to deal with different spatial demands and should therefore be able to understand the consequences of planning decisions (see chapter 7.2.2).

Currently, knowledge is provided through one-way communication by the Soil Defence Department to different actors, including local authorities, experts, and spatial planning professionals. The department organises meetings and tries to explain the content of flood maps. Moreover, more detailed advice can be

[199] Monitoring is involved in SEA, for instance. SEA therefore already represents an existing framework for monitoring purposes.

given for specific plans when a situation does not seem clear and spatial planners struggle to interpret the regulations of the PAI correctly (Interview I-IV, 2013). One representative from the Soil Defence Department takes the view that spatial planners and engineers should cooperate more intensively in general. On the one hand, engineers can always help planners to understand the contents and provisions of hazard maps. Hence, they should assist spatial planners in correctly interpreting the maps despite the fact that professional geologists check the final plan. On the other hand, engineers need to have more knowledge about possible strategic consequences when designating areas as P1 (low hazard) or P2 (medium hazard). This information can in turn be provided by spatial planners. Accordingly, a closer link is required between these actors (Interview I-IV, 2013).

Geologists think along similar lines. In fact, risks belong to the field of competence of spatial planners as they allocate a certain use of land to the territory (Interview I-VII, 2013). Geologists suggest that the role of spatial planners in disaster risk prevention should be strengthened as they reckon that spatial planners could positively influence a more prevention-oriented management of risks. In this respect, spatial planners should be more involved in handling risks. The problem is that while it is quite simple to determine where building is allowed and where it is not allowed, planners need and should apply a holistic knowledge of the territory to enable different solutions in addition to a mere prohibition of any construction (Interview I-III, 2014). After all, a holistic knowledge is indispensable when attempting a more comprehensive and reasonable development of space. Ultimately, spatial planning solutions for disaster risk reduction do not only consist of leaving areas free of development, but of applying different possibilities and risk management options, e.g. as promoted through the SEA procedure (see chapter 9). Such comprehensive spatial development remains difficult as long as the spatial planners' understanding of disaster risk issues is limited.

According to one representative of the Soil Defence Department, spatial planners are currently not involved in the mapping process. The flood and landslide hazard maps are produced without specifically contacting spatial planners (Interview I-VIII, 2014). The regulations they produce with the maps, however, have to be applied in spatial planning processes in the end. This is why the interviewee himself considers turning the mapping process into "team work" worthwhile (Interview I-VIII, 2013). Due to the fact that mapping cannot be based on mathematical modelling only, partly because of the uncertainties connected to modelling and reproducing floods on a purely mathematical basis, expert judgements are crucial. Flood hazard mapping neither relies on mathematical nor on historical aspects only. All available information has to be combined in order to produce meaningful results. This is why the involvement of different actors, including spatial planners, geologists, civil protection and the public, should be promoted to achieve a comprehensive expert judgement (Interview I-VIII, 2013).

8.3 Concluding remarks

Summarising this chapter, it can be stated that each country has developed its own way of preparing hazard and risk analyses of different natural hazards. In France and Italy, procedures are quite elaborate due to the long history of hazard mapping. Poland has only recently begun to start mapping its landslide hazards. However, the country is currently working on a nationwide assessment and data base which has turned into a large and lengthy project. The legislative basis and regulations for integrating risk information into spatial planning processes differ accordingly and depend on existing hazard and risk maps. While the

Polish case study site applies maps which display the hazard, the French case study site uses maps which show the risk (PPR) a particular area is exposed to. In the Italian case study site, the PAI consists of both: hazard maps for geo-hydrological hazards and maps that display the hazard and elements at risk for geomorphological hazards. Insofar approaches for integrating this information into spatial planning processes differ according to whether hazard or risk maps are used and according to the legal provisions these maps and plans implicate.

Furthermore, the chapter explains different aspects related to the use of risk information in the three case study sites in more detail. Differences are particularly apparent regarding the role and competencies of spatial planners in dealing with disaster risk and their respective needs for risk information. A main reason for these variations are differences in the types of maps and zoning instruments that are applied as well as legal regulations for spatial planning practices connected to them. With reference to the different approaches of integrating and presenting natural hazards within a local land use plan (see Chapter 4.2.3), differences can be summarised as follows:

In the French case study site, the PPR represents a risk-zoning map with legally binding character. The same applies to the PAI in the Italian case study sites. The risk zones of a PPR and the hazard zones of a PAI are displayed in a separate map with direct effects for third parties, i.e. land and property owners. Municipalities are legally obliged to implement the provisions of the respective plans. However, to implement such legally binding provisions, an exact evidence base is required; otherwise problems of acceptance may occur. An exact evidence base cannot be provided, due to uncertainties related to the assessment of risks. Just like deterministic flood maps explained in Chapter 4.2.3, both the PPR and the PAI do not communicate uncertainties as they do not provide for or display different probabilities. This involves the danger that spatial planners and decision-makers rely on the given information without further questioning or a further elaboration of the local conditions. Moreover, for PPRs and PAIs decisions have already been made by respective consulting agencies and scientific experts, who in fact represent decision-makers themselves rather than advisors. While spatial planners in France favour this approach for reasons of convenience and applicability, it is questionable from an actual spatial planning point of view, since a coordinated management and development of the urban space proves difficult. In order to promote acceptance of planning decisions, early public involvement is crucial in order to foster understanding. SEA might be beneficial in this context, as the consultation and participation phases required during the SEA process may provide a more intensive involvement of the public. Since SEA should accompany the planning process and since consultation and participation should take place simultaneously, important aspects can be considered and integrated into the plan early in the process and not only when the plan has already been prepared. A higher acceptance of the plan could be achieved by enabling a high degree of public involvement and by solving problems early.

In the Polish case study site, maps used in spatial planning processes are based on probabilistic approaches. While the new flood hazard maps and the maps of former flood protection studies show the possible extents of floods for different return periods, landslide hazard maps provided by SOPO show four different stages of landslide activity as well as scarps, trenches, thresholds and height of landslides. Despite the fact that landslide hazard maps are hard to interpret for spatial planners when dealing with non-active landslides and landslide-endangered areas, such probabilistic maps are generally beneficial for spatial planning purposes as they indicate the magnitude or intensity of an event for different probabilities, i.e. return periods. They take uncertainty into account and may guide spatial planning actors to determine adequate prevention measures within a weighing up process. Areas prone to flood hazards are considered during the compiling or review of a local land use plan. Hence coordinated hazard zoning takes place during the planning process while different concerns are weighed up. In this regard it might as well happen that decision-makers do not sufficiently consider hazard zones in spatial planning processes. If public pressures are too high, if interests of the public, single landowners or investors prevail and economic benefits are considered more important, hazard zoning could be completed less strictly. SEA could provide a useful framework in this context, as it may help inform a suitable allocation of types and intensity of land uses. For landslide hazards, the law foresees the sole consideration of areas prone to hazards. There are no legal regulations to use a particular type of map or plan. Hence, SOPO maps constitute independent hazard maps without a direct binding character, but with valuable information. An advantage of SOPO maps consists in the fact that the latest scientific knowledge can be implemented. The maps are currently being produced and are based on the latest assessment and modelling approaches. While spatial planners are predominantly grateful for this additional information about landslide hazards, objections may be raised by the public towards decisions that are made on the basis of these maps. Hence, the maps will not be effective in the event of stakeholders', i.e. land and property owners, unwillingness to follow the provisions. In principle, public involvement may facilitate the communication of risks to the population and promote awareness raising and knowledge transfer. However, public involvement is not necessarily exerted to a great extent, which is why its success and influence is sometimes questionable. Again, SEA might be beneficial in this context in terms of strengthening public involvement (see above). Local plans of physical development do not have to be prepared and they only contain information about hazard-prone areas when a specific reference is made. Accordingly, there is no guarantee that disaster risks are transferred into legally binding regulations for particular areas or plots of land, which can be considered a disadvantage of this approach.

9. Dealing with disaster risks in Strategic Environmental Assessment in the case study areas

This chapter is concerned with Strategic Environmental Assessment practices in the case study sites. It focuses on the respective use of risk information in SEA as well as on the role and relevance of SEA for risk management. More specifically answers will be given to the questions raised in Chapter 7.2 that refer to SEA in particular. For each case study answers will be provided that refer to:

- The consideration of disaster risk in environmental assessment procedures;
- The adoption of a future perspective by developing and comparing alternatives, including the zero alternative;
- The awareness and capability to choose between different strategies to deal with and manage risks.

9.1 The use of risk information in Strategic Environmental Assessment in the case study areas

Chapter 5 provided reasons for integrating risk information into SEA. In the course of this chapter current practices related to the use of risk information in SEA in the case study sites will be presented. SEA practices were examined in order to identify, whether disaster risk is considered a separate topic and to what extent risk information is used. Moreover, this chapter focuses on the comparison of alternatives as part of the SEA procedure. Local spatial plans and their implementation may have long lasting consequences for the urban space. As explained in Chapter 7.2.2 the adoption of a future perspective is therefore required. This can be done by appropriately considering different development alternatives, including an evolving environmental baseline. Accordingly, SEA reports were examined for their consideration and comparison of alternatives – including the zero alternative.

9.1.1 Examples from the French study area

In France, the SEA regulation does not impose a specific list of topics to be addressed when analysing the initial state of the environment. However, the analysis of the initial state of the environment should refer to both the provisions of the SEA Directive (Annex 1 (f)) as well as the objectives of the SCoT and the PLU as outlined in the Urban Planning Code (Article L 110 and L 121-1) (CGDD, 2011c; CGDD and SEEIDD, 2011). These articles declare the prevention of natural and technological risks as one of the main principles of urban planning. Therefore, it would only be consistent if risk information was also integrated into the SEA of urban planning documents.

Analysing the initial state of the environment is a key point of the environmental assessment. It constitutes an objective analysis of strengths and weaknesses and takes account of different trends and perspectives as well as existing interaction between different environmental issues. The analysis of the initial state should not represent the environment as a constraint. Instead it should identify those assets of the territory which may represent unique features as well as those weaknesses which could be enhanced by the planning document (CGDD and SEEIDD, 2011, p. 25). Accordingly, it is of vital importance that the environmental assessment does not predict a priori what might cause problems or impacts on the territory. It should address all environmental matters equally in order to allow a characterisation of the state of the environment and its evolution as a whole (CGDD, 2011c, p. 1). This is why at the beginning of the SEA procedure the contracting authority will initiate preliminary studies. This step encompasses the very first synthesis of the project and aims to identify all relevant environmental issues (Interview F-VIII, 2013). Environmental issues may be presented by single elements of the environment (e.g. water, air, soil, climate) or through links that exist between humans and their environment (e.g. resources, pollution, risks). Attention should always be paid to identifying relationships between the different environmental issues (CGDD and SEEIDD, 2011, p. 26). Studies related to single environmental elements are usually completed by professional consulting agencies. This means that analyses are carried out by experts such as hydrologists, geologists and biologists who prepare specific studies in their field of expertise (Interview F-VIII, 2013). Figure 53 illustrates which elements of the environment should be considered (landscape, biodiversity, natural risks, water cycle, soil and subsoil, energy, waste, air quality, technological risks, noise), how they are influenced by political perceptions in terms of consumption of space, use of resources and pollution and how a change of environmental elements may impact on climate change and health, for instance.

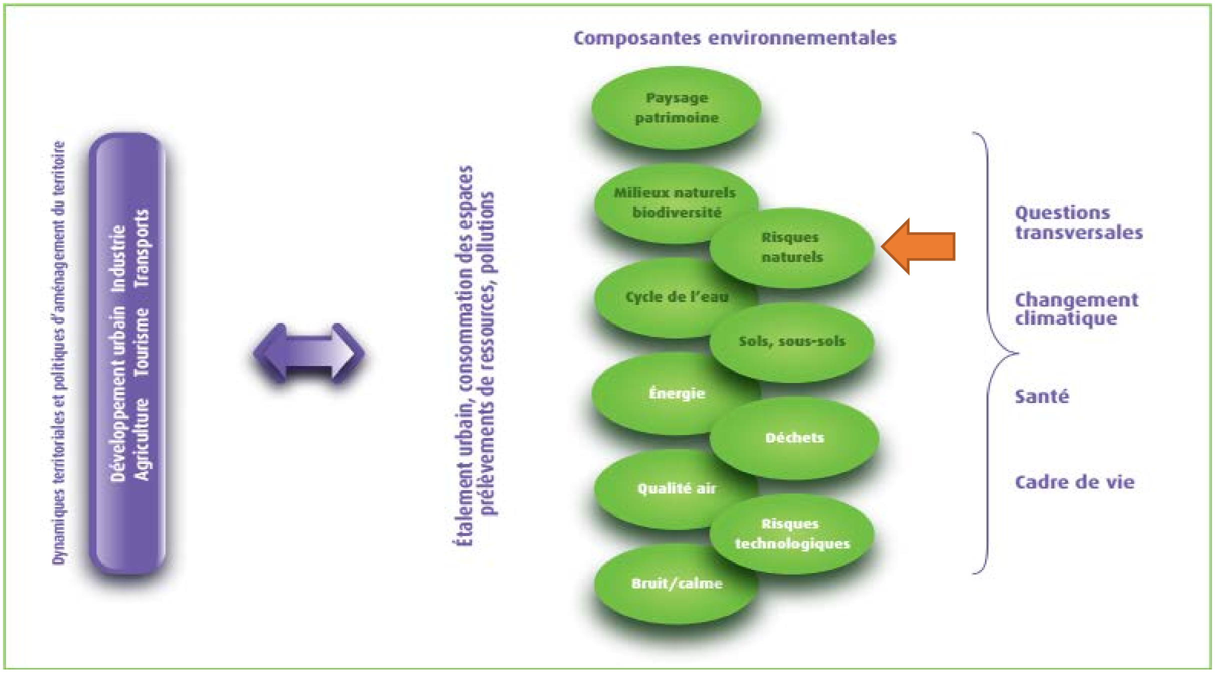

Figure 53 Environmental aspects of the initial state of the environment (orange arrow added by author) (Source: CGDD and SEEIDD, 2011, p. 26)

While the analysis of the initial state gives a comprehensive view of the territory, it must also highlight more local issues of the area which may be important for the respective plan. The existence or elaboration of adequate maps is essential in order to illustrate the specific local conditions. It is also necessary to view the environment in a larger geographical and administrative context in order to get a more holistic understanding of the territory (CGDD and SEEIDD, 2011, p. 25).

The DIREN Île-de-France and the DDEA Val d'Oise (2009) provide a checklist which can be used to analyse the initial state. This way an appropriate consideration and integration of all environmental issues during the SEA procedure can be ensured. As illustrated in Figure 53 natural risks are one of the elements which need to be addressed and integrated into the analysis of the initial state. According to this checklist, aspects that need to be considered in terms of disaster risk include (DIREN Île-de-France and DDEA, 2009):

- Knowledge about natural and technological risks;
- Local awareness about the risks;
- Existence (prescription or approval) of a PPRN;
- Consequences of existing risks and of the PPR (e.g. in terms of urban development or protection of the population);
- Policies to reduce hazards;
- Economic, environmental and social management of the areas exposed to risks;
- Prospects related to an evolution of hazards (especially in terms of climate change);
- Options to reduce the hazards.

The SEA procedure does not only consist of an analysis of the initial state of the environment. At the heart of the environmental assessment is the analysis of significant impacts. These depend on the respective draft version of the plan which gives a first indication of where to build and what. The existence of a PPR ensures that risks are taken into account even before the preparation of a draft version of a plan. After all, the draft version already has to integrate the provisions of the PPR. This is why municipalities which have a PPR available take risks into account before the actual impact assessment. In theory, the draft version of the plan will omit to allow urbanisation in flood zones or in landslide-prone areas[200] (Interview F-VIII, 2013). This means that not only the plan but also its environmental assessment needs to consider the provisions of the PPR from the very beginning[201].

Each of the above-mentioned experts evaluates the impact of the project within their fields of competence, e.g. biologists evaluate the impacts on the natural environment and biodiversity, hydrologists and geologists analyse natural risks. According to one of the interviewed SEA experts, the analysis of significant impacts represents a study that evaluates the planning document a posteriori (Interview F-VIII, 2013). Hence, it is only carried out once the plan has been made. Therefore, strictly speaking it is a step that follows after the conception of the plan, which is why it already requires a sufficient consideration of risks in the design phase of the plan (Interview F-VIII, 2013).

The analysis of significant impacts is combined within a summary report which is then submitted to public inquiry in order to inform the public about all the impacts the plan may possibly have as well as about the ways in which the plan will take account of these impacts (Interview F-VIII, 2013). In this context it is crucial that the impact analysis, just as the analysis of the initial state of the environment, involves all environmental problems (e.g. landscape, heritage, natural and physical environment, natural risks) in order to provide a full and comprehensive information of current problems to the public.

[200] According to one of the interview partners, the PPR is sufficient for an adequate consideration of risks. Due to the fact that risks are considered a priori in case a PPR exists, the environmental assessment merely needs to assess whether the provisions of the PPR have been appropriately respected in the plan (Interview F-VIII, 2013).

[201] It is worth mentioning that urban planning documents need to be *compatible* with a number of plans and programmes (e.g. SDAGE, SAGE and flood risk management plans) and they need to *consider* a certain number of others. PPRs are not counted among those documents, however, since approved PPRs are public easements that impose themselves on all public and private entities. Obviously, and due to this reason, SCoTs and PLUs still have to be elaborated in direct relation to PPRs, provided they exist or are being produced (CGDD, 2011a, pp. 1–3).

Evaluating a planning document amounts to questioning its orientations and provisions in relation to environmental issues in order to assess significant impacts. In this respect, different elements of the draft plan need to be examined: The directions of the PADD, the binding provisions of the regulation as well as the guidelines for planning and development of the PLU and the SCoT. The questions needed for the investigation should only be formulated after analysing the initial state of the environment in order to ensure the consideration of all environmental issues relevant to the territory in question (CGDD, 2011d, p. 1). Examples of questions which can be raised in order to assess the impact of a PLU or a SCoT in terms of disaster risk include (CGDD, 2011d, p. 2):

- Are existing risks adequately taken into consideration?
- Are hazards aggravated through the localisation of industrial plants or through increased sealing that causes greater runoff?
- Is there an increase in the vulnerability of the territory or the exposure of the population?
- Are flood plains preserved and kept free of development?

The results of the impact analysis are described in a separate environmental report or they are integrated into the "rapport de présentation" of the PLU (see Chapter 6.2).

The quality of environmental reports can be quite different and risks are not always sufficiently considered. Often it depends on the attitude of decision-makers (Interview F-X, 2013). The environmental authority ("autorité environnementale") provides an opinion on the environmental report, or the analysis of significant environmental impacts respectively, which is then published for public inquiry. While this opinion is not legally binding, the public is always informed about the environmental authority's observations and results. If the initial quality of the environmental assessment was not satisfactory, the environmental authority will indicate shortcomings in the assessment and make suggestions for improvement. It is up to the decision-maker to decide whether the assessment and the report are amended and redone or whether the opinion of the environmental authority is ignored. At times the assessment is modified and suggestions are considered since from a political point of view decision-makers do not want to accept a negative opinion of the environmental authority in front of the public. In other cases, decision-makers do not take into account the opinion of the environmental authority. In such cases they risk legal disputes with the public (Interview F-X, 2013). In the majority of cases, the municipality tries to make minor modifications to the document in order to at least indicate a considerate attitude. These modifications are not always sufficient, however[202] (Interview F-X, 2013).

Within its area of responsibility, the environmental authority will also assess whether disaster risks have been considered in the environmental assessment of a PPP. As outlined above, risks should be considered and integrated into the SEA of an urban planning document, provided the area in question is exposed to a natural or technological hazard. In any event, the quality of the assessment is directly linked to the fact that the SEA integrates any relevant information. An environmental assessment that does not use and integrate any risk information would ultimately be considered incomplete (Interview F-X, 2013). The only exception

[202] The representative of the environmental authority explains that since the given opinion is not legally binding there is a danger that the suggestions are only considered when an area is at high risk, for example in the littoral zone. In such cases, environmental associations provide for a lobby and may represent an opposition. The suggestions are a lot less considered in areas where there are no such strong associations (Interview F-X, 2013).

are special documents that have no impact on risk in the moment of the assessment. Consequently, each environmental report should describe the initial state of the environment including information about risks, the impacts of the PPP on this initial state of the environment and the measures that are taken to avoid or reduce negative impacts (Interview F-X, 2013). What has not been considered in this statement of the environmental authority representative are the impacts of a changing environment on the plan.

In regard to spatial planning documents the main objective consists in asserting that the project in question is not located in a risk zone or that the plan does not foresee sensitive development in a risk zone. According to the representative of the environmental authority, some plans manage to succeed, others fail (Interview F-X, 2013). The interviewee continued to explain that for EIAs of important projects (e.g. projects by the company “Electricity of France”) risk is sufficiently considered. At the local planning level there is no particular tradition to take risks into account, however. Sometimes the consulting agencies that are responsible for the environmental assessment offer and produce their studies as convenient as possible. Some consulting agencies merely base their studies on those documents provided by the state. These might not necessarily cover the whole territory of the municipality and assess the environment in an integrated way. In theory, consulting agencies need to undertake more specific studies in order to get a full perspective of the risks that threaten a territory. This is the case, for example, when a municipality has no PPR available and there is no information about risks provided by the state. In some cases, however, due to lack of financial resources and/or lack of competence such additional studies are not completed. This is the reason why the final results in the form of the environmental report may lack quality, in particular when it comes to the consideration of risks (Interview F-X, 2013).

Especially in municipalities that do not have a PPR available, the SEA may be a useful tool to contribute to an informed decision-making in terms of disaster risk. Experiences show that in the past municipalities encountered problems with flooding which caused severe damages. These problems emerged because municipalities had authorised construction in flood-prone areas due to a poor understanding of flood risks. One of the reasons for insufficient knowledge on flood risks is a lack of PPRs. On the one hand, municipalities which do not have a PPR often lack extensive analyses of natural hazards. On the other hand, there is also no legal constraint and the municipality may still authorise construction in flood-prone areas. In this respect, a well-elaborated environmental assessment may help fill gaps in risk knowledge and promote more reasonable planning decisions (Interview F-X, 2013).

As mentioned in Chapter 6.3.1, the PPR might be subjected to SEA itself by a case-by-case analysis. PPRs correspond to the definition of PPPs provided by the SEA Directive and hence cannot be excluded from the assessment by the French regulation a priori. Moreover, a PPR may potentially have impacts on the environment. However, in general PPRs are not susceptible to environmental impacts since they promote the preservation of natural or agricultural land in risk zones and prohibit construction. Besides, due to their prevalent objective to protect they are not likely to have noticeable impacts on the environment in a majority of cases (Rich, 2012). In some special cases the PPR requires protective works or structures (e.g. tracks in forests to help fight against fire risk) and may imply impacts in these rare cases (e.g. on Natura 2000 areas) which require to make them eligible to an SEA and, therefore, an opinion from the environmental authority[203]. In contrast, spatial planning documents at all planning levels are subject to SEA as well as an opinion of the environmental authority, because they are considered a priori as documents that might have a negative impact on the environment (Interview F-X, 2013).

When looking at specific SEAs in the French case study site, the PLU of the municipality of Jausiers from the year 2008 can exemplarily be examined[204]. The exposure to natural hazards is considered a main disadvantage in Jausiers, as noted in the analysis of the initial state. Flood risks in particular constitute a major risk to which a large part of the municipal territory is exposed to. Further natural hazards that affect the territory include rock falls, avalanches, landslides and other. In the impact analysis, all the different zones are examined for their suitability for a potential urban extension. Due to the fact that the PPR addresses both new and already existing buildings, after the adoption of the PPR existing buildings need to adjust to the new provisions within five years (atelier 4, 2008, p. 17). The detailed analysis of the state of the environment does not refer to existing constructions, but only to new constructions planned in the blue zones. The blue zones are not homogenous and identified risks are more or less important. Hence, the rules for construction are more or less restrictive. Main constraints consist in adapting the height of entrances or windows or the height of the habitable level.

The PLU, by following the notion of sustainable development, aims to assign reasonable uses and activities to each zone. It therefore tries to diminish the exploitation of agricultural land and supports a more harmonised development of the city centre, among others. In fact, the “zones d’activités”, i.e. zones where development can take place, are limited to just one available part of town (atelier 4, 2008, p. 21). Other zones are either agricultural or natural areas or areas identified as red zones in the PPR. This shows that urban development respects aspects of sustainability and that different territorial constraints and possible impacts of the plan on the environment are carefully considered.

Following this it will be examined to what extent a future perspective is adopted during an environmental assessment. As mentioned in Chapter 5 it is not only important to assess the impacts of the plan on the environment, but to also assess possible future impacts of the environment on a plan. This requires the consideration of a changing environmental baseline, i.e. ways in which the environment may develop and how this might affect a plan and its provisions and contents in the future. The prospective vision of the territory is called in French the “scénario au fil de l’eau”, or the baseline scenario. This is what the EU SEA Directive refers to as the likely evolution of the environment without implementation of the plan, i.e. the zero alternative.

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[203] The representative of the environmental authority explains that about one out of fifteen PPRs is subjected to an environmental assessment. Sometimes the case-by-case procedure may also subject those PPRs to SEA that would not be restrictive enough in their measures to protect against risks. The case-by-case analysis is based on the criteria of Annex 2 of the SEA Directive, which leaves quite some room for interpretation. The specific problem in France consists in the fact that the environmental authority and the entity that is responsible for the development of the PPR are the same body, which is the prefect of the department. This may lead to a problem of independence of the environmental authority (Interview F-X, 2013).

[204] The municipalities of Jausiers and Faucon de Barcelonnette are the only municipalities in the French case study site which already have a PLU. For the municipality of Faucon only the PADD could be retrieved in addition to the map, however. The regulation and the presentation report were not available. In addition, Faucon is a very small municipality with many scattered hamlets and it is covered with a „carte communale” particularly restrictive which explains the fact that buildable areas are inexistent. This is why it is not considered a representative example case. All other municipalities still have the former planning document, the POS. The municipality of Barcelonnette is currently developing a PLU. However, as of June 2016 the PLU had not been adopted. This is why the PLU of Jausiers was chosen as an example.

Again, the French guidance document specifically mentions the need to not only complete the evaluation of the planning document in relation to the situation of the environment at the time the plan was prepared, but to also integrate the likely evolution thereof (CGDD and SEEIDD, 2011, p. 28; MEDDE, 2013, p. 23). In order to develop this zero alternative, the current situation as well as past trends of its evolution and environmental policies, programmes and actions that are put in place and which may influence this current situation need to be analysed. Hence, this kind of information has to be collected together with the data and information on the initial state of the environment (CGDD and SEEIDD, 2011, p. 28).

Accordingly, the baseline scenario requires three types of information (CGDD and SEEIDD, 2011, p. 28):

- The dynamic evolution of the territory: This involves the predicted evolution of the territory according to the provisions of the former plan in demographic and economic terms as well as the consequences in terms of consumption of space. By extending past trends into the future, by drawing upon demographic projections, by using average ratios of consumption of space as observed in recent years, it is possible to establish perspectives in terms of consumption of space.
- The development trends of the environmental situation of the territory: These development trends need to be assessed in the light of changing pressures on environmental resources.
- Policies, programs, actions that influence the territory: These could be related to a reduction of pressures on the environment or an improvement of resources.

The baseline scenario should not be considered a worst case scenario that simply extends all negative trends that happen due to a missing exertion of influence which could be put forward by a new plan. Instead, different (external) initiatives must be considered that influence and help improve the environmental situation. In fact, this environmental baseline development without implementation of the plan is indispensable for an analysis of significant impacts. By providing a vision of the territory in the event that current trends continue, the baseline scenario will be an important element for decision support (CGDD and SEEIDD, 2011, p. 29). After all, a comparison between the baseline scenario and the results of the impact analysis of the proposed plan will highlight improvements of the new plan and underline those problems that might be solved. Reasons in favour of the new plan will be more easily comprehensible and decision-making be made more transparent.

In addition to this baseline scenario or the zero alternative, the environmental report must justify *"the choice made with respect to other possible solutions"* (Article R123-2-1, Urban Planning Code, own translation). In this respect the EC guidance document on integrating climate change and biodiversity into SEA even underlines that *"an analysis of alternatives is often viewed to be at the heart of the SEA process, as this provides confidence that the proposed course of action is the best one available"* (European Commission, 2013, p. 42). Presenting different possible alternatives and reasons for their rejection is a good way of making decision-making more transparent.

Depending on the methods chosen by the commune, these scenarios or alternatives can be real options for territorial development between which decision-makers have to decide. They can also represent deliberately contrasting scenarios that have a purely pedagogical objective which serve as a basis for developing the actual plan (CGDD, 2011b, p. 1). The Urban Planning Code does not define any specific methodological guidelines on how to deal with alternatives and scenarios. The objective consists in explaining the choices made in relation to the environmental issues examined and to compare them with each other as well as with the baseline scenario. The comparison of alternatives should by no means merely consist in compiling fictive scenarios a posteriori with the only purpose to approve the choices that were taken (CGDD, 2011b, p. 1).

As mentioned in Chapter 7.2.2, considering alternatives may help to identify the one alternative or scenario which yields the most resilient development perspectives. The presentation report of the PLU of Jausiers which involves the environmental assessment does not compare any alternatives. Nevertheless, the detailed analysis of the environment, which is added as Annex 2 to the presentation report, gives an outline in chapter 7 (conclusions and orientations) of the contents that should be referred to in the PADD. Among others, it is suggested to establish development scenarios and to test their advantages and disadvantages. Three scenarios are named: The scenario “laisser faire” which corresponds to the zero alternative; the scenario “utopia” which represents a development perspective without any constraints; the “realistic” scenario which follows the ideas of the utopian scenario by adapting the idealised perspectives to local realities by considering spatial, economic and other constraints (atelier 4, 2008). However, when looking at the respective PADD, there is no mentioning of these three scenarios. There is a reason to presume that an actual comparison of alternatives did not take place. Still, it is possible that different scenarios were considered but were just not described in the PADD. In any case, a transparent comparison of scenarios or alternatives was not conducted, as none of the documents that form part of the PLU provide a detailed description.

Consequently, it cannot be confirmed with certainty, that different scenarios were actually considered by planning consultants who were responsible for preparing the documents. Due to the fact that a zero alternative has not been described, there is no further indication of whether possible future impacts of the environment on a plan were assessed and whether the baseline environmental development was an issue for the development of the plan. The presentation report still gives an indication of how a long-term (future) perspective was adopted as well as how attempts were made to follow a sustainability- and resilience-oriented development planning[205].

In summary, these elaborations show that different reasons make an integration of risk information in SEA necessary. Available guidelines and additional information “sheets” describe in detail how to carry out an environmental assessment and what are important aspects to consider. As described above, important aspects also include those related to natural hazards. Both guidelines and expert opinion underline the importance of considering disaster risk in the course of an environmental assessment. The practical example of the PLU of Jausiers confirms that a consideration of risks as planning constraints is crucial. Especially in mountainous areas such as the Ubaye valley, municipalities are highly influenced by constraints originating from their exposure to multiple natural hazards. Even without the existence of a PPR, risks need to be considered and made a topic. For the PLU in Jausiers and its environmental assessment disaster risk was a major topic and development decisions were greatly influenced through the municipalities’ exposure to hazards. Although a comparison of alternatives was not effectuated, at least not as part of the environmental assessment, the presentation report refers in some points to the choice of decisions and to the justification of the zoning. This means that to a certain extent decisions and reasons in favour of this present alternative were still made transparent.

[205] More information about the long-term perspective will be provided in Chapter 9.2

9.1.2 Examples from the Polish study area

In Poland, analyses concerning disaster risk are performed at the stage of the eco-physiographic study (see Chapter 6.2.2), i.e. prior to the development of planning documents. This way they can inform planning processes and be integrated into planning documents at the local planning level. The eco-physiographic study contains all available, relevant information about the environment. It indicates areas of potential landslides, of active landslides, of potential flood areas and protected landscape areas (see Appendix 2, Figure 12) and outlines areas that are adapted, less adapted and not adapted for construction. Since data and information included in the eco-physiographic study inform the subsequent planning process, it constitutes the basic source of information for the weighing up process[206].

Accordingly, in the Polish case study site information about risks is considered when preparing the eco-physiographic study which is valid for both the Study of Determinants and Directions of the Local Space Economy and the Local Plan of Physical Development. For the municipalities of Stryszawa and Wieprz a consulting agency was responsible for preparing all three documents: The eco-physiographic study, the local spatial plans as well as their respective environmental assessments. Local plans and their environmental reports were prepared almost simultaneously and based on the same eco-physiographic study which was prepared beforehand. The eco-physiographic study includes aspects such as:

- Characteristics of the environment, including relations and natural changes in the environment;
- Diagnosis of the status quo and functioning of the environment;
- Prognosis of future changes of the environment;
- Natural conditions for future landscape patterns (functional and spatial);
- Evaluation of environmental development opportunities and limitations for land use and spatial development.

The eco-physiographic studies for the municipalities of Stryszawa and Wieprz include a very detailed analysis of landslide and flood hazards. Each study describes which landslide hazard maps have been taken into account and provides detailed information about the location of active and inactive landslides. Active and inactive landslides including their scarp are also illustrated on the map that accompanies the eco-physiographic report. Flood hazard information considered within the eco-physiographic studies rely on results of the study of flood protection by the RZGW Krakow. The maps display the boundaries of the 100-year return period flood. After giving an indication about the possible future development of the environment, a description is provided of certain dispositions for the development of the functional and spatial structure of the municipality. These dispositions are an important prerequisite for designations in local spatial plans, but do not unequivocally determine anything. This means that the actual planning designations may differ from those suggested in the eco-physiographic study, provided they are justified by valid reasons other than environmental conditions. In the end, the report distinguishes between different zones of land development which have to fulfil certain conditions resulting from the suitability of the natural environment for development. These zones include areas characterised by the occurrence of mass movements and landslides, imminent flooding, sanitary protection of water intakes etc. and are marked on

[206] Purposeful elaboration of an eco-physiographic study is necessary, as it is a main source of information for spatial planners. Sometimes this study is already available in a municipality and does not have to be produced from scratch. However, usually the process of plan-making starts with a state of environment report. Then the preparation of a draft plan follows and finally the environmental assessment of the plan is carried out (Interview P-I, 2013).

the map (Instytut Rozwoju Miast, 2014b). A considerable part of the municipality of Wieprz, for instance, is located in flood-prone areas. In addition, the existence of active and potentially active landslides poses limitations on settlement development and investment planning. Such conditions require respective regulations within the spatial plan in the form of leaving areas free of development (e.g. in case of an active landslide) or allowing construction by using building codes which aim for flood-adapted buildings.

The boundaries of various environmental aspects outlined on the map of the eco-physiographic study are used as a basis to make decisions about which land uses should be allocated where. However, a representative of the Environmental Protection Agency explains that this document is not legally binding for the further planning process. This means that sometimes for the municipality and those responsible for making the LPPD it just represents a means of preparing the actual development of the plan in a preliminary phase, whereas provisions are not necessarily considered. The different boundaries do not need to be respected. This is why it is technically possible to ignore certain flood boundaries and allow building in areas of flood risk (Interview P-VI, 2013). As the preparation of the document is quite expensive, the mayor usually makes sure that all the information of the eco-physiographic study is included in the local spatial plans. However, if the pressure from the population is high, at times the mayor ignores the boundaries and decides to allow construction in areas at risk. In the end of the planning process such decisions might still be refused by the regional authority or the RZGW by not giving an approval. Apparently, it is a common practice that mayors first follow the demands of the local public and try to correspond to their proposals and expectations. When in the end the plan is not approved by a higher level authority, the mayor can blame the approval giving authorities for prohibiting construction (Interview P-VI, 2013).

While the eco-physiographic study represents a comprehensive analysis of the status quo of the environment in a first step, the SEA assesses the impact of a plan on the current and future state of the environment in a second step. The actual environmental report which has to be provided as a necessary document as part of the SEA procedure gives a description of the risks the municipality is exposed to and names the respective sources of information (e.g. the studies of flood protection from the RZGW Krakow, the SOPO maps as well as further maps resulting from studies on landslide hazards). The main part of the SEA report, the assessment of significant impacts, refers to flood and landslide hazards in relation to the assessment of possible impacts of the plan on humans. The environmental report for the Study of Determinants and Directions of the Local Space Economy of the municipality of Wieprz states that the proposed new residential areas are located outside the areas of high risk of flooding. Development areas at risk of flooding that were previously determined, i.e. before more detailed knowledge about flood risk was available, will require the implementation of technical solutions to minimise losses in case of a flood[207]. In regard to mass movements, the environmental assessment suggests a clarification of regulations adopted in legally binding land use plans due to the uncertainty attached to an actual activity of landslides on the basis of a separate study. The need for such a study results from the difficulty to determine an acceptable extent of areas that can be allocated for settlement development as well as to define the zoning. In any case, those areas allocated for construction and concurrently at risk of landslides

[207] Due to private property rights already existing land use designations cannot be easily changed. This is why the municipality has to resort to different means of flood protection.

will require a particularly careful determination of geotechnical solutions for the foundation of planned buildings (Instytut Rozwoju Miast, 2014b).

It has to be stressed that it is not the purpose of SEA to indicate areas at risk of flooding or mass movements (Interview P-VI, 2013). There is no separate assessment of flood or landslide hazards during SEA, but the environmental report ideally integrates the content of the eco-physiographic study. Suggestions and implications of the eco-physiographic study should be adopted and boundaries transferred to the spatial plan. This is why the environmental report refers to the eco-physiographic study when it addresses the relation of the elaborated plan with other documents[208]. According to the representative of the Environmental Protection Agency (Interview P-VI, 2013), municipalities usually fully implement the contents and provisions of the eco-physiographic study into the plan. Spatial planners who produce the local spatial plan often also produce the eco-physiographic study and the environmental report. This is why all three procedures are closely related and usually well-coordinated. Moreover, municipalities know that they require approvals for and opinions on the plan. Approvals are provided by the RZGW for all issues related to flood risks and by the Head of the Region for all issues related to landslides. Opinions are given by the Environmental Protection Agency and the "Wojewodzki Inspektorat Sanitarny" (Regional Inspectorate for Sanitary). This is why they cannot simply ignore the provisions of the eco-physiographic study, as positive opinions and a final approval of the plan would be harder to achieve.

In summary, risk information is only used within SEA through the eco-physiographic study. In other words, although no specific risk assessment takes place during SEA, risk information is used and integrated by adopting results of the eco-physiographic study. Risk information stemming from the eco-physiographic study is further applied in a way that informs decisions regarding the allocation of different land uses (in case of preparatory land use plans) and even specific building conditions (in case of legally binding land use plans)

In order to find out whether spatial planners assess changes to the baseline environment and try to identify the most resilient alternative by adopting a future perspective, the types of reasonable alternatives outlined in the environmental reports for the preparatory land use plans of the municipalities of Wieprz and Stryszawa were examined.

The environmental report for the amendment of the Study of Determinants and Directions of the Local Space Economy of the municipality of Wieprz did not include an assessment and comparison of reasonable alternatives. After naming the aspects and circumstances that have to be considered at this stage of the planning process, the environmental report mentions that there is no further need to formulate proposals for alternatives in relation to the amendments presented in the draft plan[209] (Instytut Rozwoju

[208] The SEA Directive requires in Annex I that the information to be provided in the environmental report includes *"an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes"* (CEC, 2001b). In this case this also relates to the eco-physiographic study.

[209] These aspects refer to specific reasons as to why the plan was amended. In this case, amendments to the plan were made for two reasons: The conservation of natural values of the Wieprzówka valley as well as the creation of new opportunities to realise residential and commercial areas. The amendments of the plan aim to reduce the development of construction within the Natura 2000 area "Valley of the Lower Skawa" and avoid investment planning in the Wieprzówka valley. Hence, the purpose of the amendment consisted in an improvement of the plan from an environmental protection point of view and not in a degradation of the plan in the form of additional negative impacts.

Miast, 2014b). This is why the environmental report deliberately disregarded the formulation of proposals for alternatives.

Moreover, the comparison of alternatives usually happens prior to the plan's development. This means that the decision for one of the alternatives has already been made, before the actual plan is prepared. Such an approach might involve problems, however:

1. The consideration and comparison of alternatives is not outlined in the environmental report, which makes it difficult for the public and the opinion and approval giving entities to comprehend the decision for the remaining alternative.
2. The environmental assessment is a procedure which should accompany the planning process. It is the very idea of the environmental assessment *"to consider the environment at an early stage of development, when alternatives are still open"* (European Commission, 2013, p. 16). If different options are considered prior to the planning process, the choice for the best (resilient) option available is already limited.

An environmental report should therefore make sure to include a section with more detailed information about the consideration and comparison of alternatives due to reasons of transparency and flexibility.

The environmental report for the Study of Determinants and Directions of the Local Space Economy of the municipality of Stryszawa examines differences in environmental impacts that arise as a result of three alternatives (Instytut Rozwoju Miast, 2012):

- Zero Alternative (0) - consists in the withdrawal from the plan;
- Draft version of the proposed plan (I) - consists in achieving the objectives set out in the draft version of the proposed plan that are adopted based on a compromise between the expectations of the population and the need to protect the environment;
- Environmental friendly alternative (II) - consists in the implementation of pro environmental solutions.

The respective, possible impacts of alternative I and alternative II were examined and compared in regard to each environmental concern (e.g. people, water, land surface, climate, natural resources etc.). Impacts of the zero alternative were not assessed separately. Instead, the environmental report states that the zero alternative is in accordance with the plan which is currently in force. Furthermore, it was pointed out that the environmental friendly alternative (alternative II) is mostly in accordance with the draft version of the amended plan (alternative I).

The report states that improvements in terms of risk reduction have been added to the draft version as compared to the zero alternative. These include aspects such as (Instytut Rozwoju Miast, 2012):

- The determination of landslide hazard zones;
- The introduction of restrictions on the possibility to construct in areas at risk of mass movements;
- The introduction of recommendations for measures to reduce flood risk.

Based on this comparison the environmental report concluded that the draft version of the plan intends to eliminate and reduce the negative environmental impacts caused by threats of an imminent expansion of the land earmarked for development purposes. The suggestions for the amendment are generally consistent with the pro environmental alternative. In the end, the comparison lead to two issues for which the possibilities for designations need to be considered and explored. Both issues, however, are not related to disaster risk.

For the environmental assessment a future perspective is adopted in the sense that the planners who are responsible for the plan and the environmental report consider the zero alternative, i.e. the change of the current state of the environment without implementation of the plan, as well as evolving baseline trends[210]. Due to the fact that the environmental assessment assesses the impact of the plan on the environment and the impact of a changing environment on the plan, e.g. by considering the impact of possible future floods and landslides, evolving baseline trends are practically fully analysed[211]. This shows that spatial planners look at both, the likely evolution of the baseline with and without the proposed plan.

In contrast, a real vulnerability assessment did not take place. As mentioned in Chapter 7.2.2, an assessment of the evolution of the environmental baseline should preferable be accompanied by a vulnerability assessment, including all alternatives. Vulnerability assessment encompasses more than just an assessment of the exposure to natural hazards and the potential harm caused by such events. It also includes an assessment of the area's ability to copy with such events. This aspect was not considered. While a comparison of alternatives did take place, including the zero alternative, the vulnerability of the area has not been assessed in a comprehensive way. Moreover, resilient alternatives were not taken into account due to the fact that the coping capacity went unnoticed. In fact, the environmental assessment lacks additional consideration of climate change and disaster risk issues. This, however, is particularly important for the consideration of resilience in SEA (European Commission, 2013, p. 42). Hence, both environmental assessment and environmental report lack the consideration of alternatives which look for good ways to meet human expectations while minimising the risks resulting from former development patterns that cannot be changed as well as the likely expected climate change related events (European Commission, 2013, p. 42).

9.1.3 Examples from the Italian study area

Differences between various regional planning approaches and procedures make it difficult to determine whether and to what extent risks are taken into account in SEA practices in Italy (Profice, 2011). There are yet a number of aspects referring to the prevention of risks that are common to SEA throughout the country (Profice, 2011):

- The term risk is often used as a synonym to the word hazard;
- The common habit to only analyse the hazard, mainly for single factors (often only hydrological hazards) and through the use of indirect sources (e.g. the geo-hydrological map of the PAI);
- The lack of analyses of exposed elements at risk and vulnerability;

[210] If the draft version of the plan is not implemented, the former plan remains in force. This is why the expected significant impacts which were identified during the environmental assessment of the previous version of the plan (i.e. alternative 0) represent the evolving baseline trends without implementation of the amended (new) version of the plan (i.e. alternative I).

[211] Hazards are considered for the environmental assessment of the proposed plan by using newly available information on floods and landslides. The draft version of the proposed plan is a reaction towards the predicted impacts by considering this newly available information. This means that alternative I constitutes an improvement of the former plan. The exposure to hazards is now taken into account more specifically and the draft version suggests ways to reduce exposures to hazards in order to avoid a disaster.

- The lack of consideration of possible increases in risk levels as a result of the plan's implementation.

SEA has to take into account all relevant documents related to natural risks and other types of risk (e.g. air pollution, noise, electromagnetic pollution, etc.) that threaten a territory. During the planning procedure spatial planners have to take into consideration different aspects and different types of risks. While the PAI provides information about geo-hydrological aspects, documents such as light plans and noise plans provide information about other types of impacts on the environment (Interview I-IX, 2013). The PAI again represents the main source of information about risks. This means that the provisions of the PAI have to be integrated both into the respective spatial plan and into the environmental report. Finally, the approval giving authority checks whether the provisions of the PAI have been considered and integrated correctly (Interview I-IX, 2013).

The consideration of risks within the SEA procedure conforms to the consideration of risks while preparing the actual plan. This means that the environmental assessment is equally subjected to a geological report or a validation by a geologist, respectively. Risks are considered within the geological report and thereby find their way into SEA. This is why risks are already included in the planning process (Interview I-VI, 2013). Consequently, spatial planners or SEA consultants prepare the environmental report, but the contents related to natural hazards are validated by a geologist. This is why all information related to risks always originate from a validation by a geologist and are included in the geological report (Interview I-I, 2013). Still, sometimes in the environmental report problems related to water management are described quite well, especially in flood-prone areas (Interview I-VI, 2013).

The purpose of SEA is to evaluate whether the measures envisaged by the plan are compatible with the environment. In terms of risks this means that *"the SEA helps to more specifically focus on the evaluation whether a river, for instance, is affected by housing or housing is affected by a river"* (Interview I-VI, 2013). Consequently, the SEA takes a more holistic view. An environmental assessment could conclude, for instance, that an increase in the level of risk is acceptable in order to persevere a high quality environment. In fact, this decision is based on a political choice which may support such a seeming contradiction. After all, the final decision is taken by the council of the region (Interview I-VI, 2013).

One of the main fundamentals of the SEA is the elaboration, provision and consideration of several alternatives and solutions. Focusing on and presenting apparent conflicts that characterise the territory, e.g. conflicts between the consumption of space and environmental conservation, are one of the main goals of the SEA procedure (Interview I-VI, 2013). Telling from experience so far, one of the interviewees admittedly notices that the SEA was rather considered a burden at the beginning (Interview I-VI, 2013). A rather sceptical opinion towards SEA practices was also provided by an interviewed planner: An actual environmental assessment and a comprehensive environmental report are only completed when dealing with major amendments of a plan or with new plans, i.e. when facing major interventions. There have been no such major interventions for several years, which is why there have been only few occasions to carry out a complete SEA (Interview I-I, 2013). The planner adds that the SEA has been emptied of all meaning, as it is not obligatory to carry out an environmental assessment for any kind of plan or planning decision. In the end SEA will hardly serve any purpose, not even for bigger amendments (Interview I-I, 2013). Today it should preferably be performed on a more regular basis due to the fact that it helps to improve the plans (Interview I-VI, 2013).

These statements hint at a typical characteristic of SEA in the Friuli Venezia Giulia region: The fact that in common planning practices a comprehensive environmental report ("rapporto ambientale") is rarely prepared, but only a so called "document of verification" ("verifica di assoggettabilità alla VAS"). According to Article 5, Regional Law 11/2005, all plans and programmes, including amendments of those in force, which are not "automatically" subject to the SEA procedure are subject to a verification procedure. This verification procedure is carried out on the basis of the criteria defined in Annex I of the EU SEA Directive, the contents of an existing environmental report as well as consultations with environmental authorities concerned. Regional Law 16/2008 introduced a number of specifications regarding the SEA of local planning instruments. In particular, Article 4, no. 3 states that competent authorities have to evaluate whether plans that determine the use of small areas at the local level ("l'uso di piccole aree a livello locale") can have significant impacts on the environment. The document that has to be prepared following this evaluation, i.e. the mentioned "document of verification", then represents the according instrument for integrating environmental considerations. It includes a description of the contents of the amendment and the information needed to verify the significant environmental impacts expected from its implementation[212]. This step of verification corresponds to the screening phase of the SEA procedure. Its aim consists solely in the identification of potential significant environmental effects of the plan. Provided the verification procedure concludes that the plan – or the amendment of the plan – has no significant impacts on the environment, the proposed plan does not fall within the scope of Article. 6 no. 2 of Legislative Decree 152/2006[213].

Figure 43 (Chapter 6.3.3) shows that in the year 2013 a total number of 10 environmental reports was prepared for PRGCs in the Friuli Venezia Giulia region. This comparably small number of reports is an indication for the minor application of the SEA procedure as a whole. It is also the reason, why not many environmental reports for PRGCs are available in the region[214]. In fact, only documents of verification are prepared due to the fact that planning practices in the municipalities of Malborghetto-Valbruna and Pontebba are characterised by usually just small amendments to the existing plan[215]. This is why no environmental report could be used as an example or a reference. In order to further examine, how risks are dealt with and addressed in an environmental report in the Friuli Venezia Giulia region, an environmental report from the municipality of Tarvisio was used. Tarvisio is a neighbouring municipality of Malborghetto-Valbruna that is affected by similar risks.

For establishing a baseline, aspects of risk have been noticeably considered in the environmental report by highlighting characteristics and important elements of the environmental condition within the municipality.

[212] The document of verification is produced with reference to the contents of Article. 12 of Legislative Decree 152/2006 and subsequent amendments.

[213] Article 6, no. 2 determines which plans and programmes are subjected to an environmental assessment.

[214] Moreover, it is worth mentioning that the responsible planning authority at regional level declined an interview by justifying they had no sufficient knowledge of the matter.

[215] Such small amendments include proposed measures regarding the definition of provisions related to the type and colour of buildings that fall within the scope of the PRGC as well as proposed changes to the zoning of the plan and provisions of the respective contents of the zones that do not involve an increase in settlement space, however.

This includes geo-hydrological hazards, geomorphological hazards and avalanche hazards[216]. The report includes an accompanying "map of hydrological, geological and avalanche hazards" (scale 1:25,000). When studying the map more closely, mostly avalanche hazards are displayed. While landslides that were assessed by the landslide cadastre of the region are visible in a scattered way, landslides based on the data of the PAI are listed in the legend but they do not appear on the map. The reason for the latter could be, that in 2008 the PAI had not yet been finalised. However, it is obvious that the map does not display all the landslides that exist in the area.

The hydrological and geomorphological conditions of the area were analysed within a geological report by a professional geologist (see above). In general it should be pointed out that these hazards rarely occur as separate phenomena in space and time; e.g. a flood wave (i.e. a hydrological hazard), tends to coincide with a landslide (i.e. a geological hazard) over time (Brugnoli and Tosolini, 2008, p. 37). Yet, an actual analysis of possible interactions between these different types of hazards does not seem to have taken place. In addition, seismic risk has not been considered at all. It is worthy noticing that in contrast to the observations made by Profice (2011) (see above) the environmental report correctly distinguishes between the terms hazard and risk.

While the hydrologic conditions are considered fairly good (e.g. river beds are mostly natural banks, dikes were erected in dimensions that provide sufficient security), the geological hazards constitute a greater threat for the areas affected. The environmental report lists all affected areas as well as single locations and provides a detailed description about various types of geological hazards menacing the territory: landslides, subsidence, liquefaction of soils and poor ground. In addition, the environmental report lists all slopes that are potentially affected by avalanches (Brugnoli and Tosolini, 2008, pp. 38–42).

The objectives of the proposed plan in terms of environmental protection do not refer to any disaster risk related activities. Instead, they solely refer to securing the highest standards of protection and preservation of areas of natural, landscape and environmental interest and to permitting the continuation of agricultural activities provided they conform to environmental protection objectives. While there are no objectives related to disaster risk, the assessment of the proposed amendment of the PRGC reveals that the suggested measures will decrease the level of risk and the exposure of the population (Brugnoli and Tosolini, 2008, p. 146). However, the exposure has been assessed in general terms only, i.e. by just focusing on and describing the exposed surface area. A proper vulnerability assessment did not take place.

Apart from these statements, no further comments are made on how disaster risk is approached by either the PRGC or its environmental report. A comparison of alternatives is missing. Accordingly, an assessment

[216] In the context of this environmental report, natural hazards refer to *"any process or potential event that could represent a threat to health, safety and well-being of a community or to the economy of any population"* (Brugnoli and Tosolini, 2008, p. 37, own translation).

of changes to the baseline environment has not been carried out[217]. This is why further statements about a comparison of alternatives cannot be made at this point[218].

9.2 The role of Strategic Environmental Assessment in the disaster risk management process in the case study area

After Chapter 9.1 focused on environmental assessment practices as such, examined whether and how disaster risks are considered in environmental assessments and to what extent alternatives are developed and compared, Chapter 9.2 now looks at the possible influence of SEA for risk management. More specifically, it refers to ways and the extent to which different strategies to deal with and manage risks are selected. This is done by checking SEA practices for indications for measures to avoid, reduce and compensate negative environmental impacts – with reference to disaster risk. Moreover, risk management requires constant evaluation and monitoring, as explained in Chapter 3.2. The Sendai Framework even highlights the importance of strengthening monitoring activities (UNISDR, 2015, p. 16). SEA can be considered an important means for providing evaluations and monitoring, since Article 10 of the SEA Directive demands the monitoring of significant environmental effects. According to Article 9 and Annex I, a description of monitoring measures has to be provided to relevant authorities and the public as part of the environmental report. Consequently, the examined environmental reports should also refer to measures decided upon concerning monitoring.

9.2.1 Examples from the French study area

Ultimately, an environmental assessment serves to identify significant negative impacts and to facilitate adjustments of the plan towards less environmental impacts. Existing guidelines in France make clear that this step necessitates the selection of alternative solutions which represent measures to avoid, reduce or compensate. This means that by examining different alternatives and by comparing their potential impacts, the impacts of less favourable solutions can be avoided. Moreover, when a significant impact emerges, the iterative process of the environmental assessment (see Figure 41) leads to suggesting an adjustment of the plan with the aim to avoid or reduce this impact to a minimum (CGDD and CEREMA, 2015, p. 44). When avoidance and reduction measures are integrated into the plan or programme, it is essential to specifically address this integration in the chapter that deals with the “justification of choice”, in order to present the iterative character of the environmental assessment. While the process of the environmental assessment seeks the avoidance of impacts and the reduction of those impacts that cannot be avoided, the compensation of negative impacts has to be considered as a last resort. Compensatory measures should therefore only be chosen when it is impossible to avoid or minimise the impacts and when the residual impacts are indeed quite significant. Such measures are virtually absent within French planning documents (CGDD and CEREMA, 2015, p. 44).

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[217] One of the reasons may be that the PRGC already promotes a decrease of the level of risk and exposure of the population.

[218] There are also examples of environmental reports in Friuli Venezia Giulia which can be considered good practice examples. For instance, the environmental report of amendment no. 61, PRGC of the municipality of Latisana refers to different types of natural hazards. It provides a number of measures to mitigate the significant impacts of the plan and it also provides a synthesis of reasons for the choice of alternatives as well as a description, how the evaluation has been carried out including possible difficulties. However, it is not the purpose of this work to identify, describe and analyse different good practice examples that can be found in the Friuli Venezia Giulia region. This is why this example will not be further examined and presented.

Reduction measures that are defined as part of the environmental assessment have to be transferred into the prescriptive parts of the planning document in order to be fully effective. For the PLU this concerns the zoning, the regulation as well as the development orientations. It is hence not sufficient to simply consider such measures in the presentation report (CGDD and SEEIDD, 2011, p. 41). The zoning, for instance, enables the protection of all sensitive areas by authorising or restricting their use depending on their respective sensitivity. The regulation offers different opportunities to define ways of planning and construction with lower environmental impact. The development orientations enable the definition of specific provisions on the environment, especially in regard to the protection of natural elements (CGDD and SEEIDD, 2011, p. 41).

It is obvious from the explanations given in the guidelines, that the iterative process of the environmental assessment is of great importance. Such an iterative process automatically involves the consideration of different alternatives. It helps to gradually approach a plan with minimum impacts on the environment. This iterative process in turn necessitates that the environmental assessment is effectively carried out in parallel with the preparation of the plan. Only when considering both the SEA and the planning processes as reciprocal, impacts can be avoided and reduced right away.

The presentation report of the environmental assessment of the PLU of Jausiers treats the subject of compensatory measures rather expeditiously. This can be traced back to the justification that the PLU itself was initiated to follow the strict provisions of the Article L 121 of the Urban Planning Code. The PLU is considered a compensation measure in itself by mainly aiming to better organise urban development. It is therefore supposed to be primarily sustainability-oriented. In this respect it aims to limit the impact of urban development on agricultural land, to protect agricultural and natural areas from a long-term impact of urban development and to define as precisely as possible the zones to be constructed in relation to reasonable needs as identified in the initial analysis[219] (atelier 4, 2008, p. 18). Such aims correspond to a long-term sustainable development which strives to enable urban development while at the same time preserving natural resources. The plan inherently attempts to avoid negative impacts.

Although these measures are rather broadly defined, an indirect relation to disaster risk exists: On the one hand, agricultural and natural areas are excluded from urban development. These areas are preserved on a long-term basis, keeping them free of development and avoiding additional exposure to potential future disasters. On the other hand, by adjusting the extent of buildable areas to the actual needs for buildable areas, the increase in vulnerability is kept to a minimum. These measures represent both reduction and prevention measures, which means that in the case of the PLU of Jausiers, responsible planning and SEA consultants considered reduction as well as prevention measures as part of the assessment. The holistic knowledge needed to determine such measures is based on the analysis of the initial state of environment. Compensation measures, as mentioned-above, are not very prominent in French environmental assessments (and reports) in general. This is why they usually remain disregarded.

In addition to elements of sustainability, the presentation report of the PLU of Jausiers shows elements of resilience. The description of the allocation of land uses and activities within the administrative boundaries refers to the problem of spatial constraints: New types of land uses and activities are supposed to be

[219] This is why the PLU of Jausiers comprises one zone AU3. Zones "AU" are zones which are subjected to future urbanisation only. This means that these zones are reserved long-term for a future use and define the desirable transition between the current and the following PLU (atelier 4, 2008, p. 29).

located within the “zones urbaines”. However, land use types that due to their impairment or importance would be incompatible with the respective habitat must be located elsewhere. The problem is that the space for locating such land uses is limited by territorial constraints, e.g. the exposure to natural hazards. Obviously, this restricts the municipality in its possibilities. Still, the local administration does not take any additional risks and aims at reasonable land uses for each zone. Evidence for this can be found in a justification of why an area on the left bank of the stream “Torrent des Sanières” is considered non buildable despite being in a blue zone and not in a red zone, for instance. The RTM had published a note stating that this zone should be considered non buildable in its current state. The local government considered it worthwhile that although the expression “in its current state” suggests the possibility of change in designation of this zone, it should not be possible within the framework of this present PLU to use this land, with the exception of tourist facilities (atelier 4, 2008). This confirms the precautionary approach of the municipality and corroborates resilience thinking of decision-makers.

The analysis of guidance documents as well as SEA practice and examples shows that an integration of risk analysis and risk management into SEA indeed takes place. By directly incorporating results of the environmental assessment into the PADD and the regulation of the PLU, outcomes of SEAs can be immediately considered. This includes information about risks or outcomes of analysing risk respectively. It has to be pointed out that when a PPR is missing there are also no real normative statements on how to deal with risks. While the PPR involves an evaluation of risk, other types of hazard and risk maps or separate geological and hydrological studies without normative statements but only with factual information do not involve any risk evaluation[220]. In such cases, SEA can be of particular importance, as it may actually provide the missing element of risk evaluation via public consultations and through an evaluation of significant effects of the analysed risk for those affected. This is a crucial aspect to consider for spatial planners and decision-makers who favour normative statements. When risks are properly evaluated as part of the evaluation of significant effects on the environment during the SEA and as part of public consultations, planning decisions can still be adjusted to public perceptions of risk. This would support a more or less objective analysis of the actual risk as well as a subjective judgement of the risk. In the end, despite missing normative statements, planning decisions would still be justifiable.

Regarding monitoring measures, neither the PADD nor the presentation report for the PLU of Jausiers mention any kind of monitoring measures. The representative of the environmental authority acknowledges the suitability of environmental assessments for evaluating risks by considering risks in all plans and programmes that are subject to SEA (Interview F-X, 2013). The interviewee does not further comment on monitoring measures, however. This supports the conclusion that monitoring activities can be expected to be rather underrepresented.

As mentioned by the representative of the environmental authority, the degree to which risks are considered and to which they play a role during the planning process depends on the respective quality of the environmental assessment and report, however. There are both positive and negative examples of environmental assessments. This is why no universal statement of the role of SEA for the management of risks in spatial planning can be made.

[220] Information about natural hazards other than the PPR has to be considered during the preparation or review of a plan, but usually has no legally binding character. Provided there is no PPR and a municipality has to resort to other types of hazard or risk maps, a suitable allocation of land uses can be informed by SEA.

9.2.2 Examples from the Polish study area

Examined environmental reports of the municipalities of Wieprz and Stryszawa both refer to solutions to eliminate, restrict or compensate negative impacts on the environment. The question is, whether these different response options relate to the management of risks.

The example of an environmental report of the municipality of Wieprz names a number of solutions which played a role for the draft plan in terms of reducing and mitigating negative impacts on the environment (Instytut Rozwoju Miast, 2014b). These solutions involve measures related to biodiversity conservation as well as the protection of cultural heritage and landscape. While the former refer to aspects such as preservation of existing forested areas and preservation of habitat diversity of agricultural land, among others, the latter refer to the protection and conservation of objects worthy of protection as well as the limitation of settlement expansions. Both the preservation of forests and the limitation of settlement expansion support the notion of disaster risk reduction to a certain extent. While forests may serve a protective purpose, the limitation of settlement expansions can promote vulnerability reduction. Finally, measures to compensate include the aim to introduce the option of creating afforestation in areas at risk of landslides while maintaining the habitat diversity of agricultural land. In this respect the aim to afforest in landslide-exposed areas serves a clear risk reduction purpose, since forests minimise the risks of mass movements.

The example of an environmental report of the municipality of Stryszawa likewise lists a number of solutions designed to prevent, limit or compensate negative environmental impacts (Instytut Rozwoju Miast, 2012). Specific risk-related measures are formulated in the following fields: environmental protection and nature, the protection of surface and groundwater, the protection of soil and ground surface. In the field of environmental protection, measures involve the introduction of provisions on biodiversity as well as taking account of protective forests. As mentioned above, the preservation of protective forests serves to minimise the risk of mass movements and hence promotes risk reduction. In the field of protection of surface and groundwater, particular risk-related measures involve the introduction of provisions on flood risk while in the field of soil and ground surface provisions are introduced related to the risk of mass movements. Both provisions share a clear link to disaster risk reduction.

These statements show, that in the Polish case study planners are able to apply different strategies of avoidance, mitigation and compensation, including those with a direct reference to disaster risk reduction. In this respect, SEA can indeed inform spatial planning processes and an adequate allocation of land uses. Most measures aim to avoid and mitigate the risk, which makes sense from a precaution point of view. However, the use of provisions for flood and landslide risk may also involve compensation measures. Such provisions do not necessarily need to be related to a prohibition of any kind of development. To a certain extent, building might still be allowed under certain conditions, i.e. by making use of building codes. Accordingly, new development does not have to be prohibited a priori. Such an approach to spatial planning and environmental assessment enables planners to compare different strategies and choose the best option available. These should preferably aim for a resilient future-oriented development. Whether resilience as such was one of the main objectives of the respective spatial plans could not be conclusively answered. It can be assumed that due to the presence and great importance of existing flood and landslide risks in the case study site and deducing from the role risk avoidance and mitigation measures play within the environmental assessment, both plans put a great focus on an adequate and conscientious consideration of these risks.

The two examined environmental reports in the Polish case study site both refer to monitoring activities. The environmental report for the municipality of Stryszawa mentions that monitoring and control activities should check the compliance of the work, both during construction and operation, with specific rules and standards for limiting environmental impacts (Instytut Rozwoju Miast, 2012, p. 46). Accordingly, it demands that monitoring should be carried out during the implementation and the continuity of the plan. The environmental report for the municipality of Wieprz even goes one step further and provides specific monitoring indicators (Instytut Rozwoju Miast, 2014b, pp. 8–9). None of the listed indicators refers to disaster risk contents, however[221]. Besides, in the interview with the representative of the Environmental Protection Agency it has been confirmed that monitoring takes place of a) the implementation of the plan and b) the impact of the plan on the environment after its implementation (Interview P-VI, 2013). So the environmental report can also include measures that will indicate and monitor the impact on the environment. However, sometimes the commune does not feel responsible for carrying out monitoring of environmental impacts (Interview P-VI, 2013). Moreover, it was stated that the monitoring activities that happen after implementing the plan are usually only used in terms of monitoring spatial development and not for environmental impacts. Instead, monitoring impacts on the environment is done by EIA for projects (e.g. when building sewage farms) (Interview P-VI, 2013).

Again, a missing element in the environmental assessment is the vulnerability assessment. Since SEAs should be used to help direct human activities and the proposed plan towards improving the coping capacity of society and hence support human responses to better cope with natural hazards and extreme events, an assessment of the vulnerability is a prerequisite. Therefore, in the future attention should be paid to vulnerability assessments. Furthermore, public consultation only takes place at the end of the planning process, when decisions have already been made. Accordingly, perceptions of the public – including those of risks – cannot be considered anymore. Hence, in order to be able to take adequate and publicly accepted decisions about tolerating or altering risks, the element of risk perceptions should preferably be considered and a real risk evaluation be included in SEAs. In this case, SEA can be used as an information basis for taking rational decisions about dealing with and managing risks. When these requirements are met, normative, politically influenced decisions about planning goals can be made.

9.2.3 Examples from the Italian study area

According to the SEA guideline prepared by the Italian National Institute for Environmental Protection and Research (ISPRA), the level of detail of the reduction, mitigation and compensation measures depends on the level of detail of the PP. In particular, for implementation plans – as opposed to strategic plans – and/or for plans at a local level, the actual types of measures must not only be clearly defined, but also be described and located within the territory (ISPRA, 2015, p. 48). To what extent disaster risk is usually considered in the determination of measures to reduce, mitigate and compensate could not be ascertained

[221] Examples for indicators include: The number of social infrastructure utilities, the length of water supply and sewage systems, the density of the road network, reduction of CO^2 emissions as a result of building insulation, the reduction of the number of people exposed to excessive noise (Instytut Rozwoju Miast, 2014b, pp. 8–9).

within this study. As mentioned before, the difficulty in analysing SEA practices in the Italian case study site consisted in the low number of available environmental reports.

In the mentioned environmental report for the municipality of Tarvisio no mitigation, reduction or compensation measures are described. Other examples of environmental reports such as the environmental report for the PRGC, version no. 51, municipality of Codroipo or the environmental report for the PRGC, version no. 61, municipality of Latisana, list indeed a number of reduction, mitigation and compensation measures. Due to the fact that different versions of PRGCs involve different levels of amendment, the extent to which such measures are needed and described also highly depends on the contents of the plan, or the contents of the version and amendment of the plan, respectively. Even when a full environmental assessment is required, it does not necessarily mean that those measures are needed.

Still, making statements about the use of mitigation, reduction and compensation measures with reference to disaster risks turns out difficult due to the lack of meaningful examples. However, judging from the interviews that were carried out in the Italian case study site as well as the environmental reports and the verification documents which were further examined as part of this research, the assumption is that SEA hardly plays any role for promoting disaster risk management. It seems that often natural hazards are merely considered when analysing the initial state of the environment. Further references to disaster risk are rarely made.

While the environmental report does not specify mitigation, reduction or compensation measures it specifically mentions the monitoring task of SEA (Brugnoli and Tosolini, 2008, p. 3). In chapter 6 of the environmental report, a number of indicators are listed, which are considered the most innovative aspects introduced by the environmental assessment. Since it may be difficult to transform some objectives of sustainability into action, the development of indicators, their temporal application and the selection of fields of observation permits gaining precise conclusions on the achievement of such objectives (Brugnoli and Tosolini, 2008, p. 158). Developed indicators are related to aspects such as air quality, waste, radiation, use and quality of soil as well as water consumption. Accordingly, no specific indicators for disaster risk have been developed.

These results reflect the statements that were made by several interview partners in regard to handling risk information in spatial planning: Disaster risk is not a topic which is considered by planners, but that is only addressed by respective experts. Accordingly, disaster risk is a problem dealt with at a different horizontal level and decisions in regard to tolerating risks as well as decisions about the feasibility of selected planning goals are taken by scientific experts. While such an approach makes sense from a scientific and judgement point of view, it might be problematic from an acceptance point of view, as the perception of risks by the public is not taken into account. Elements of risk perception could still be added to scientific opinions and judgements in order to ensure publicly acceptable planning decisions. This could be guaranteed by effectuating more effective public consultations as part of the SEA process, for instance. However, first of all the general role of SEA and the significance of environmental reports for spatial planning needs to be strengthened. Moreover, piecemeal planning and the realisation of ever small amendments to existing plans is to the detriment of an integrated urban planning approach and hence stands in the way of planning towards resilience.

9.3 Concluding remarks

Above elaborations show that disaster risk is a topic in SEA in all three case study sites. Different degrees of development of SEA practices make a comparison difficult, however. While SEA application seems well advanced in the French and Polish case study sites, hardly any examples of SEA procedures were encountered in the Italian case study site. Nevertheless, there is evidence for all three case study sites that disaster risks are treated separately in SEA procedures and that risk information is used.

Only in the Polish case study site the examined examples referred to the development and comparison of alternatives, including the zero alternative. Since guidelines exist in France which specifically refer to the comparison of alternatives, and other examples exist in Friuli Venezia Giulia where alternatives were compared, it can be assumed that the examined examples in the French and Italian case study sites simply lacked this specific element.

Regarding options to choose between mitigation, reduction and compensation measures, SEA application in France, Poland and Italy generally seems rather heterogeneous, which is why no universal statement of the actual contribution of SEA to risk management can be made. In France, compensation measures are hardly applied and measures are almost exclusively directed towards the mitigation and reduction of adverse impacts. In the Polish case study site, all three types of measures were applied. While most measures aim to avoid and mitigate negative impacts – including risk – provisions for flood and landslide risk may also address compensatory measures. For the Italian case study site, no final statements can be made regarding the use of mitigation, reduction and compensation measures.

Finally, monitoring activities exist – at least "on paper" by being mentioned in environmental reports in the Polish and Italian case study sites. To what extent monitoring is actually implemented could not be conclusively examined. What can be noticed is that in cases indicators were developed they did not refer to disaster risk, but only to other environmental aspects and concerns.

According to above elaborations, SEA application in the Polish case study site is not only far developed, but SEA can indeed serve information purposes when being consciously carried out. Downsides of SEA application are seen in the extension of the planning process and in the need for (a time-consuming) public involvement. Despite the fact that in the French and Italian case study sites risk reduction instruments exist that already provide an adequate evidence base, planning practice can still benefit from integrating risk assessment and management aspects into SEA. Provided existing SEA processes enable a more intense and early involvement of the public, an integration of disaster risk into SEA may inform the public about existing risks, raise awareness and ultimately help ensure acceptance of planning decisions. In the French case study site, trust into local governments appears high and rules as well as legal regulations are usually followed. As the PPR is quite restrictive and many mountain areas are more or less completely limited in urban extension, public involvement serves to communicate existing constraints to the public in order to foster awareness and understanding. For all three case study sites it can be concluded that a vulnerability assessment would add to the quality of SEA application. Only when considering aspects of vulnerability, a complete assessment of the risk has taken place.

10. Interim conclusion – Summary of findings

The theoretical framework and principles described in the first part of the research work served as a basis for understanding and elaborating the topic and the problem as well as for the subsequent analysis. The analysis was guided by the two main questions:

- How is risk information used?
- How should risk information be used?

With respect to the first main guiding question as well as the sub-questions outlined in Chapter 1, the following results and findings can be presented[222]:

Availability of risk information

Availability of risk information differs widely between municipalities in France, Poland and Italy. Especially the PPR in the French case study site and the new flood hazard and risk maps in the Polish case study site are not prepared for any municipality. This causes difficulties for spatial planners and decision-makers. When no hazard or risk maps are available, separate studies – specific to the area in question – need to be elaborated. This requires additional expenses which is why such studies are not always produced. If no external information about risks or no sufficient risk information is available that originates from a scientific source, spatial planners need to resort to their own experience or try to base their planning and development work on whatever risk information is available. In some cases this may be geological maps which are usually only available at a small scale and hardly transferable to the local scale. In any case, a lack of risk information hampers the plan-making and decision-making process.

Moreover, maps used in the three case study sites are mainly hazard maps and not risk maps. Accordingly, hazard-related information is primarily taken into account while there is hardly any specific information about the exposure to hazards[223]. Hazard-related information in the form of hazard maps is taken to produce an overlay with intended land-uses. This way, spatial planners can identify areas exposed to hazards and – depending on the respective probability of occurrence and the expected intensity of the hazard – make adequate planning decisions. As outlined by the river basin authority “Alto Adriatico” (see Chapter 8.1.3), from a spatial planning point of view it is even more advisable to consider just the hazard instead of the risk, since areas can be designated as hazard-prone that up-to-date do not comprise any elements at risk. Hazard-related information can therefore be applied more specifically and location-oriented, while risk information is less flexible to changes.

One exception is the PPR in France, which integrates both, a hazard map and a map of land uses/objects in order to produce a risk map. A further exception are the geological maps of the PAI in the Italian case study, which show the elements at risk and existing structural defence works in addition to the hazard levels (see Chapter 8.1.3). After the adoption of the EU Flood Risk Management Directive, flood risk maps are now also produced in Poland. These maps will only be prepared for larger catchments, however. Consequently, in the Polish case study area as well as in other areas represented by small catchments and

[222] The following summary follows the criteria developed for the empirical study and outlined in Chapter 7. Not all of the problems that were identified are equally valid for all three case study sites. Differences between the case study sites will be explicitly mentioned. Reflections on the second guiding question will be presented in Chapter 12.

[223] This statement corresponds with the findings of the ARMONIA project.

streams, mainly hazards are assessed, while the assessment of vulnerability and hereafter the analysis of risks are being neglected.

Awareness of planners about existing regulations to consider disaster risk and their capability to formulate demands on risk information

The spatial planners that were interviewed are all aware of the different types of natural hazards that might occur in the municipalities they usually work for and that they have to consider. They are also aware of the existing regulations regarding the consideration of natural hazards and risks for urban planning and the information that should be used when preparing local land use plans. Moreover, planners in the French and especially in the Polish case study site are able to describe what information they need and to formulate specific demands. Only in the Italian case study site, spatial planners do not consider themselves responsible for handling risks and therefore have no specific needs or demands on how this information should look like.

However, spatial planners do not always fully understand the information about risks that they use and are not able to fully grasp the illustrated content. This is especially the case for landslide hazard information in the Polish case study site as well as for information about risks other than the PPR in the French case study site. In the Italian case study site, spatial planners hardly use any risk information. They point out that they are no experts in disaster risks and therefore have no understanding of risk information. They do not feel the need to possess knowledge about risks, due to the fact that they are not required to use risk information in the first place.

Spatial planners favour instruments such as the PPR in France, which are easily understandable and applicable. The PPR represents a zoning map with binding character as described in Table 4. In contrast to hazard maps that provide information about the extent and probability of occurrence, the PPR acts on a value level. Not only does it indicate risk exposed zones, it also assigns a value to each zone and regulates the use of land by determining where building is allowed and where it is prohibited. The PPR therefore includes normative provisions and goals to be reached (e.g. keeping a certain area free of development). Accordingly, spatial planners do not have to weigh up concerns related to risk reduction against other concerns and they do not have to take risk-related decisions. Instead, decisions are already made by sectoral planning agencies. This is why spatial planners in France do not need specific knowledge about dealing with this kind of risk information. Problems only occur if there is no PPR available.

The situation in Italy with the PAI is comparable to the situation in France. However, while the PPR can be both a single and multi-hazard instrument and can be produced for ten different types of hazards, the PAI only considers hydro-geological, geomorphological and avalanche hazards. It is also prepared on a value level as it indicates zones that are at high risk and at low risk. Spatial planners can therefore use the maps of the PAI to make a pre-evaluation in order to respect building prohibitions when facing an area at a high hazard level, for instance. However, as already mentioned the PAI is merely used for this pre-evaluation and does not constitute an imperative tool for spatial planners.

In Poland, flood and landslide information is provided on a factual level: The content of flood hazard and landslide hazard maps reflect the current state of the environment and describe the actual given conditions of the environment. The maps do not assign a value to these conditions. Such descriptive, scientific facts are not suitable for deriving normative statements. Planners are not able to make decisions based on geo-scientific facts and conditions only, as valuation standards, objectives and measures cannot emerge from value statements alone (Scholles, 2008). A value can only be added when taking into account societal values and social conventions. This means it has to be determined which degree of risk is acceptable. After all, *"the definition of specific risk levels is crucial, and generally dependent on either law requirements or expert judgements"* (Bell et al., 2006, p. 77). Consequently, spatial planners demand risk information on a value level, because they cannot attach a value to factual information themselves, as they are no experts in hazard and risk assessments.

It was noticed during the interviews, that some of the interviewed spatial planners did not distinguish between the terms hazard and risk in their language and use both terms interchangeably. Only the interviewed Polish planners differentiated between the two terms. Due to the fact that spatial planners often do not know the difference between hazard and risk, it is likely that they do not understand the rationale behind risk assessments and how risk is analysed. This makes it even more difficult to interpret the content of the maps.

Usability, applicability and comprehensibility of risk information

Spatial planners primarily wish to be provided with readily applicable information. This is why they prefer legally binding provisions. According to the interviewed planners in the three case study sites, clear provisions in the form of hazard or risk maps are needed, as they help or serve to legitimise planning decisions and constitute a reliable evidence base, which can easily be used to develop evidence-based, justified planning measures.

Missing risk information or a lack of clear provisions issues a challenge to spatial planners and administrators responsible for spatial planning. On the one hand, information and data provided at a different scale, e.g. in the form of geological maps (see above), is not easily translated onto the respective planning level. This problem of scale can hardly be solved by spatial planners alone. On the other hand, spatial planners are usually not trained to employ "non-processed" information. This means that in cases in which risk information is not provided on a value level planners find it difficult to attach a specific value to the information and to take decisions about the future use of land. In other words, spatial planners expect that risk information is presented in a way that allows them to take undisputable decisions and that issues clear instructions. By implication this means that spatial planners do not wish to be responsible for a proper interpretation of risk information.

This means in turn that spatial planners working at the local planning level encounter difficulties when weighing up different concerns if natural hazards are involved, as it is challenging to assess the actual risk and attach appropriate values to risk reduction. The local level alone is neither suitable nor capable of dealing with natural hazards alone. Accordingly, dealing with natural hazards requires preparatory information processing either at a higher horizontal planning level or by sectoral planning authorities. Legally binding provisions regarding natural risk management in a planning document at regional scale, for instance, or separate sectoral approaches that are integrated into spatial planning approaches are considered supportive in this regard[224].

[224] The downside of legally binding provisions of sectoral approaches will be described in the second part of this chapter.

Communication and handling of uncertainties in risk information and anticipating future changes

Spatial planners encounter difficulties in adopting a future perspective and in anticipating future changes, e.g. those connected to climate change. This problem is further intensified by the fact that future predictions are always connected with great uncertainties. Spatial planners and representatives of local governments both lack understanding and comprehension concerning the predictions about climate change. Therefore, actors concerned find it difficult to assess the consequences of those predictions for their territory and to deal with uncertainties connected to the provided information.

Since the level of risk is likely to change, data and information that mirror the current state of the art of the environment are not suitable for predicting future impacts. The problem is that spatial planners and local governments can only base their decisions on available information. They have to rely on data and information that is at their disposal and apply this information in order to verify whether a plan or project is possible or not. Spatial planners are aware of the fact that the information they use includes a certain degree of uncertainty. However, often they do not feel they can deal with this uncertainty, at least not deliberately. Sometimes they even ignore uncertainty because they do not know how to deal with it. When facing uncertain and unclear provisions, spatial planners tend to apply the precautionary principle – both intentionally and unintentionally. This principle represents one way of dealing with uncertainties and can be applied in different ways. In France, it was even inserted into the French Constitution. In the French case study site decision-makers tend to maximise, overestimate the risk by expecting the worst. Accordingly, spatial planners are required to translate these precautionary provisions and ideas into the local plan. However, it was also stated that the principle remains partly theoretic and is not always well translated down to specific places and measures. Likewise, in Poland decision-makers sometimes install measures even when uncertainty exists by predicting the biggest and most probable danger – especially in regard to landslide hazards.

There is no doubt that uncertainty in the provided information should be communicated to end-users. Hence, there is an obvious mismatch between the fact that uncertainties have to be communicated and the missing ability on the part of spatial planners to deal with these uncertainties – or even the missing willingness to consider these uncertainties, respectively. The problem is that spatial planners do not seem to be aware of the options and aspects available that help to deal with uncertainties or of the strategies that can be applied. The only exception consists in an application of the precautionary principle. Therefore, it is important that spatial planners are provided with guidance documents as well as suitable instruments that help them deal with uncertainties.

Public involvement when handling risks in spatial planning

Public involvement is legally required, which is why in all three case study sites examples for public involvement exist. Especially as part of spatial planning and SEA practices but also during the elaboration of flood risk management plans involvement activities take place. However, often participatory processes happen too late in the process. This holds true for both, spatial planning processes and processes related to the elaboration of hazard and/or risk maps. Such a late involvement might imply problems related to the acceptance of planning decisions, as interests and concerns of the public are not included from the start of the planning process. Moreover, public participation serves educational purposes in the form of awareness raising and knowledge transfer. Both aspects rather speak for an early and more thorough involvement of the public, especially when considering the fact that in some cases the public is not sufficiently informed or aware of the risk they are actually facing. In this respect, a continuous involvement of the public could help ensure public acceptance for planning decisions, inform and raise awareness about present and possible future risks. Promoting a better knowledge about the risk situation again can help create understanding for development restrictions. A better understanding of restrictive development options may in turn prevent the public from expressing concerns and opposing against a draft plan.

Despite these arguments, several of the interviewed spatial planners in the Polish case study site still consider public participation as a hindrance rather than a support. Often consultations and public inquiries slow down the planning process and cause extra trouble for those preparing the plan. A possible reason for this rather reserved attitude towards public involvement can be seen in the characteristics of the hazard zoning approach applied in the Polish case study site: As there is no separate, legally binding map or plan that has to be considered during the planning process, decisions regarding hazard zoning and according provisions are harder to enforce. Moreover, due to the lack of separate maps with binding character, the existence of hazard zones and according risks is only communicated to the public through land use plans. The public is not necessarily aware of existing flood hazard and risk maps or flood protection studies. Finally, planners need a good reasoning in order to effectively justify planning decisions and to be able to explain why they put more weight on one concern than another. Bad reasoning and a lack of transparency of decision-making may cause people affected by the plan to complain. The less decisions are understandable, the more people will complain and the longer the planning process will take. The environmental report therefore clearly needs to include a presentation of different alternatives and reasons for selecting one specific alternative. In contrast, interviewed spatial planners in France consider public involvement important. As explained in one of the interviews, involvement in the form of public meetings is helpful in raising awareness and understanding, since current conditions of the territory, including its constraints, can be explained in detail. Especially when carried out effectively and early in the planning process, public involvement certainly yields obvious benefits. In the Italian case study site similar opinions were expressed as in the Polish case study site. The consultation of the public often gives room for complaints and opposition. Diverse opinions of the public may be a problem in election periods, as some demands of the population may be met, while others cannot be met. Since mayors are usually interested in re-election, they tend to try to meet as many demands as possible in order to please a great part of the population.

Use of risk information in SEA

Both natural and technological risks need to be included in SEAs of local spatial plans beyond doubt. Risks are one of the aspects that need to be considered in the analysis of the current state of the environment as well as during the assessment of potential significant impacts of a PPP. However, it depends on the quality of the environmental report, whether risks were considered and properly included in the assessment or not. Some environmental assessments are well done; others are poorly elaborated in this regard. This means that in reality risks are not necessarily always assessed within SEA.

A guide prepared by the French Ministry of Ecology, Sustainable Development, Transport and Housing explicitly lists both natural and technological risks among the aspects that need to be examined and considered during the SEA process. The same applies to the two Italian guidelines prepared by the INTERREG project “enplan” in 2004 and by the Italian National Institute for Environmental Protection and

Research in 2015. While these guidelines clearly name natural risks as one of the environmental issues that need to be considered and analysed, no detailed information is provided on how exactly to assess risk-related issues during the environmental assessment. In Poland natural risks have to be assessed in the context of the obligatory "Ekofizjografia". The "Ekofizjografia" is considered a useful basis for integrating risk-related issues into SEA and the plan. Again there is no detailed description on how to deal with this information in the further course of the environmental assessment. It is evident in all cases that natural and technological risks need to be considered and integrated into an environmental assessment, as they are clearly important features of the environment. Nevertheless, the handling of collected information and the actual assessment of risks over the course of the assessment is hardly addressed and described.

While risk information is regularly used during the first stage of analysing the initial state of the environment, it is not used for monitoring purposes. According to the UNISDR (2007, p. 6) *"consideration of monitoring and evaluation needs to be built into the planning stage, to ensure that the right data is collected as part of all activities and that the process is tailored to answer the relevant management questions […]"*. Consequently, information and data about risks should also be used within a monitoring tool. After all, plans and programs have to be adapted to a changing environment continuously. SEA constitutes a suitable tool for monitoring activities, since monitoring represents one of the stages of the SEA procedure. However, a monitoring of implemented strategies hardly takes place in the examined cases. When indicators were listed for monitoring and evaluation in environmental reports they did not refer to disaster risk. Moreover, when asked about monitoring and evaluation of measures and planning decisions in general, the only monitoring-related activity that was mentioned is the official approval of construction works. It appears that once decisions are made and measures are implemented, their effectiveness or impact is not being evaluated, but only the correct implementation of provisions is checked. Accordingly, risk information is only used to take decisions and to implement measures. It is not used at a later stage to monitor and evaluate these measures.

There are several reasons for the in part poorly assessed risks in SEA. Among others, a general lack of guidance documents on the implementation of SEA for spatial plans can be identified. Among the examined case studies, the French site is the only one that has a comprehensive guideline on SEA of local spatial plans (prepared at the national level for use at the local level). This guideline also refers to natural risks. No such guidelines are available in the other two case study sites or regions, respectively. The existence of such a guideline could help improve SEA implementation for spatial plans and help make it more effective. This is why guidance documents can be seen as a clear benefit for SEA and planning practices.

Moreover, the SEA Directive only indirectly refers to risks. It does not directly call for risk assessments. Instead, the current wording of the SEA Directive only implicitly suggests considering risks. This means that the necessity for risk assessments can only be indirectly derived, which is why risk prevention is not necessarily always sufficiently addressed (European Commission DG Environment, 2008). There is no direct mention of either impacts of the plan on a changing climate or of a changing climate and respective increase in frequency and magnitude of extreme events/natural hazards on plans. It should, however, be considered that a plan operates within an evolving environmental baseline, i.e. one that changes over time. Moreover, a material link between risk assessment and SEA is clearly given. Nevertheless, a specific reference to climate change and climate change induced risks in the Directive itself might be helpful in terms of an actual consideration of these aspects in the implementation of the Directive and in planning practice.

Implementation of the SEA Directive differs considerably between Member States, and risk prevention and disaster risk reduction are not necessarily addressed in a sufficient and effective manner. Hence, there is no guarantee that relevant potential risks are assessed. Furthermore, an environmental report often only constitutes a tool which has to be prepared (according to legal regulations) and which serves as a communication tool with the public in order to justify and legitimate decisions towards the public. The decision-aiding purpose of SEA is not always recognised. This means that the environmental report is predominantely prepared because of its legal requirement.

Finally, not every PPP is subjected to SEA. The fact that the Directive itself determines that some areas are exempted from the requirement to have an environmental assessment leaves options open to circumvent an assessment. This is particularly obvious in the Friuli-Venezia-Giulia region, where mostly minor changes are made to local spatial plans, which do not require an environmental assessment. Accordingly, mostly short studies are available on whether the amendment of the plan is subjected to SEA. Consequently, very few environmental assessments were completed in the region for either local or for inter-communal land use plans.

Risk information in informal planning instruments

Risk information is mainly used for formal planning instruments and less for informal planning instruments. Although informal planning instruments exist in France, Poland and Italy, they hardly play any role for the management of risks.

Informal planning instruments are generally less prevalent in these countries as compared to other European countries such as Germany, for instance, where spatial planning has a comparably wide range of both formal and informal planning instruments at its disposal. In France, existing informal planning instruments focus on the coordination of different planning levels as well as on the involvement of actors that are usually not part of formal planning processes. In Poland, informal planning in the form of cooperating planning approaches that encompass different institutions and administrative levels hardly takes place. In Italy, in addition to the missing terminology for planning practices that can be characterised as “informal”, there is also no description or account of informal planning approaches in the Italian planning system. However, a few plans exist which can be considered “informal”.

Moreover, risk management – in addition to climate change mitigation and adaptation – hardly plays any role in informal planning. This is why existing informal instruments are not used for risk management purposes. Natural hazards are only considered in informal planning processes if they influence a desired vision or strategic goal or if they hamper development strategies. However, in Italy municipalities are now beginning to develop climate change adaptation plans, which also involve a risk and vulnerability analysis and which therefore consider natural hazards. Ancona and Bologna are among the first pilot municipalities that elaborated climate change adaptation plans. Accordingly, the importance of such instruments could possibly grow in the near future, especially when funding options are made available for municipalities to prepare such planning documents.

The role of public involvement in Italy could be one of the reasons for a negligible role of informal planning instruments in addressing disaster risk. In any of the three countries public involvement is not very well implemented, which is why existing informal instruments are instruments that are used between different planning entities only, but without focused public participation.

Information exchange between users and providers of risk information

Scientific experts or sectoral planners (geologists, hydrologists etc.) prepare hazard maps based on scientific knowledge and their best available analysing methods. Different users are the addressees of such maps with spatial planners being only one of many possible user groups. Scientific experts usually prepare these maps without considering the different users of their maps and do not take into account the wide range of different user needs and expectations. Although entities that are responsible for preparing these maps are often aware that spatial planning is one of the fields of application they do not develop the maps with the specific user requirements in mind, but follow purely scientific reasoning. Consequently, the procedure is rather offer-driven, with the natural hazard specialist, i.e. the scientific expert, producing and creating the hazard map for the targeted reader without acknowledging the importance of targeted communication (Meyer et al., 2011). Depending on the need for information, different user groups have different demands on content, readability, accuracy or resolution of risk information (EXCIMAP, 2007), e.g. in terms of details or contents displayed on a hazard or risk map. While the provided information can indeed be of high scientific quality, it may still not meet the needs of the specific user, if specific user needs are not taken into account.

Information exchange and knowledge transfer between scientific experts and spatial planners clearly exist in all of the three case study sites. However, often communication channels only exist in one direction, i.e. from information providers to information users. This is more common than from information users to information providers, especially in the French and Italian case study sites, where expert advice is considered crucial. In both case study sites, interviewed spatial planners expressed the need for sufficient information from experts and the provision of scientific evidence. In the French case study site, one of the interviewed spatial planners mentioned the existence of an information exchange in both ways and confirmed there is an actual mutual information exchange. Interestingly, in the Italian case study site the sectoral planning representatives, i.e. the information providers, underlined the need for a more intensive cooperation and strengthening of a reciprocal communication. Interviewees in the French case study site shared the same opinion: Effective collaboration between all actors involved is what a strong and legitimate planning document requires. In the Polish case study site more examples of types of one way information exchange could be observed. For instance, workshops for spatial planners are held in order to explain the context of flood and landslide hazard maps and how to apply them. Further informal ways of information and knowledge transfer exist between the environmental protection agency and spatial planners.

In terms of participation of spatial planners in hazard and risk mapping, hardly any examples were identified. In the French case study site, although no actual evidence was given related to an involvement of spatial planners in hazard and risk mapping, findings indicate that hazard and risk mapping is a task of sectoral consulting agencies only and that spatial planners are not directly involved. In the Polish case study site similar observations were made: spatial planners and planning authorities are not directly involved in any hazard and risk mapping processes. Nevertheless, spatial planners may – led by their in some instances quite detailed knowledge of the territory – express their concerns towards drafts of hazard maps. This can be considered an example of a two-way information exchange. One-way information exchange from sectoral planning bodies towards spatial planners and respective authorities is more common, however. In the Italian case study site flood and landslide hazard maps are prepared without involving spatial planners. One interviewee suggested that a closer link between spatial planners, hydrologists and geologists is needed. Although in fact this closer link was thought of a better way to inform spatial planners how to apply the provided information in planning processes, it could at the same time also foster mutual learning and a two-way information exchange.

These results and findings, which refer to the sub-questions outlined in Chapter 1, reveal a number of shortcomings in relation to existing theories[225]. Likewise, a couple of reasons exist for these shortcomings. However, at the same time there is also room for improvement. Consequently, above elaborations are now followed by a discussion of possible reasons and suggestions of ways to approach remaining problems.

Reflections on how to address shortcomings

The analysis has shown that approaches to disaster risk reduction differ between the examined case study sites. In general, disaster risk reduction has to be addressed by case-specific solutions and by trying to address inherent questions and problems. Still, a number of recommendations can be formulated which are not context-specific. They are valid for all three case study sites and are transferable to different national, regional and local contexts other than those examined.

Improving governance structures by facilitating coordination and collaboration processes

Spatial planners have to consider several concerns of spatial significance. It is impossible to train and educate them specifically and profoundly enough in all of these single aspects equally. This is why it is crucial that risk information is processed in a way that takes account of spatial planners as one main user group. Such a user-oriented approach should focus more on a demand-driven way of preparing risk information. In order to foster better two-way communication between spatial and sectoral planning, or between hydrological, geological and environmental experts as information providers and spatial planners as information users respectively, coordination and collaboration between these groups of actors should be strengthened.

Coordination between different actors and a coordinated decision-making process are required in order to align desired goals and existing restraints. Work stages and responsibilities between spatial panning and spatially relevant sectoral planning actors need to be coordinated in order to efficiently implement risk reduction measures. A more coordinated approach would promote a *"continued exchange of knowledge between the actors, a pooling of resources, as well as increased effectiveness and efficiency"* (stadtland Dipl.-Ing. Sibylla Zech GmbH, 2011, p. 58) in implementing risk reduction measures. Figure 54 shows a possible workflow and indicates the roles and required interactions between spatial and sectoral planning authorities in case of climate change adaptation. Such a workflow would also work for issues related to

[225] The term "theories" refers to assumptions of good practice in dealing with disaster risk in spatial planning, based on literature study. The selected criteria and indicators that were presented in Chapter 7.2 were predominantly deduced from the literature. They reflect presumably good examples of dealing with disaster risk in spatial planning or refer to respective requirements for adequately dealing with disaster risk. The analysis of planning and SEA practice in Chapter 8 and 9, which makes use of the criteria and indicators as guiding factors, reveals to what extent "theories" or assumptions of good practice were met.

disaster risk, as the reduction of vulnerability and an increase in resilience are equally valid goals for disaster risk management.

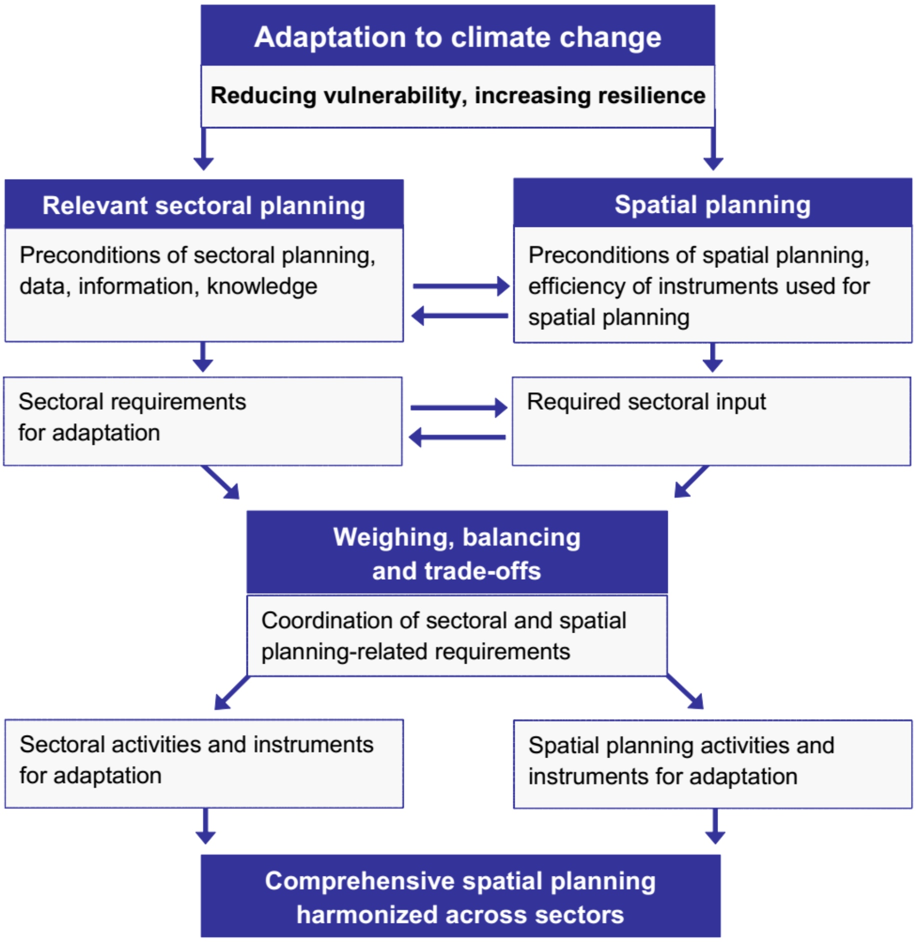

Figure 54 Coordination between sectoral and spatial planning authorities (Source: stadtland Dipl.-Ing. Sibylla Zech GmbH, 2011, p. 59)

Collaborative interactions are increasingly required under complex decision-making processes to facilitate knowledge and contribution from different actors towards better-informed decisions (Edelenbos et al., 2011; Failing et al., 2007). Collaboration is also a useful means to improve awareness, knowledge and understanding. This is why in addition to coordination, collaboration between sectoral and spatial planning should preferably be intensified.

In short, solutions are needed which improve the understanding of the risk topic from a spatial planning point of view. The topic of natural risks needs to be brought to the agenda of different kinds of spatial activities. By improving existing governance structures through both formal and informal coordination processes and through facilitation of collaboration processes, two-way communication and thus a better understanding of each other's interests, goals and needs will be promoted. A better coordination and collaboration in turn help achieve a more integrated comprehensive planning approach.

More integrated comprehensive planning approaches

Planning practices in the case studies concerned are rather represented by poorly integrated planning approaches. Planning can therefore be characterised as piecemeal rather than integrated planning.

Although spatial planning is supposed to be integrative, comprehensive and meta-disciplinary in nature, examples in practice show that often spatial planning happens on a case-by-case basis, especially in the Italian case study site. Regular, small amendments to PRGCs bespeak a lack of holism. Although no specific examples in the Polish case study could be detected, Polish planning practice in general is also characterised by piecemeal planning: Reluctance of local authorities to implement Local Plans of Spatial Development and the preference of issuing single building permits underpin this statement. Moreover, spatial planning is greatly influenced and "overruled" by a number of sectoral planning concerns and decisions. Sectoral planning is more specific and aims at controlling and regulating specialist problems. This means that planning decisions are often "guided" by sectoral planning tools or policies and that the actual focus is on the realisation of specific sectoral planning interests.

This has also been highlighted by the PEER-Report on Climate Policy Integration, Coherence and Governance, which came to the following conclusion:

> *"While the need for co-ordination and integration across sectors, scales and levels is growing, the capacities to respond are frequently shrinking because of the rigidity of administrative and political borders, the stability of departmentalism and the strength of sectoral interests and preferences for small-scale solutions. While it is generally recognised that the role of spatial planning for climate mitigation and adaptation should be strengthened, the practice is not very well developed as yet"* (Mickwitz et al., 2009, p. 60).

Although this statement addresses climate change mitigation and adaptation aspects, it can likewise be broadened towards risk management related aspects. Despite the fact that spatial planning is supposed to be responsible for comprehensive planning, it is often deprived of its competences by sectoral provisions.

It should not be the task of a sectoral planning authority to more or less dictate the use of land a priori. In addition to attending their own field of expertise and responsibility, in terms of spatial planning related aspects a sectoral planning authority should only be responsible for providing adequate information and material to be considered in the weighing up process together with other concerns. A more integrated, comprehensive planning approach offers a number of benefits after all. Such benefits include securing sustainable development and fostering a development towards a resilient community as well as the resolution of single problems with no adverse effects. Comprehensive planning pays attention to a problem in all its spatial dimensions and implications; it looks at the bigger picture and does not try to solve single problems.

An improved integration of different aspects and topics within the planning process can be achieved by integrating specialised and responsible actors, i.e. institutions, sectoral planning entities, experts, spatial planning entities etc. into the risk management process and by facilitating collaboration between sectoral and spatial planning in particular (see above for the importance of coordination and collaboration). Such a way of organising risk management by involving, integrating and aligning all actors facilitates the consideration, presentation, discussion and weighing up of different stakeholder interests. Here, interdisciplinary governance and participatory processes could support a better integration of all actors and their interests (BMVBS and BBSR, 2013, p. 101). Moreover, instead of focusing on planning at the local scale, an integrated approach could be promoted by facilitating and initiating processes at an inter-communal or regional/sub-regional scale. After all, hazards regularly cut through administrative boundaries. This is why a disaster usually concerns more than just one municipality, requiring solutions elaborated at higher administrative levels and concerning a larger territory.

A more integrated planning approach can be promoted by SEA and parametric governance, for instance. In the following, these two options and their contribution to an integrated, risk-related planning approach will therefore be presented. Chapter 11 will follow up on the role of SEA, due to the fact that SEA is a main aspect of this research work[226].

Strategic Environmental Assessment

According to recent changes in the EIA Directive, an environmental impact assessment now requires the consideration of impacts on climate change (Annex III, No. I f. and Annex IV, No. 5 f) and disaster preparedness (Article 3, Paragraph 2). Due to the close link between EIA and SEA, the existing legal framework of the SEA Directive is likely to be amended likewise. It is expected that the SEA Directive will be amended accordingly and that it will soon include more specific provisions regarding the consideration of climate change and disaster impacts.

As explained before, it is not only important to assess the impacts of a plan or programme on the environment, but also to assess the long-term risks associated with climate change and respective consequences for and impacts on the plan or programme. As the current wording of the SEA Directive only implicitly suggests taking risks into account, planners, or planning authorities respectively, might not necessarily be aware of the fact that a risk assessment could be carried out as part of the SEA process.

Consequently, guidelines should be provided to planners that help apply SEA more effectively. Positive examples for such guidelines include the EU “Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment” as well as the French “L'évaluation environnementale des documents d'urbanisme. Le Guide”. The need for better guidance becomes evident when acknowledging that the concept of using SEA as a means to reduce risks has not been widely implemented in practice (Kanwar and Thummarukudy, 2014). Besides, the consideration of uncertainty also seems to be neglected in SEA reports and studies. Improvements should therefore aim to more specifically hint towards the great potential SEA offers in addressing risk prevention and minimisation. In this respect, preparing and distributing guidelines can be a first step.

Missing guidelines may also be one of the reasons for a lack of monitoring practices and evaluation systems. The same applies to the current lack of indicators for measuring effectiveness of implemented strategies and for measuring the actual progress in reducing risks. In order to purposefully measure effectiveness and progress, disaster risk actors need to employ indicators that help focus on the relevant issues. However, spatial planners need support in order to decide for suitable indicators and to identify links between cause and effect. These can hardly be decided on individually.

In any case, SEA requires monitoring of significant environmental effects. This stage of the SEA procedure could thus be used for monitoring the effects of implemented measures in the context of risk management (see also Greiving, 2004). Due to the fact that the monitoring stage seems rather neglected in SEA practices, spatial planners first need to be made aware of SEA as a monitoring tool. In addition, support

[226] Parametric governance is introduced additionally as a supporting concept. It does not play a greater role in this research, however, which is why the remaining chapters will not continue to refer to this concept.

could be provided in terms of suggesting indicators that can be used for risk management purposes in the monitoring stage.

In the Polish case study site, planners employ probabilistic maps with no legally binding character. Here, SEAs that integrate risk assessments can be particularly useful in terms of informing planning decisions. As decisions are not guided by sectoral provisions, SEA offers a suitable decision-making framework. The Polish approach of dealing with natural hazards also requires the formulation of specific targets, due to the differentiation between factual and information levels. In order to interpret and draw conclusions from risk information, options should be given that enable a connection between information and predefined goals. Within the SEA procedure, such a connection could be established, provided goals exist. Moreover, the legally required consultation of relevant authorities can ensure sufficient cooperation. In this respect, the capacity of planners to understand and appropriately assess the given information could be enhanced. Hence, SEA constitutes a suitable framework for connecting risk assessment results with risk management decisions. Ultimately, results of environmental assessments inform planning decisions.

A last aspect that needs further improvement is the role of public involvement within SEA. By intensifying public involvement and trying to integrate the public more intensively into the environmental assessment process, clear benefits may arise. Risk prevention requires a strong participation of those actors that have expert knowledge in order to determine suitable mitigation, reduction and compensation measures. However, involvement of the public is just as essential when it comes to legitimising planning decisions that are made under uncertainty. On the one hand, it is important to involve the public to raise awareness and increase the knowledge about existing constraints. On the other hand, public involvement is also important for considering people's perception about risk. Although the PPR is prepared by involving the public through consultations and public inquiries, practice shows that in some cases consultations happen too late in the process. Furthermore, the quality of PPRs depends on the reliability of the consulting agency that produces the plan. In this respect, public involvement can improve the quality of the PPR. For instance, it can help determine levels of precaution to be considered for the zoning map by investigating the prevailing risk perception. SEA can also be particularly useful when preparing PLUs in communes exposed to one or more hazards that do not have a PPR available. In this case, risk assessments that are part of the environmental assessment can support and facilitate decision-making. Producers of the PAI in the Italian case study site acknowledged, that the consideration of local knowledge is crucial in order not to base hazard modelling on mathematical calculations only. In his respect, also the consideration of people's perceptions of risk can yield benefits and help determine appropriate hazard zones, that are not just based on mathematical modelling. Again, SEA can offer a suitable framework for purposeful public involvement. In the Italian case study site spatial planners are not concerned with risks, but decisions are taken by experts. Instead of making scientists liable for planning decisions that turned out to be wrong, the public could be more involved to help determine accepted and tolerated risk levels.

Some of the interviewed spatial planners were not exactly in favour of an intensified involvement of the public. Reasons for such a reserved attitude towards public involvement may be that in many cases public inquiries only cause extra work and do not necessarily contribute to an enhancement of the plan. The population often takes the occasion to contradict rather than to provide constructive suggestions for improvement. Consequently, legally required public consultations are often seen as a necessary evil than a benefit, especially in the Polish case study site. Existing literature on SEA backs this observation, as it often equally indicates difficulties in public involvement in SEA and refers to problems such as conflicting values and opinions as well as unequal distribution of knowledge among involved parties (Rega and Baldizzone, 2015, pp. 113–114).

Until today only little empirical evidence is available related to the extent and the outcome of public involvement in SEA processes. In fact, some SEA experts hold the opinion that benefits arise when effective public engagement takes place (see Chapter 5). In order to promote public involvement and benefit from the advantages it yields, a change in perception of usefulness of such an involvement seems promising. This constitutes a long-term goal which additionally requires strengthening of the legal framework and elaborating useful guidelines in the short-term (Rega and Baldizzone, 2015, p. 114).

In summary, by amending the SEA procedure, trying to strengthen the role of SEA and aiming at improving single steps or procedures within the SEA process, some of the above-mentioned deficiencies can be addressed and improved. Furthermore, typical features of spatial planning – such as public involvement – can be promoted by a further development of legal frames and SEA guidance. Finally, a more effective SEA process might also help enhance cooperation and collaboration between actors involved and foster a more integrated planning practice.

Parametric governance

A different solution to some of the encountered problems can be seen in parametric governance. Parametric governance can be understood as a form of governance, *"by which the steering body defines operationalized objectives but leaves it open to the implementing bodies how the goals may be achieved"* (Cools et al., 2002, p. 19, 2002, p. 219). This means that higher level planning entities set standards to lower level authorities, but only define the goals that need to be achieved and not the exact ways to get there[227]. Such an approach is particularly suitable when dealing with climate change, as it offers more flexibility and leaves a margin for decentralised entities in order to find more problem specific solutions. Flexibility is needed when coping with climate change, as conclusions cannot be easily drawn on the basis of past events (Greiving and Fleischhauer, 2010). This holds also true for dealing with issues related to disasster risk. As lower level authorities gain more responsibility and competences, solutions might be better accepted by the local administration and the public than the usual top-down solutions provided by higher level spatial or sectoral planning entities (Cools et al., 2002, p. 219). The main focus is on the output and on goal achievement, not on single solutions as such. Consequently, there is no need for defining and providing specific provisions and for prescribing precise risk reduction measures, as it is up to the responsible authority to define those measures, which contribute to goal achievement.

Merely specifying operationalised targets instead of providing legally binding solutions can be a real asset in the examined study sites for several reasons:

Operationalised targets guide planning decisions. While no specific provisions are stipulated, the main targets and objectives are set. This way a direction for development is given, as the predefined goals constitute an important point of reference. Such objectives can indeed serve as a basis for decision-making and legitimise planning decisions. Furthermore, they also foster an integrated planning approach,

[227] In Germany, for instance, parametric governance is predominantly suited for the relation between the sub-national and the regional level (Cools et al., 2002, p. 227). This is why it is questionable whether it is equally applicable at the respective local levels.

as an integrative governance process needs to be initiated on the local level. Finally, they promote the coordination and collaboration between different actors as the process of coordination of planning becomes particularly important in deciding for a favourable way to reach the objectives. Decisions are taken jointly, not separately. Due to the involvement of all actors, expert knowledge is generally available and can be shared between all involved entities.

Parametric governance is suitable in cases in which one problem should allow for taking different solutions. Often different situations and conditions require different solutions for the same problem. In the case of natural hazards, risk prevention always depends on the location, which is why no universal solution can be formulated. Parametric governance permits the development of different solutions. For issues related to disaster risk this means that different mitigation and reduction measures can be applied as long as they help achieve the defined goals. This makes planning more flexible and allows case and location specific planning decisions.

Additionally, parametric governance can be supported by the application of informal planning instruments, which is why the development of informal planning instruments should be (further) promoted. Involvement of the local public becomes increasingly important in the light of climate change and risk management and consensus about thresholds for acceptable risk is a prerequisite (Greiving et al., 2013). Responsible authorities in the case study sites could therefore direct their attention to informal planning instruments instead of more or less underestimating their value and contribution. Incipient stages are recognisable, but a further development of such instruments is desirable in order to grant them a more prominent role.

A challenge for parametric governance lies in the fact that addressees often perceive it as a limitation, despite the fact that they gain more autonomy (Cools et al., 2003, p. 164). Moreover, parametric governance can lead to more hierarchy and a formalisation of relationships between relevant actors, if it is linked to a decentralisation of organisational structures (Nagel and Müller, 1999, p. 30; Gerstlberger et al., 1998, p. 285 cited in Cools et al., 2002, p. 227). In fact, it generates decentralisation in governing, but centralisation in control (Cools et al., 2003, p. 163). Another problem of parametric governance can be seen in the sectoralisation of planning. This means that parametric governance favours the development of sectoral spatial plans that potentially give more weight to sectoral interests (Cools et al., 2003, p. 163). Finally, parametric governance requires a high level of communication. The existence of a good culture of communication is a prerequisite. Only when actors communicate openly and provide their knowledge, good conditions for learning processes can be enabled. Meeting this requirement is highly unlikely, however, as such a highly developed culture of communication hardly exists (Cools et al., 2003, p. 164).

Proposal for a concept to integrate risk information into SEA

The main findings that were outlined above and the following reflections on what could generally be improved support the conclusion that a more thorough integration and continuous consideration of and reflection on risk-related issues during the whole course of the SEA process can help improve the environmental performance of PPPs. While it is not yet evident whether parametric governance is easily applicable in all planning systems at all planning levels, SEA is a procedure that is required in all EU Member States for at least every PPP that might have significant impacts on the environment. This regulation automatically includes all spatial planning documents at different levels. Therefore, a case can be made that more attention should be paid to the role of SEA in disaster risk reduction.

It has to be acknowledged that all three of the examined case study sites are characterised by somewhat different situations and problems: The French and Italian case study sites are characterised by strongly risk-preventive conditions. Both, the PPR and the PAI are risk prevention instruments that have a very strong influence on spatial planning. The difference between these two case study sites consists in administrative aspects, in particular. France is still a very centralised country, especially when it comes to issues related to disaster risk reduction. The PPR is a risk prevention instrument promoted, financed and initiated by the central government. The central government also enacts the most important laws related to disaster risk reduction. In Italy, administrative structures are more regionalised, especially in an autonomous region such as the Friuli Venezia Giulia region. This is why differences exist between regions in approaching problems related to disaster risk.

A further difference between approaches in the French and Italian case studies consists in attitudes of the population and decision-makers towards risk prevention in general.

The French disaster risk approach is characterised by a strong focus on precaution and safety of the population, due to a long tradition in risk prevention. After an initial phase of scepticism, the PPR is considered a useful prevention instrument today. The PPR, in addition to assessing the risks, also involves the element of risk management as it anticipates planning decisions by determining the prohibition or permission to develop land a priori.

In the French case study disaster risk is an important topic. This is why many policy fields, including spatial planning, pay attention to potential adverse effects connected to disaster risks. In cases in which an environmental assessment is consciously carried out and well done, disaster risk is usually sufficiently considered during the SEA procedure. The description of spatial planning and SEA approaches and in-practice examples in the previous chapters show that the French case study site supports the conclusion that these practices can generally be considered a good example. However, problems arise when there is no PPR available. Furthermore, sometimes spatial planners have difficulties taking explicit decisions for development in blue zones of the PPR. In such cases, an environmental assessment should play a bigger role as decision-support instrument. In case of a missing PPR, spatial planners need an alternative evidence base, which SEA is able to provide. Moreover, by comparing different alternatives, an environmental assessment can help to take adequate decisions for areas designated as blue zones in the PPR and pay attention to making a plan disaster resilient. Prohibiting urban development and construction a priori is not always the best and most resilient decision in the long-run. By considering different alternatives during SEA, the optimal solution for each specific case can be found. Finally, a more effective implementation of public involvement as part of the SEA may provide additional benefits in terms of transparency, higher acceptance of planning decisions and knowledge transfer in regard to risk-related aspects.

The Italian approach towards disaster risk is characterised by a rather risk-responsive approach. The civil protection system is highly developed and there is a long tradition of volunteering. For instance, the Friuli Venezia Giulia model of volunteer activities follows a historical tradition of fire brigades (Bianchizza et al., 2011). This is why local activities are often directed towards disaster response. Interviews in the Italian case study further provided evidence that a) the population does not necessarily consider itself at risk, which is why restrictive local planning might not be easily accepted and b) outmigration is a big problem in the valley, which is why decision-makers might not be in favour of restrictive planning but rather support structural measures and emergency response activities. The impression is that the PAI is not entirely well accepted. However, due to the fact that people in the Friuli Venezia Giulia region well respect legal provisions, in contrast to regions in Southern Italy, for instance, regulations related to risk prevention are always duly implemented.

Improvement of the SEA process, especially in terms of public participation, could promote public awareness for risk issues and acceptance for risk-related planning decisions. Moreover, with regard to the problem of piecemeal planning, a more prominent role of the SEA and a more thorough implementation of the SEA process could help establish a more comprehensive planning approach that integrates different concerns and fosters cooperation between different relevant and affected actors. Such a comprehensive, cooperative planning process would promote a more integrated perception of different problems, of which disaster risk is only one. This is particularly important for spatial planners, who need and should apply a holistic knowledge of the territory in order to enable different solutions and options in response to prevailing risks or environmental problems in general. Such comprehensive spatial development remains difficult as long as the planners' understanding of disaster risk issues is limited. SEA could help to improve this understanding.

Finally, practices in the Polish case study site differ more significantly from those in the French and Italian case study sites. In contrast to France and Italy, in Poland there is no such universal risk prevention instrument but only separate hazard-related sources of information. This is why the local administration and decision-makers have more influence on planning decisions and are also more flexible. Here, the weighing up of different interests is even more crucial, as planning decisions are less determined a priori. Development is prohibited in flood plains and on active landslides. For areas for which the level of hazard is predicted to be lower, spatial planners are less restricted by provisions from sectoral planning authorities.

In the Polish case study site, prevention is important, which is why the disaster risk approach as such can be considered as rather risk-preventive. However, in order not to limit urban development too much, spatial planners need to adequately balance different interests by employing normative statements to evaluate them. Statements related to disaster risk made on a value level do not exist. This means that spatial planners have to attach values to different concerns themselves and have no information basis on a value level to base their decisions on. SEA can be a decisive decision-support tool in this case, as it may help to weigh up all relevant concerns and demands. It also supports the comparison of different alternatives and a final decision on appropriate measures to reduce, mitigate and compensate impacts of the plan on the environment and impacts of the environment on the plan. Another crucial feature of SEA for the Polish case study site can be seen in an improved cooperation between spatial and sectoral planning authorities. Due to the fact that Polish spatial planners expressed difficulties in interpreting and understanding provided risk information, the environmental assessment can provide an ideal platform for an exchange of knowledge and information and help improve mutual understanding. As van Stigt et al. (2015) concluded, the provision of a better decision-making framework – such as SEA – can enhance the weight attached to environmental values (see Chapter 5.2). This is why more attention should be given to improving frameworks such as SEA rather than supplying decision-makers with better knowledge about possible environmental impacts of the plan. This way they can more easily balance interests and arrive at a politically and publicly supported and also feasible decision. Finally, like in the two other case studies, a more effective public involvement can provide the already mentioned benefits.

Following these reflections and conclusions on the role of SEA for disaster risk related issues, while at the same time considering the fact that currently guidance on how to integrate disaster risk into SEA is limited, or missing even, a concept of how to integrate risk information into SEA will subsequently be developed and outlined. This concept suggests a way, how to deal with disaster risk as part of SEA and how to better integrate risk-related issues via SEA into the planning process.

Part IV: The concept

11. Concept for the integration of risk information into SEA

Lessons learned from case study research and conclusions taken from the results presented in the previous chapters indicate that an appropriate consideration of disaster risk in spatial planning requires a proper assessment of natural hazards and vulnerability. In order to be able to provide planning provisions for risk reduction, spatial planners and decision-makers are in need of an adequate evidence base. It can be argued whether such an evidence base can best be provided through a separate risk assessment process or whether it is more advisable to integrate risk assessment and management into an already existing assessment procedure such as SEA. Both options seem feasible[228]. This study argues that an integration of risk assessment and management steps into the SEA stages is more beneficial, due to the following reasons:

The SEA Directive requires the assessment of impacts not only on natural aspects (biodiversity, flora, fauna, soil etc.), and therefore ostensibly "environmental" aspects, but also on human health, material assets and cultural heritage. This implicates that also impacts caused by natural hazards should be part of the assessment, as they may not only have impacts on the natural environment, but also significantly affect human health and property. In fact, the reduction and minimisation of disaster risk should be an integrated part of urban planning and development and should therefore also be kept in mind during every planning step. As SEA accompanies the planning process and informs different steps of plan-making, it makes perfectly sense to fully integrate risk assessment and management steps into the SEA and thus simplify the consideration of risk-related environmental problems.

According to the "Guidance on integrating climate change and biodiversity into Strategic Environmental Assessment" by the European Commission (2013), climate change has to be built into the plan-making process from the very beginning, when many options are still open. It can be argued that not only climate change, but also aspects related to a changing climate such as climate change-induced natural hazards should be integrated into the planning process from the very start. Moreover, new steps or stages of neither the planning process nor the SEA process itself are necessary. In contrast, a separate assessment process would imply extra work and the preparation of an additional assessment process. Furthermore, the results of a separate process would only be considered once the risk assessment process was finalised. As a consequence, only the final results would be taken into account during the planning process, which would make more detailed and coordinated measures difficult. Individual and targeted responses to problems related to disaster risk can only be achieved through continuous coordination with both competent (risk-related) authorities and the public. Results of the whole planning process will be more promising in terms of attaining a resilient plan if there is a constant consultation with disaster risk experts and the public. When integrating the notion of disaster risk into planning documents, such an integration is supposed to be accomplished more easily through an overall integrated approach instead of just imposing sectoral approaches or separate assessment results.

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[228] In this context, one interviewed SEA expert pointed out that while both the planning process as such and the SEA process are formalised and standardised procedures, defined by law, risk assessment and management in turn are non-standardised procedures (Interview SEA-I, 2015). Consequently, risk assessment does not necessarily have to be carried out as a parallel process with plan-making and SEA. While both a plan and its environmental assessment have to be carried out simultaneously, there is no particular legal requirement to accomplish a risk assessment at one specific point in time or one specific point during the planning process or SEA procedure. It can be done at any time and it can therefore be a separate assessment process.

The importance of integrating climate change aspects and issues related to disaster prevention and extreme events into environmental assessments has recently been acknowledged by the European Commission. In 2014 the EIA Directive has been amended and now specifically names “climate” as a separate concern. Considering the fact, that the SEA Directive was originally introduced in order to consider environmental aspects in the planning process as early as possible, before a project is planned and before an EIA had to be accomplished, it is a logical – and necessary - consequence if similar or equal amendments were also decided for the SEA Directive (see Chapter 5.2.1). When looking at the guidelines prepared by the European Commission (2013) and the OECD (2006), an according development and amendment of the SEA Directive related to climate change and disaster aspects is very likely. Once respective changes were made for the SEA Directive, there would even be a legal basis for integrating both climate change and disaster risk issues into the SEA process.

When aiming at an improved integration of disaster risk aspects into spatial planning it should be kept in mind that spatial planning depends on negotiations and the weighing of interests in order to find a balance between development and protection. Therefore, when starting the planning process all constraints that the plan in question is exposed and subjected to need to be coherently assessed and articulated. Afterwards solutions can be suggested on how to reduce their impact (MEEDDAT et al., 2012). After all, the goal should be to identify the overall potential of the territory and not to prohibit development a priori by simply limiting all development in hazard-prone areas.

The weighing up process plays a particularly important role for the planning process. It is crucial to consider different expectations in a balanced way. The weighing up of different concerns and interests has to be accomplished before considering political ambitions and objectives. During the weighing up process, special attention has to be paid to the problem of taking decisions under uncertainty. According to several authors such as Greiving (2002), Hallegatte (2009), Larsen et al. (2013) and Walker et al. (2013), decisions taken under uncertainty have to be integrated into planning decisions and have to be specifically considered within the weighing up process. A weighing up process as well as the final decision always have to be properly documented, as decisions are being scrutinised. Weighing up has to be made in a scientifically and methodologically sound way and decisions always need to be justified. As a consequence, within the planning justification a statement is required that explains which scientific data and prognoses were used and why. SEA can constitute a useful basis for such a statement and support the weighing up and decision-making process by informing about all environmental problems in a detailed way within the environmental report.

Accordingly, the concept that is introduced below proposes an approach of how to integrate risk assessment and management issues into the SEA stages. It takes account of the fact that risk assessment and management underlie various different external drivers and that both are influenced by many factors. A distinction can be made between natural and anthropogenic factors. Figure 55 gives an idea of the diversity of external factors the single components of risk are subjected to. Those factors are not conclusive, however.

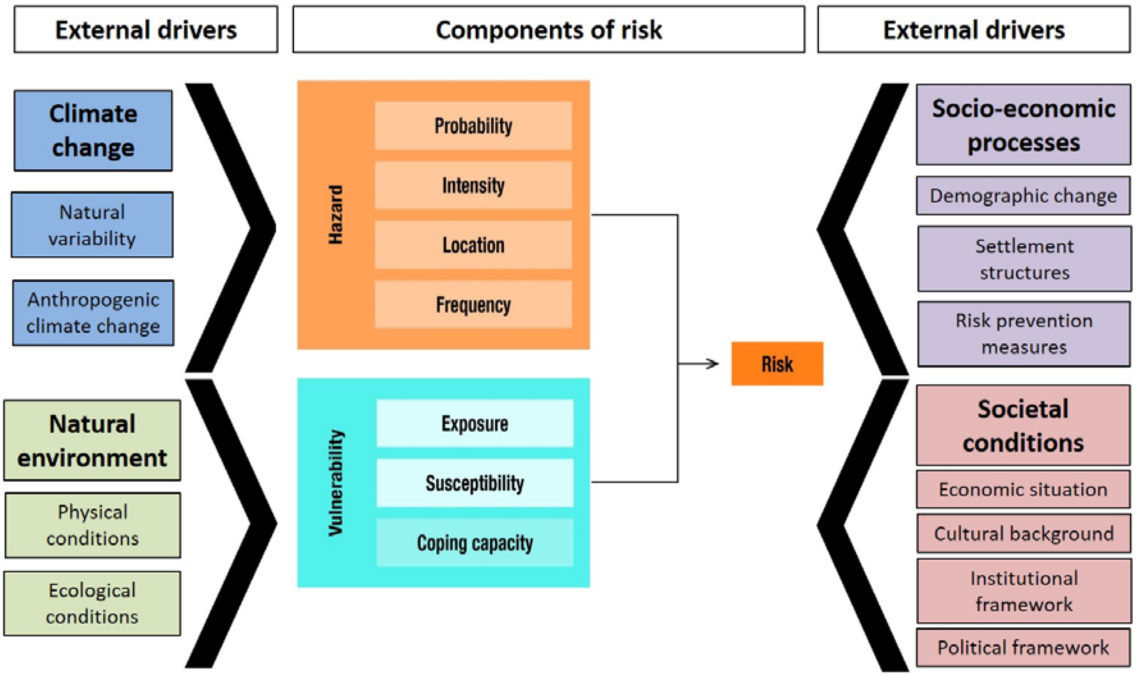

Figure 55 External factors influencing the different components of risk (Source: own illustration adapted from Fleischhauer, 2004; IPCC, 2014; MOVE, 2010)

11.1 Requirements for integrating risk assessment and management into SEA

In Chapter 5.2.1 a detailed description has been provided on how to consider disaster risk during SEA of spatial plans. Based on this description, impacts related to disaster risk could be assessed in three dimensions:

1. **Potential impacts of the plan or programme on the current and future state of the environment (including biodiversity, flora, fauna, human health, material assets, cultural heritage etc.):**
   Once a new plan or programme is implemented, it can adversely influence the vulnerability of the environment towards natural hazards, in particular the susceptibility of existing settlement structures, infrastructure or ecosystem services. If, for instance, the plan allows development in flood plains not only the new development will automatically be exposed to floods, but also existing developments behind the flood plain will be deprived their natural protection against floods. A second example: when on a landslide-endangered area a forest is changed into agricultural land, the soil will not be as stabilised as before. When analysing the impact of the PPP on the future state of the environment, the current environmental conditions need to be assessed against a changing environmental baseline (see Chapter 5.2.1). Moreover, in order to assess the future vulnerability, not only the plan or programme in question needs to be taken into account, but also other PPPs, which in turn might also influence socio-economic or climatic factors.
2. **Potential impacts of the current and projected level of risk on development objectives of the new plan or programme, influenced by a) climate change-induced natural hazards and b) changing socio-demographic conditions:**
   Current environmental conditions might already constitute a threat for planned land-uses and development objectives due to the possible occurrence of natural hazards. Those conditions might

even aggravate in the future because of a changing climate and a potentially higher vulnerability after changes in key economic and social trends. This is why the so-called zero alternative should be considered in order to assess the development of the environmental baseline without implementation of the plan. This way it is possible to assess, whether the PP would still be permissible in the future.

3. Potential impacts of disaster risks on present, already existing structures for the purpose of integrating adaptation measures through the new plan or programme:
   If the current but even more so the future level of risk cause a threat for existing developments and conditions (settlements, public buildings, ecosystem services etc.), the new plan or programme may react to the current state of affairs by implementing according measures to avoid or reduce significant impacts. This may support a reduction in vulnerability to disaster risks of the community and therefore perhaps facilitate the implementation of the PPP's own development objectives (by making the plan or programme more resilient to future disasters). This assessment dimension also complies with requirements to integrate solutions for reducing significant negative impacts and constraints early into the planning process (see above).

The proposed concept was discussed with two SEA experts/practitioners in order to figure out, whether the concept was applicable as suggested and whether an integration of the notion of disaster risk into single steps of the SEA process was feasible[229]. The feedback and the suggestions for improvement that were provided and the criticism that was offered during the interviews feed into the discussion of the concept that follows at the end of this chapter. In this closing part of the chapter, specific aspects of the concept are discussed that render it not entirely feasible from a practical point of view. Furthermore, more general aspects are mentioned that require consideration in future SEA practice. This discussion therefore constitutes some sort of reflection on current problems which influence the application of the concept as proposed below.

In general, the concept was prepared with the aim to improve and simplify the consideration of aspects of disaster risk within the planning process of spatial plans by integrating risk characteristics of the territory, or the area subjected to the PP in question, into the SEA stages. Hence it aligns the single steps of risk assessment and management with SEA stages. This way, choices in land use can be directed towards reducing the overall vulnerability of the area and towards the most resilient alternatives possible. Such an approach can also be seen as essential for promoting a sustainable urban development in the long term. However, the integration of risk-related aspects depends on the respective plan that is prepared. This is why it should be acknowledged that the concept primarily addresses planning procedures of regional plans as well as local plans encompassing the entire municipal area. Special attention was paid to the process of local spatial plan development[230]. The concept is not exactly suitable for very large scale maps[231]. This is

[229] As practitioners deal with SEAs on a daily basis it was considered both necessary and useful to ask them their opinion on the concept and to validate the preliminary version. Without considering the expertise and opinion of practitioners, the concept might not be applied in the end.

[230] The research work undertaken as part of this study addressed issues of spatial planning, local spatial planning in particular. This is why for the elaboration of the model attention was given to local spatial plans.

why the consideration of climate change or socio-economic developments is not considered necessary for large scale maps that address smaller parts of a municipality.

SEA and the plan-making process are still often perceived as two separate processes. It is important to underline that both processes are always interlinked and that steps of SEA and plan-making go in parallel (Interview SEA-I, 2015). Therefore, practitioners should always keep in mind, that SEA and the plan-making processes are accomplished simultaneously. SEA has to continuously inform a plan during its elaboration, which is an important prerequisite for the quality of the plan or program.

In contrast, the single SEA steps follow in a logical sequence, with the exception of consultations and the participation of different stakeholders as well as the integration into decision-making (see below). While the former *"must be considered as a parallel, continuous process"*, the latter *"is conceived primarily as an "approach", rather than a "step", or a task"* (European Commission DG for Energy and Transport, 2005, p. 11). The EU DG TREN (2005) adds that "integration into decision-making" should not be misinterpreted as an autonomous process that requires the complete integration of results of the assessment into the weighing up process for the plan. All other steps from screening and scoping to monitoring can only be carried out once the respective previous step is completed[232].

The proposed concept aims to be applied in different national planning contexts. The general SEA stages have been defined by the EU SEA Directive, which is why the main SEA steps should not substantially differ between different EU Member States. It needs to be pointed out, however, that approaches to SEA differ between the European Member States (see Chapter 5.1). Differences in SEA approaches are partly owed to differences in spatial planning instruments in each country and the respective process of plan-making (see Chapter 6.2). After all, implementation of SEA also depends on the according plan or program it is subjected to. Still the model is supposed to be generally applicable, since just basic explanations and suggestions will be given. These will not be related to any particular planning system, but follow the usual SEA stages. It should therefore be possible to apply it to (local) spatial plans in different settings and spatial planning contexts.

Until today only few approaches exist in the literature, which provide guidelines or experiences for integrating disaster risk prevention into the SEA process. General guidelines have been developed by Benson and Twigg (2007) for environmental assessments in general and by OECD-DAC (2010b) for SEA in particular. Specific examples for application in national planning systems include Profice (2011), who developed a method for integrating SEA and risk analysis for local spatial plans in Italy as well as MEEDDAT et al. (2012), that elaborated a methodology for a reasonable integration of natural risks into spatial planning documents in France. The latter study does not specifically refer to the problem of how to

[231] The reason is that when preparing large scale maps a risk can be more easily noticed. In absence of a potential risk, the steps explained below do not have to be carried out, as it is not necessary to further consider risks. In addition, it is even more difficult to obtain data on just certain parts of a municipality. Socio-economic information, for instance, mainly only exists for the whole municipality, if at all. Economic data is usually aggregated at the level of the whole municipality. Also, more detailed data is hardly accessible due to private property rights. In fact, a plan at a large scale has more influence on socio-economic conditions of the municipality, than the socio-economic conditions have on the plan (Interview SEA-I, 2015).

[232] Due to the given explanation in regard to consultation and participation of stakeholders, the elaboration below will not consider consultation and participation as a separate step, but will for each step explain how stakeholders can participate and be involved and consulted.

integrate risk analyses into SEA, but explains how to deal with natural risks as part of the PADD. The PADD in turn is an important part of the planning process, which serves to analyse environmental impacts of the planned choices. It identifies the compatibility of the orientations of the plan with environmental aspects, includes an environmental report and therefore constitutes at the same time an important step of SEA. The presented concept is based on the general procedures for risk analysis and SEA and furthermore gives indications on how to link both procedures with the usual planning process for urban planning instruments. Risk information needs are specified and adequate indicators provided for each step. Moreover, the listed questions should guide activities within each SEA step. It has to be pointed out, that these lists of information needs, questions and indicators are not conclusive. They constitute suggestions to begin with and can be complemented accordingly. Moreover, it always depends on the respective plan an environmental assessment is completed for: Not all indicators are applicable to each type of planning document.

The chosen indicators serve to operationalise the concept for the actual planning process of spatial plans. The formulation of indicators is considered useful for the purpose of integrating risk information into SEA, as often guidelines do not explicitly describe how to meet the objectives or how to measure goal attainment. This means that indicators help to determine whether the facts or elements required in theory exist in reality or to what extent they exist, respectively (Kromrey, 2006). Some indicators reflect the information needs and directly refer to the type of information that should be consulted during the SEA process.

According to Wanczura (2010), determining objectives is not the main challenge, nor is the determination of a desired state or desired procedure. Nevertheless it can be difficult to turn objectives, visions as well as required measures and their effectiveness into actually measureable elements. Therefore, the challenge rather consists in determining to what extent the status quo meets the target state or whether and where there are needs for changes and adjustments. In the present case indicators were chosen that help operationalise SEA guidelines in regard to the integration of risk issues. This means that on the one hand, indicators give an indication of which conditions and structures have to prevail in order to reach the objectives. On the other hand, they allow measuring goal achievement by providing means to assess the performance in terms of risk integration in general. After all, the main question is how to integrate risk assessment and management into SEA and how to consider risk information in the SEA process. Thus it is not sufficient to explain the basic requirements, steps and information needs, but to also provide clues which help meet these requirements. Finally, indicators serve to evaluate the proper performance while preferably realising needs for adjustment and improvement.

The following part will describe the single steps of the concept. Figure 56 illustrates the alignment of the steps of a SEA process as outlined in Chapter 5.1.1 and the basic steps that constitute the risk assessment and management process as outlined in Chapter 3 as well as the steps of a usual planning process.

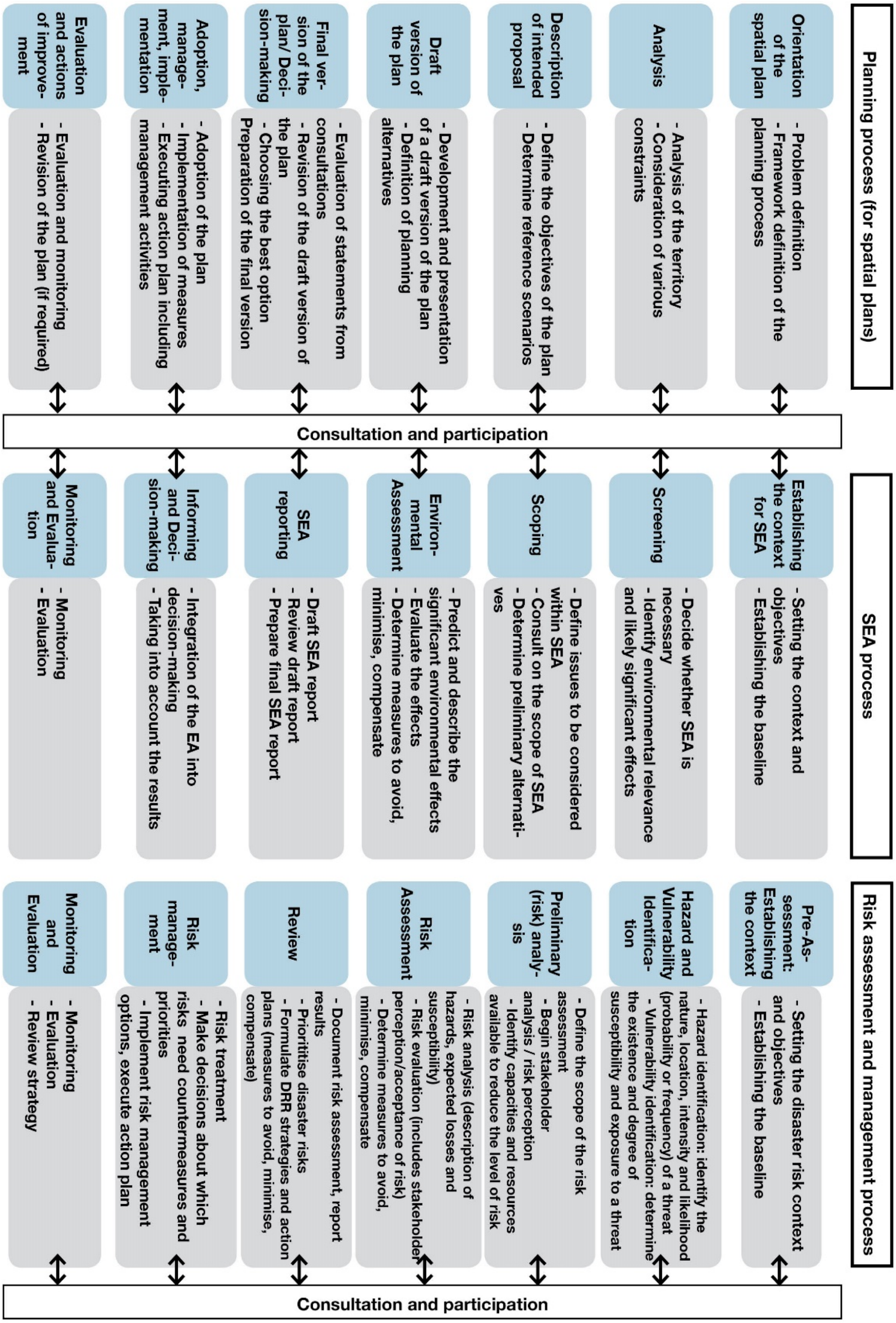

Figure 56 Steps of the planning process (left), SEA stages (middle) and steps within the risk assessment and management process (right) (Source: own elaboration adapted from European Commission DG for Energy and Transport, 2005; Greiving, 2004; UN-HABITAT, 2015)

11.2 Integration of risk-related aspects into SEA and spatial planning

As described in Chapter 5.1.1, the SEA process consists of four main stages:

1. Establishing the context for SEA
2. Implementing SEA
3. Informing and influencing decision-making
4. Monitoring and Evaluation

Each of these stages can again be divided into sub-steps, requiring certain activities. The different steps will now be explained in more detail by naming:

a) Objectives and characteristics of each step;
b) Information needs and basic questions to be addressed and
c) Indicators.

The provided questions and indicators should be considered as examples. It is certainly not possible to equally consider all indicators. They should constitute a support for implementing SEA, but not a requirement since considering all indicators is not always possible.

1. Establishing the context for SEA

Establishing the context for SEA includes the establishment and description of a baseline for the assessment as well as the screening step, which determines whether SEA is necessary or not. In the following, issues related to disaster risk consideration within this SEA stage will be outlined.

a. Setting the context, establishing the baseline

In regard to risk integration, one of the main elements of this step is to *"identify, collect and assess available information on the natural and human hazards that affect the region concerned by the policy, plan or program as well as information on the vulnerability of regions, populations and sectors to those hazards"* (OECD, 2010b, p. 10). Such information is crucial for evaluating the exposure of the area to natural hazards and for identifying what might be significant hazards and hazard impacts to inform the screening and scoping steps of the SEA process for a PPP. Collected information can also help define SEA objectives (see scoping phase).

The question is what type of risk information can be useful and should be collected, other than the information provided in the PPP description. An answer is partly given by the EU SEA Directive, which lists in Annex II relevant criteria for determining the likely significant effects of the plan or program. Some of these criteria have a direct connotation to natural hazards and therefore indicate a material interrelationship between risk assessment and SEA (Greiving, 2004). This is the case for the following aspects (CEC, 2001b):

- Probability, duration, frequency and reversibility of the effects;
- Cumulative nature of the effects;
- Magnitude and spatial extent of the effects (geographical area and size of the population likely to be affected);
- Value and vulnerability of the area.

More precisely, in terms of natural hazards this means the consideration and assessment of the probability, duration, frequency and reversibility of a hazard, its magnitude and spatial extent as well as potential cumulative effects (e.g. the triggering of other negative effects or even hazards). These aspects first have to be operationalised and then different impacts and strengths of impacts can be assessed. In terms of vulnerability it is important to consider the susceptibility of elements at risk and their exposure to natural hazards. Annex II of the Directive also points at the requirement to consider risks to human health or the environment. Accordingly, both hazard and vulnerability have to be considered and assessed in order to be able to determine potential risks to human health and the overall damage potential. Consequently, collected information should outline and inform about each of these aspects. Otherwise a complete assessment of significant environmental impacts on the environment related to disaster risk cannot be accomplished.

<u>Information needs</u>

In addition to the already mentioned information requirements it is important to consider that certain characteristics of the hazards are affected by climate change. As the current environmental baseline changes it is important to take account of the future baseline (see above). After all, later within the environmental assessment and reporting stages both the current and likely future environmental baseline need to be taken into account Accordingly, also climate change scenarios are needed. Specific information in regard to floods and landslides that should be collected includes the mapping of different return periods for floods displaying both extent and depth of water as well as the mapping of susceptibility of slope failure, slope stability and drainage in landslide prone areas. Furthermore, it is advisable to include information on soils, geology, historic data of hazards or damages occurred (Benson and Twigg, 2007). Such information will help determine the relevance of risk reduction or prevention for the PPP in consideration. In order to be able to later assess the vulnerability of the area towards natural hazards, also information about present development, infrastructure and building stock as well as the social setting should be collected. However, again not only the current baseline conditions need to be considered, but also the possible, projected future development. Hence, in addition to climate change scenarios a projection of the demographic development of the area is required.

In addition, collecting information includes the identification of *"measures and policies or policy reforms that currently address disaster risks in relevant sectors and government agencies"* (OECD, 2010b, p. 10). The purpose is to identify and determine whether other plans and programs have an impact on the plan and program to be developed, either because they increase or decrease existing risks or because when considered and integrated in the spatial planning process they can reduce disaster risk. Examples include risk prevention plans and flood risk policies but also climate change adaptation plans, coastal protection programs etc.

More specifically, collected information should be able to address and answer the following questions:

- Which hazards occur in the area addressed by the plan or programme?
- What are the areas or zones most likely to be adversely affected by natural hazards?
- What are the key climate change trends over time (e.g. for the next 30 years)?
- What can be extreme climate situations which could trigger extreme weather events (such as flash floods)?

- What is the current land use pattern?[233]
- What are the key demographic trends and what is the likely demographic development?
- What are other relevant policies, plans and programs that have impacts on the vulnerability of an area or contain risk mitigation or reduction measures that could affect the development objectives of the plan and should be considered?

Indicators

- Presence of future climate change scenarios and/or projections
- Presence of socio-economic scenarios and/or projections (e.g. demographic and economic development prognoses)
- Presence of trend data related to:
  - Probability and frequency of natural hazards
  - Magnitude or intensity of natural hazards
  - Spatial extent of natural hazards

These indicators refer to the hazard component of risk. As mentioned above, information about exposure and susceptibility parameters has to be equally considered. However, information about exposure aspects such as current land use pattern as well as about existing buildings, structures and uses (housing, industry etc.) is usually available. This is why information about the current exposure to natural hazards does not necessarily need to be collected. Information about susceptibility is also already partly available. For instance, information about the type of building (e.g. school, hospital, residential building) permits drawing conclusions about the susceptibility of human settlements and relative weaknesses of social issues. The existence of fragile ecosystems hints at weaknesses related to ecological issues.

Indicators for exposure and physical susceptibility can include the susceptible population (elderly and handicapped people), assets, production, livelihoods, historic monuments, ecosystem services and human activities (Masure, 2003; Lavell, 2003 cited in Cardona, 2008, p. 12).

Table 12 highlights the main steps for setting the context and establishing the baseline.

Table 12 Integration of risk issues into SEA during the phase for establishing the baseline (Source: own elaboration adapted from European Commission, 2013; OECD, 2010b)

SEA process	Integration of risk issues into the SEA process
Setting the context, establishing the baseline • *Collecting baseline information*	Identify and collect available information on natural hazards.
	Define and understand the objectives of the PPP in terms of risk reduction or risk prevention.
	Consider information on hazard, exposure and susceptibility parameters.
	Collect information on climate change scenarios and socio-economic scenarios.

[233] Information about the land use pattern serves to determine the vulnerability to given types of natural hazards.

b. Screening

The purpose of "screening" in SEA consists in determining whether SEA is necessary or required (see Chapter 5.1.1). During the screening step the question is addressed whether the plan or program is likely to have significant environmental effects. Criteria for determining the likely significance of environmental effects are listed in Annex II of the SEA Directive.

As already mentioned, disaster risk needs to be considered as disasters may significantly affect the environment, which according to the SEA Directive does not only include ecological or natural factors such as flora, fauna and climate, but also the population and human health as well as material assets and cultural heritage. All these aspects constitute potential elements at risk if exposed to a natural hazard. Accordingly, the plan or program might increase the risk level of the area concerned by increasing the vulnerability: either by exposing new developments (buildings, infrastructure etc.) to a hazard, for instance by building in a landslide-prone area or in a flood plain, or by increasing the vulnerability of existing developments after the effectuation of the plan. Information collected in the previous step shall be used in the screening phase for determining environmental effects as well as the level of further hazard and vulnerability assessments required.

In regard to the integration of risk issues into the screening phase it is therefore important to determine and consider the potential impact of the plan or program on the environment and thus identify significant effects of the plan on the vulnerability of communities, i.e. existing settlements, to natural hazards. This includes also positive impacts. Furthermore, it is just as important to determine whether natural hazards are likely to have significant effects on the proposed PP (see above). A draft version and the initial description of the PP should be used for determining whether an SEA is necessary.

As explained in Chapter 5.1, SEA is a participatory process during which the general public, including the private sector and all relevant stakeholders that will generally be affected by or are interested in the PP, may comment on the draft plan and contribute to better decision-making. The screening phase should therefore include a thorough stakeholder analysis in order to identify and determine those stakeholders that are relevant for the environmental assessment (OECD, 2006, p. 55). Identified relevant stakeholders should then be involved during all further stages of the SEA process. As the provision of information to stakeholders usually poses no problem, particular attention will be paid to enabling the consultation and participation of different stakeholders.

During the initial phase and the screening step, the plan-making authority should identify and consult with stakeholders knowledgeable in disaster risk in order to recognise key issues early in the SEA process and to improve compliance with natural risk aspects. Decision-makers need to be consulted as well. As aspects of disaster risk affect a wide range of sectors, risk reduction has to be cross-sectoral and therefore engage a wide variety of stakeholders (OECD, 2010b, p. 10). The consultation of stakeholders might also reveal new information. In particular, consultations with vulnerable stakeholder groups and decision-makers should be organised throughout the entire environmental assessment (OECD, 2010b, p. 10) in order to identify crucial hot spots and individual interests and concerns (see below "risk evaluation").

While consultation is supposed to be provided to stakeholders throughout the process of SEA, mainly with the aim of collecting additional information and identifying essential problems, stakeholder participation is supposed to promote the decision-making process. This means that public participation is mainly required during the actual environmental assessment (see below). When establishing the context for SEA, i.e. during the screening step, there is no particular need for public participation. Instead, during the screening step coordination happens rather on a bilateral or trilateral basis between relevant public authorities.

When looking at river floods, flash floods and landslides in particular, the European Commission (2013, p. 34) suggests to address the following key questions during screening:

- What type of infrastructure (e.g. road segments, rail networks, water supply, energy) is at risk of flooding due to its location in extreme flood zones?
- Will the proposed plan or programme provoke the reduction or an improvement of the capacity of ecosystems and existing flood plains for natural flood management?
- Will the proposed plan or programme increase the exposure of vulnerable parts of the population (e.g. elderly people, unwell or young people) or of sensitive receptors (e.g. critical infrastructure) to floods?
- What parts of private and public property, persons or environmental assets are at risk because of a possible occurrence of landslides?

Further questions that should be asked as part of the screening step include:

- Will the proposed PP ensure that new developments and infrastructure are not at risk of flooding or landslides?
- Will the proposed PP ensure that – when building in hazard exposed areas – sufficient protection in the form of mitigation measures will be provided?
- Will the proposed PP ensure that existing developments and infrastructure systems are sufficiently protected against floods or landslides (or at least not increase their exposure to floods or landslides)?

In relation to stakeholder identification and involvement the responsible authority should aim at answering the following questions:

- Who are the key stakeholders and authorities that might help identify key disaster risk issues and provide new information?
- Which (sectoral) authorities need to be consulted because they are likely to be concerned by the effects of implementing the plan or programme within their field of (risk) competence?
- Which other parts of the public (population, environmental organisations, NGOs, public and private organisations etc.) might be affected by and interested in the implementation of the plan or programme in terms of vulnerability increase?

<u>Information needs</u>

Information needed at the screening step is supposed to be collected during the initial stage of SEA (see above "identify and collect available information")[234]. In addition to the already collected information related

[234] When looking at the questions, information is needed in particular regarding exposure and vulnerability to natural hazards (i.e. planned and existing developments, infrastructure, types of land uses etc.) as well as possible extents of natural hazards (in the case of floods and landslides), i.e. information which is supposed to be available by the time the screening starts.

to the status quo of the environment and the likely change of environmental baseline, at the screening stage of SEA a preliminary outline of the plan or program has to be available in order to identify potential significant effects on the PP.

Information required during stakeholder consultation before or during the screening stage depends more or less on national contexts and the specific plan or programme in question. In general, it can be argued that actors that are responsible for the environmental assessment need to be aware of which bodies to consult. The latter can differ from country to country. Usually bodies to consult include environmental and natural protection agencies, authorities responsible for hazard and/or flood and landslide risk assessment (such as river basin authorities or geological surveys) as well as climate change management, meteorological services etc. However, in case of doubt who to consult a common advice can be to seek help at the national HFA focal point, which is supposed to provide an entry point for identifying respective national mechanisms[235] (OECD, 2010b, p. 10).

Indicators

In regard to the probability, duration and frequency of the effects:

- Existence of modelling outcomes for different return periods of flood events (e.g. 1/50 years, 1/100 years, 1/300 years)
- Identified area affected by a landslide in the past
- State of activity of landslides (active, non-active)

In regard to the risks to human health or the environment:

- Number of planned buildings exposed to natural hazards
- Total area of protected zones or vulnerable ecosystems exposed to natural hazards (including ecosystems for natural hazard management, e.g. flood plains, protective forests)

In regard to the magnitude and spatial extent of the effects (geographical area and size of the population likely to be affected):

- Total area exposed to one or more natural hazards (in km² or ha)
- Total area of urbanised or inhabited zones (i.e. areas in which humans live that are in a potential danger of a disaster) (in km² or ha)
- Percentage of people living in danger zones
- Total lengths (if related to a network) or total number (if related to a specific point or a location) of sensitive receptors (e.g. critical infrastructure such as energy plants) exposed (transport infrastructure, energy supply, communication networks, drainage networks etc.)

In regard to stakeholder involvement:

- Provision of stakeholder participation during the initial phase of SEA (related to relevant authorities and institutions);

[235] Until today, national HFA focal points have been designated for most of the European countries, including the countries that form part of this study.

- Existence of a communication plan: This communication plan should include actors involved in disaster risk issues and address topics related to disaster risk and is to be used throughout the whole SEA process.

Table 13 summarises those aspects that should be considered during the screening phase.

Table 13 Integration of risk issues into SEA during the screening phase (Source: own elaboration adapted from Environmental Protection Agency, 2015; European Commission, 2013; OECD, 2006, 2010b)

SEA process	Integration of risk issues into the SEA process
Screening • *Identifying key stakeholders* • *Determining whether likelihood for potential significant environmental effects may necessitate entire Strategic Environmental Assessment*	Identify stakeholders (interested in and/or affected by the PPP) and organise their involvement.
	In collaboration with stakeholders (private authorities in particular) identify the key risks and key effects on vulnerability by the PPP and its alternatives.
	Identify plans and programmes, which have an impact on the PPP in terms of natural hazards: flood hazard and risk maps, flood risk management plans, water quality or coastal protection programmes, etc.
	Consider whether the PPP is likely to have significant effects on vulnerability, factoring in uncertainties.
	Consider the impacts of disaster risk on the PPP, factoring in uncertainties.
	Consider the impacts of climate change and socio-economic change on the PPP as well as mitigation measures that it may need to include based on current levels of vulnerability and coping capacity.
	Identify whether the plan or programme impacts on other PPs in terms of increasing vulnerability.

2. Implementing SEA

After establishing the context and after verifying whether an environmental assessment has to be carried out, SEA can be fully implemented. Implementation of SEA consists in scoping, in the actual environmental assessment and in environmental reporting, i.e. in preparing an environmental report.

a. Scoping

Scoping should anticipate and define the likely significant environmental effects and factors to be considered and studied in more detail (European Commission DG for Energy and Transport, 2005, p. 33; Fischer and Phylip-Jones, 2008, p. 138) (see Chapter 5.1.1). It also includes the elaboration of SEA objectives. A definition of SEA objectives is required in order to determine the role of the environmental assessment within the planning process and to *"provide a means by which the environmental performance of the plan or programme and alternatives can be assessed"* (Office of the Deputy Prime Minister, 2005, p. 24). Risk information is insofar important for the definition of SEA objectives, as certain objectives might be directed towards achieving the reduction or minimisation of disaster risk and help determine the most resilient alternatives in the end. In this context, however, it is just as important to look at and understand the objectives of the PPP itself, as SEA objectives need to be in line with the PPP objectives. A link between PPP objectives and SEA objectives should be established by determining the role risk reduction will play in the overall planning process and by estimating the degree to which this topic requires consideration.

During the scoping phase it has to be ensured, that risk-related issues are considered when agreeing on those aspects that need further investigation during the environmental assessment (Benson and Twigg, 2007, p. 84). This means that the scope of SEA and the objectives to be addressed by SEA should take account of environmental problems related to disaster risk. If a preliminary hazard and vulnerability assessment during the screening phase revealed that there are either likely significant risks which impact on the PPP or the PPP is likely to have significant impacts on the vulnerability, these aspects need to be further assessed, discussed and consulted upon at subsequent SEA stages. In particular, responsible authorities need to determine the required baseline information, resources and expertise in the form of expert knowledge in order to carry out the assessment in a meaningful way. Furthermore, the problem of uncertainty needs to be taken into account during the scoping phase. In this context, the SEA team should determine the expertise that is needed to enable factoring uncertainty into scoping (European Commission, 2013, p. 20).

Stakeholder participation is very important during scoping. Relevant stakeholders should be thoroughly analysed and selected during the scoping stage. Especially when dealing with less known aspects such as disaster risk, input from knowledgeable stakeholders is crucial.

<u>Questions to be asked during the scoping step</u>:

- Which entities and experts need to be consulted (sectoral authorities responsible for energy, environment, transport, water, health, economy etc.) in order to give expert advice on the preliminary version of the plan?
- Which stakeholders need to be actively engaged? What are possible methods and mechanisms for enabling participation?
- Which baseline information on disaster risks will be used and needed for the assessment?
- Which human and financial resources are available for disaster risk reduction?

<u>Information needs</u>:

Information needs include baseline hazard data for the area concerned by the plan or programme, information on significant natural hazards and their potential impacts on the plan or programme, relevant legislative regulations and provisions, relevant institutions as well as climate change assessments (Benson and Twigg, 2007, p. 84).

Furthermore, information is needed on areas exposed to natural hazards, allowing the drawing of conclusions on potentially affected parts of the population, as well as on the demographic structure of the area covered by the plan (e.g. social data) in order to identify which parts of the population are amongst the most vulnerable. Finally, since also the economy might be affected, it is important to have information at hand about the businesses/industries located in the area concerned.

<u>Indicators</u>:

- Existence of political and institutional arrangements for integrating disaster risk assessment into the PPP (which provide for an adequate consideration of disaster risk issues in the scoping phase)
- Existence of alternatives of the PPP focusing on the problem of disaster risk reduction

- Existence of information and communication networks and plans that help determine:
    - Potentially affected parts of the population (including both inhabitants and economy)
    - Most vulnerable parts of the population (including both inhabitants and economy)

Table 14 lists aspects which should be considered for an integration of risk issues into the scoping phase.

Table 14 Integration of risk issues into SEA during the scoping phase (Source: own elaboration adapted from Environmental Protection Agency, 2015; OECD, 2010b; Wilson and Piper, 2010)

SEA process	Integration of risk issues into the SEA process
Scoping • *Defining stakeholder involvement and participatory approaches to consult on the scope of SEA* • *Determining preliminary alternatives* • *Identifying available resources* • *Developing SEA objectives*	**Establish environmental baseline**: Describe the current climate and socio-economic conditions as well as the likely future climatic and socio-economic changes based on relevant scenarios, observations and/or projections.
	Describe the likely evolution of the environment without implementation of the plan or programme (see EU SEA Directive). With regard to an evolving environmental baseline it is important to consider in particular cumulative climate change effects (potentially influencing hazard factors such as frequency and magnitude of events) and demographic change(s) in settlement structures (potentially influencing exposure and vulnerability). This includes effects of other PPPs that can affect exposure and vulnerabilities.
	Identify, with the help of GIS and in collaboration with key stakeholders, existing risks and vulnerability consequences of the plan or programme being prepared. Areas may be ascertained that are particularly vulnerable, in which case the implementation of a particular plan can appoint specific protection and adaptation measures.
	Ensure the consideration of uncertainties by identifying those aspects of the plan or programme that are susceptible to natural hazards.
	Early consultation: Ensure consultation of all relevant stakeholders on disaster risk issues in order to incorporate essential disaster risk facts into the environmental assessment process from the very beginning. Define participatory approaches and plan the involvement of stakeholders. Ensure that all concerns and needs are taken into account and pay particular attention to the inclusion of the most vulnerable.
	Ensure that the relevant stakeholders have all the information on risks and risk reduction options they require in order to participate considerably and contribute to the decision-making process.
	Define reasonable and practical alternatives of the plan or programme that are to be addressed in the assessment, focusing on the problem of disaster risk reduction.
	Determine whether sufficient financial and human resources are available to promote a better consideration and handling of risk reduction measures.
	SEA objectives: Develop risk reduction objectives that take account of uncertainties (climate change, socio-economic change etc.) and consult on and define the scope of the assessment to ensure that aspects of disaster risk are properly considered.

b. Environmental Assessment

During the environmental assessment the likely significant impacts of a PPP, as well impacts of reasonable alternatives, on all relevant environmental issues are identified. This step involves identifying actions and measures which could have an impact on the frequency, intensity and consequences of natural hazards as well as significant impacts of these hazards on the PPP (Benson and Twigg, 2007, p. 85) and suggested alternatives. Alternatives are expected to be defined prior to the actual assessment. They are supposed to focus, among others, on problems related to disaster risk and in particular on key hazard and vulnerability related problems (see scoping phase). In this context it is advisable to develop resilient alternatives representing 'win-win' or 'no-regret' approaches (European Commission, 2013, p. 10) and to then identify and select the most resilient alternatives – if possible. The European Commission (2013, p. 42) points out that considering alternatives should help minimise the risks resulting from previous land use and development patterns by taking into account the context of different climate change and socio-economic scenarios. At the end, a preferred alternative of the PPP should be identified and considered for the further SEA process[236].

Comparing different alternatives presupposes the development and definition of reasonable and practical alternatives of the PPP, dealing with problems related to hazards and/or vulnerability. Current practices in the case study sites revealed a lack in suggesting different alternatives in the first place. This is why it is important to make SEA practitioners aware of the importance of suggesting and comparing alternatives instead of perceiving it as a hindrance.

An environmental assessment also requires the testing of objectives of the PPP against the SEA objectives (Environmental Protection Agency, 2015, p. 15), including risk reduction objectives, to identify synergies or inconsistencies. Conclusions may help to further define development objectives of the PPP or elaborating PPP alternatives if risk reduction objectives are not met. Therefore, this step necessitates assessing the impacts of the PPP and PPP alternatives on risk-related objectives and indicators.

Benson and Twigg (2007, p. 85) suggest that *"the assessment should begin with a detailed hazard assessment and mapping of significant hazards identified in the screening and scoping stages (…), also taking into account relevant climate change modeling (e.g., how a rise in sea level might affect storm surges or how changes in precipitation might affect drought and flooding)"*. As mentioned above, in the context of disaster risk reduction not only climate change modeling plays a significant role, but also the consideration of socio-economic scenarios. Hence, preliminary hazard and vulnerability assessments should be completed by considering relevant climate change and socio-economic modelling. Attention should be paid to ensuring an evaluation of impacts of the PPP and plan alternatives on disaster risk reduction objectives and on vulnerability on the one hand as well as potential impacts of hazard events on the PPP on the other hand.

Risk evaluation includes the element of risk perception. This is why stakeholder acceptance of risk needs to be assessed. This can be done, for instance, through consultation of different stakeholders. Based on the analysis of risks and the assessment of stakeholder acceptance of risk it can be determined whether

[236] The identification of a preferred alternative constitutes a link to the parallel plan-making process. Having defined the preferred alternative possibly means making necessary changes to the draft plan and revising the primary version of the PPP that existed before initiating the environmental assessment.

each of the identified significant effects is acceptable or not. If any of the evaluated effects is not acceptable, adequate management options and measures to avoid and minimise the potential effects must be identified and implemented, which may level them up to an acceptable range (Benson and Twigg, 2007, p. 85). This risk evaluation should be accomplished by considering trends and the likely evolution of the environment (climate change and socio-economic processes) with and without implementation of the PPP or suggested alternatives. The PPP can then be evaluated against the current state of the environment and against a potential future state of the environment if the plan was implemented and if it was not implemented.

Finally, datasets can be proposed that measure the performance of the PPP in terms of risk reduction. Arrangements can be determined how to monitor effectiveness of risk-related appointments of the plan (Benson and Twigg, 2007, p. 83) by evaluating, for instance, its contribution to avoiding an increase in risk or options to cope with existing, residual risk in a good way.

Questions to be addressed during the environmental assessment include:

- What are possible resilient alternatives (which promote 'win-win' or 'no-regret' approaches)?
- What are the potential damages or adverse effects of the PPP and suggested alternatives?
- What is the probability and frequency of occurrence of impacts caused by disasters? What is the possible magnitude and spatial extent of impacts caused by disasters?
- What are possible cumulative effects of disasters?
- In regard to concern assessment of stakeholders, i.e. the analysis of risk perception of stakeholders:
    - What are the public's concerns and perceptions towards disaster risk?
    - What is currently the social response to risk? What is the predominant political attitude towards facing and dealing with disaster risk?

<u>Information needs</u>:

Again information needs include baseline hazard data for the area concerned by the plan or programme, i.e. information on significant natural hazards in the form of hazard studies and/or hazard maps based on past experiences and projections. Further information is needed on potential damages and adverse effects caused as well as on climate change scenarios and socio-economic scenarios that should help reveal factors influencing hazard occurrence and vulnerability. In addition, information has to be collected from the public for aspects related to risk perception in order to carry out a proper risk evaluation.

<u>Indicators</u>:

- Existence of developed alternatives
- Existence of developed resilient alternatives
- In regard to the probability, duration, frequency and reversibility of the effects:
    - Number of flood events that have occurred in the past, divided into different return periods (e.g. separated into 1/10-year, 1/100-year and 1/500-year flood events)[237]

[237] These return periods represent the Polish case study site example. In Poland, a more frequent flood event is represented by the 1/10-year return period, while extreme flood events with low probability are represented by the 1/500-year return period. These regulations differ from Member State to Member State and even within Member States. Only floods with a medium probability of occurrence (likely return period ≥ 100 years) are predetermined by the EU FRD.

  - Number of landslide events that have occurred in the past
- In regard to the cumulative nature of the effects:
  - Existence of a possibility of interactions between hazard factors (that might trigger cumulative effects)
- In regard to the risks to human health or the environment:
  - Percentage of properties/homes at risk of flooding or landslides in the area concerned
  - Percentage of people living in areas exposed to flooding[238]
  - Total area of protected zones or vulnerable ecosystems exposed to natural hazards (including ecosystems for natural hazard management, e.g. flood plains, protective forests etc.)
- In regard to the magnitude and spatial extent of the effects (geographical area and size of the population likely to be affected)
  - Number of houses damaged or destroyed during a past event
  - Total area exposed to one or more hazards (in km^2 or ha)
  - Percentage of infrastructure at risk from flooding in the area concerned[239] (transport infrastructure, energy supply, communication networks, drainage networks etc.)
- In regard to concern assessment during consultations:
  - Provision of consultation sessions with authorities competent in disaster risk reduction matters
  - Provision of consultation sessions with the public affected by and interested in disaster risk

Table 15 summarises those aspects which are important to be accounted for during the environmental assessment as such.

[238] When studying flood hazard maps, exposures of buildings and people that live in flood-exposed areas can be determined based on a specific return period of a flood. This is difficult for landslide hazards, however, as the exposure to landslides as well as the level of risk differ among landslide-endangered areas. This is why this exposure-related indicator only refers to flood hazards.

[239] See previous footnote for the consideration of landslide hazards.

Table 15 Integration of risk issues into SEA during the environmental assessment phase (Source: own elaboration adapted from Benson and Twigg, 2007; Environmental Protection Agency, 2015; European Commission, 2013; OECD, 2010b)

SEA process	Integration of risk issues into the SEA process
Environmental Assessment • *Testing the PPP objectives against the SEA objectives* • *Develop strategic alternatives* • *Identifying/predicting and describing significant environmental effects of the PPP and alternatives* • *Evaluating the environmental effects, including alternatives* • *Identifying measures to enhance opportunities and avoid or mitigate adverse impacts* • *Proposing measures to monitor the environmental effects of plan or programme implementation*	Test objectives of the PPP against the risk reduction objectives: Assess the effects of the PPP and PPP alternatives on risk-related objectives and indicators.
	Alternatives: Develop, define and suggest reasonable and practical alternatives of the PPP, dealing with problems related to hazards and/or vulnerability by implementing measures promoting disaster risk reduction.
	Develop resilient PPP alternatives that constitute 'win-win' or 'no-regret' approaches; By defining alternatives look for ways to not only mitigate the risks resulting from the PPP, but also to minimise the impacts resulting from previous developments and land use patterns as well as to mitigate or prevent impacts on current, already existing structures.
	Risk analysis: Predict and describe potential significant impacts of the PPP and of suggested alternatives on frequency, intensity and consequences of natural hazards as well as the impacts of natural hazards on the PPP and alternatives under current environmental conditions.
	Estimate frequency and magnitude of risk scenarios; Consider the context of socio-economic scenarios; Predict and describe the potential consequences of the PPP and suggested alternatives on the frequency, intensity and impacts of natural hazards as well as significant impacts of natural hazards on the PPP and alternatives under projected future environmental conditions; Involve stakeholders in order to adequately consider expected losses and susceptibility.
	Risk evaluation: Extend the preliminary hazard and vulnerability assessment by evaluating the effects of the PPP and plan alternatives on disaster risk reduction objectives and on vulnerability as well as the potential impact of hazard events on the PPP→include both costs and benefits of effects.
	Assess stakeholder acceptance of risk by consulting different stakeholders. Evaluating the effects will help to determine if any of these are not acceptable.
	Put the PPP into perspective by considering trends and the likely evolution of the environment with and without implementation of the plan or programme or its suggested alternatives.
	Risk management: Identify appropriate management options and measures to avoid and mitigate impacts that increase the level of risk (especially if evaluated effects are not acceptable) and solutions for dealing with residual risk, which cannot be prevented.
	Propose datasets and indicators that monitor the impact of the PPP on vulnerability and the impact of natural hazards on the PPP, that evaluate the performance of the PPP in terms of risk reduction and that measure the effectiveness of measures to avoid and mitigate adverse impacts.

c. SEA reporting

The mandatory environmental report (see Chapter 5.1.1) can be a means to confirm that all possible significant risks have been identified, analysed and evaluated by properly presenting the results of the assessment. It should be ensured by the SEA preparing body that a quality check on risk issues is carried out by adequate authorities that are particularly knowledgeable in aspects related to natural hazards. These authorities also need to review the suggested measures to avoid, minimise and compensate significant effects and give feedback on whether the suggested measures are suited for mitigating or reducing disaster risk and whether it is feasible to implement them.

As outlined in Article 2 (1) of the SEA Directive and described in detail in Chapter 5.1.1, consultation is a crucial element of the assessment and report preparation. Consultations of the public aim at consulting on elements that are likely to have significant environmental effects, including those caused by or related to disaster risk. Results of consultations have to be considered in decision-making. This holds true for results obtained from both, consultations of authorities and the public (CEC, 2001b). In fact, the reporting phase is a key stage for public participation. Accordingly, the draft version of the report should be publicly available for a certain period of time. Again it should be taken account of the most vulnerable groups and the responsible authority has to ensure that vulnerable people may adequately participate (OECD, 2006).

As the results of the assessment need to be understandable to all stakeholder groups, a non-technical summary and illustrations or graphic presentations should be prepared and provided (European Commission DG for Energy and Transport, 2005; OECD, 2006). This means that risk analysis and risk evaluation have to be presented in a comprehensible way. Illustrations need to be understandable for lay persons, as the general public usually has no deeper or detailed knowledge about risk aspects.

In the end, the provided feedback obtained from consultations should help re-elaborate the draft report and make according changes for the final report. The final report as well as the prepared PPP should incorporate the management measures that are needed to address identified vulnerabilities and risks (Benson and Twigg, 2007).

Questions to be asked during the SEA reporting phase include (IRGC, 2008):

- What is known about the hazard and the vulnerability and how can it be conveyed to interested stakeholders, decision-makers and the public, so that they can understand the content and give their opinion and thoughts?
- Are the comments and remarks on risk issues gained during consultations being fully considered and referred to in the final version of the report? Are the recommendations of competent authorities adequately considered?
- What risk management options should be chosen for implementation (structural, non-structural)? Are these risk management options sufficiently explained?
- Is the integration of risk issues – as outlined in the SEA report – being comprehensibly translated into the PPP?

<u>Information needs</u>:

Information needed for the preparation of the environmental report consists in the feedback and opinions, concerns, recommendations and advices expressed by environmental authorities, interested stakeholders and the public during the consultations and the review process. The information collected during the consultation then needs to be taken into account when preparing the final version of the report.

Indicators:

- Existence of references to risk-related aspects in the environmental report
- Existence of management options related to disaster risks in the environmental report
- Provision of a consultation of authorities during the reporting stage
- Existence of monitoring arrangements related to risk mitigation/minimisation measures suggested in the environmental report, e.g. through proposed disaster risk indicators

Table 16 refers to the required steps and tasks to consider and include in an environmental report.

Table 16 Integration of risk issues into SEA during the environmental reporting phase (Source: own elaboration adapted from Benson and Twigg, 2007; Environmental Protection Agency, 2015; The Scottish Government, 2010; Wilson and Piper, 2010)

SEA process	Integration of risk issues into the SEA process
Environmental Reporting • *Writing the draft environmental report, including the results of the assessment* • *Consulting responsible authorities and the public on the draft PPP and the draft of the environmental report* • *Getting feedback and making changes on both the PPP and the draft report before preparing the final report*	Explain in the environmental report and the draft version of the PPP, how disaster risk issues have been identified and managed, including how uncertainty related to probability of occurrence and magnitude of significant effects has been factored into the decision-making process.
	Consult authorities responsible for risk management and other stakeholders able to provide good practice advice; Obtain feedback on suggested measures to avoid, minimise and compensate disaster risks. Consult on relevance of risks and suggested risk management options.
	Consult the public on those contents and elements of the preferred alternative of the PPP that are likely to have significant environmental effects, including natural hazard and vulnerability factors. Consult on acceptance of suggested risk management options.
	Finalise the environmental report and prepare a PPP which integrates the SEA recommendations and concerns expressed during consultations and incorporates the management measures necessary to address natural hazard vulnerabilities and risks identified.
	Ensure in the final report that monitoring arrangements are explained that should be put in place in order to verify the implementation and measure the effectiveness of the suggested risk mitigation/minimisation measures.

3. Informing and influencing decision-making

Responsible authorities are asked to prepare a summary of how they have taken account of the findings expressed in the environmental report and how they have been integrated into the PPP by explicitly referring to the environmental report (European Commission DG for Energy and Transport, 2005, p. 13; Office of the Deputy Prime Minister, 2005, p. 37). In the environmental report, decision-makers have to explain which environmental issues have been considered in general and why weight has been given to some concerns while to others it has not (see Chapter 5.1.1).

When dealing with disaster risk in particular, difficulties arise as decision-makers neither want to over-estimate, nor to under-estimate existing risks. As disaster risks may have severe impacts, it is first of all necessary to sufficiently refer to the risk assessment within the SEA report and according documentation for decision-makers. Still, decision-makers might find it difficult to attach the adequate value to decisions in response to disaster risk. On the one hand, they do not want to constrain too much, as this might hamper social and economic development. On the other hand, they do not want to put people's goods and property or human lives at risk and increase the damage potential. Therefore, often the precautionary principle is applied, as decision-makers do not want to take the risk of being blamed for not taking sufficient precaution. In this respect, the elaboration of 'win-win' or 'no-regret' measures as part of SEA may help to find ideal options. If such options were part of the recommendations within the SEA report, it could substantially support decision-making and promote more resilient planning and development. At the same time, in the environmental report the competent authority could try to specify the weight attached to different values, so that decisions can be more easily taken by responsible decision-makers. This suggestion would be in line with the conclusion of van Stigt et al. (2015, p. 167), who argued that better decision frameworks were required for decision-makers. If SEA could fulfil this demand, it would constitute a decisive support for decision-makers and would be considered an even greater decision-aiding tool.

Questions to be asked during the stage of informing and influencing decision-making include (IRGC, 2008):

- What are the demands and needs for information on disaster risk issues from a decision-making point of view?
- How is risk information interpreted by those who receive it? How are different values attached to different concerns and problems?
- Are the concerns of stakeholders and the public in regard to risk reduction being clearly articulated and are decision-makers paying sufficient attention to all concerns expressed?
- Are final decisions being justified and explained?

Information needs:

During this part of the SEA process, the main channel of information consists in the environmental report and the PPP themselves, which are communicated to the decision-makers. Furthermore, it consists of the recommendations made for decision-makers as well as the detailed explanations about management options. It is crucial for risk reduction purposes that the information provided towards decision-makers is as distinct as possible and can be easily used and applied and turned into binding or valid decisions. Decision-makers do not only use the information comprised by the environmental report for making decisions on risk management strategies and measures (after the weighing of different interests), but also for documenting and justifying their decisions towards the public.

Indicators:

- Existence of a decision framework that specifies the values attached to different concerns and their respective weight, provided by the authority responsible for the environmental report
- Frequency of communication between SEA experts and decision-makers about their work
- Existence of clear explanations on the main risk implications of the PPP
- Existence of detailed and comprehensive explanations on risk management options open to decision-makers, including, in particular, 'win-win' or 'no-regret' options
- Presence of risk management options in the implementation plan of the adopted PPP

Table 17 points out the relevant aspects for informing and influencing decision-making.

Table 17 Integration of risk issues into SEA during the phase of informing and influencing decision-making (Source: own elaboration adapted from Environmental Protection Agency, 2015; OECD, 2006, 2010b)

SEA process	Integration of risk issues into the SEA process
Informing and influencing decision-making • *Informing about the findings* • *Making recommendations to decision-makers* • *Integrating the assessment into decision-making*	Describe how resilience to disaster risks has been brought into the PPP.
	Communicate risk-related findings and their relevance to higher administrative levels: Inform senior decision-makers on the main risk implications of the PPP and on possible options/measures to address these risks.
	Communicate risk-related findings and their relevance to lower administrative levels: Encourage decision-makers to properly examine risk reduction issues and to work cross-sectorally and in an integrative way to identify most pressing risks and ideal responses.
	Determine appropriate risk management options and assess their respective effectiveness as well as costs and benefits.
	Decision framework: Formulate specific recommendations to decision makers on how to take SEA results into account; Suggest how to implement proposed solutions and risk management options.
	Inform in a detailed and comprehensible way about risk management options open to decision-makers, what the likely effects of choices are, and what would be the consequences if they prioritised different options. Focus in particular on 'win-win' and/or 'no-regret' options.

4. Monitoring and Evaluation

A basis for monitoring is already provided during the environmental assessment phase, where arrangements should be determined and datasets and indicators proposed that monitor both the impact of the PPP on vulnerability and the impact of natural hazards on the PPP as well as the effectiveness of natural hazard related appointments of the plan (see above). Chosen datasets and indicators should be relevant to the PPP in question, so that its contribution to risk reduction and its effectiveness in risk management can be measured.

According to the European Commission (2013, p. 48) monitoring still constitutes a weakness in SEA, mainly due to difficulties in defining appropriate indicators. This lack of monitoring provisions can be considered an issue. After all, it is *"particularly relevant for complex and often uncertain issues like climate change adaptation [..], as monitoring injects flexibility into PPs and strengthens their adaptive capacity"* (European Commission, 2013, p. 48). This statement is valid for issues like disaster risk and coping capacity alike. Hence, efforts should be taken to properly implement monitoring and evaluation measures in order to address disaster risk reduction. Only if such measures are monitored and – if needed – adjusted, an effective risk management strategy can be effectuated. Therefore, the identification of monitoring indicators is crucial for the implementation of a successful monitoring process. Example indicators have been listed above (see indicators under "environmental assessment").

Moreover, it is important to not only look at data and indicators, but also at institutional capacity and responsibilities. For instance, responsibilities for monitoring activities have to be determined and institutional capacity for monitoring and evaluation has to be strengthened (OECD, 2010b, p. 13).

Implementing a strategy for monitoring and evaluation therefore also involves determining how indicators will be applied (OECD, 2010b, p. 13).

Monitoring and evaluation should constitute a continuous and repetitive step. Unforeseen developments and changes can always occur and such changes may require an adaptation of the plan. Therefore, continuous monitoring and evaluation will ensure immediate responses to changes, even in the long term.

Questions to be asked during monitoring and evaluation include:

- Have all environmental objectives or recommendations made in the SEA report or the PPP been met?
- What actions need to be taken in order to respond and to reduce or eliminate unforeseen adverse effects once they have occurred?
- Which indicators can help monitor the impact of the PPP on vulnerability and the impact of natural hazards on the PPP?
- Which indicators can help measure the effectiveness of risk-related provisions of the SEA report and the PPP?
- Who is responsible for monitoring risk management activities and for collecting climate change and socio-demographic change data?
- Is sufficient institutional capacity available for implementing a proper risk management strategy? If not, how can institutional capacity be strengthened?

<u>Information needs</u>:

Main information requirements for the monitoring phase consist in adequate natural hazard and vulnerability indicators. In addition, information is needed on climate change and socio-demographic data, mainly because monitoring indicators are based on such data. In this context, information is also needed on potential cumulative effects of natural hazards.

<u>Indicators</u>:

- Percentage of implemented risk reduction measures as outlined in the PPP
- Existence of a monitoring and evaluation strategy and plan, including:
    - The identification of appropriate indicators related to disaster risk
    - The characterisation of ways for continuously collecting climate change and socio-demographic change data and information
    - The allocation of responsibilities for using and tracking these indicators and for collecting data as well as for carrying out the actual monitoring activities

Table 18 shows the necessary steps and aspects to consider in terms of monitoring and evaluating an integration of risk assessment and management into SEA.

Table 18 Integration of risk issues into SEA during the monitoring and evaluation stage (Source: own elaboration adapted from Benson and Twigg, 2007; Environmental Protection Agency, 2015; OECD, 2006, 2010b; Wilson and Piper, 2010)

SEA process	Integration of risk issues into the SEA process
Monitoring and evaluation • *Developing aims and methods for monitoring* • *Monitoring decisions taken on the PPP and the results of their implementation* • *Evaluating monitoring results and feeding them into the PPP review*	**Develop a strategy for monitoring and evaluating disaster risk**: develop databases and indicators and ensure institutional capacity exists for the monitoring process and the evaluation.
	Ensure that risk-related features and measures are properly implemented.
	Monitor hazard potential and susceptibility towards natural hazards as well as the effectiveness of risk-related appointments of the plan.
	Monitor cumulative effects related to natural hazards in order to be able to respond to any unpredicted adverse impacts identified.
	Consider the latest climate change science data and predictions as well as the latest socio-demographic projections and how these could impact the significant effects of implementing the PPP. Review the plan or program if needed.
	Determine responsibilities for continuous monitoring and evaluation of risk management issues.

11.3 Discussion of the proposed concept and problems to consider

In the following, the concept will be critically reflected. The discussion is primarily based on comments obtained from the two interviewed SEA experts. First, some general remarks on SEA application are made, however.

The OECD (2010b, pp. 16–17) points to a number of "lessons learnt" from previous SEA applications to disaster risk which require consideration in future SEA practice. Problems in SEA application that have been recognised by the OECD (2010b, pp. 16–17) include:

- During the **screening** step it will be necessary to ensure that sufficient cooperation is available from key stakeholders (governmental authorities, NGOs and the public). Moreover, it will be necessary to assess whether sufficient environmental baseline and other information is available as well as a SEA team with necessary experience to work in challenging conditions, including those that address disaster risk. Lack of information may then require impromptu decisions.
- During the **scoping** step the full scope of the SEA may sometimes not be determined from the very beginning. However, the problem is that when dealing with disaster response situations, the levels of uncertainty about prioritised strategies and risk management options may be too high to permit the SEA team to determine a detailed scope by responding to stakeholder needs.
- **Stakeholder involvement** necessitates a thorough stakeholder analysis before the process begins. Nevertheless, it may not be feasible to complete a stakeholder analysis in a systematic or rigorous way. Due to the fact that the affected population will be focused on the most pressing needs for protection, encouraging stakeholders may be challenging. Still the SEA team will need to encourage as many stakeholders as possible to actively participate. However, stakeholder involvement may not always work as desired, e.g. when a conflict of interest is prevalent.
- **Implementation of SEA**: In some cases, comprehensive baseline information may not be available. For instance, relevant hazard and risk maps or plans may be hard to find or simply non-existent.

> In such a case, risk assessment may have to be based on first principles instead of modelling results. Moreover, planning decisions will often be guided by short term needs and instant objectives. This makes monitoring process all the more important: SEA needs to track opportunities for reviewing early findings and monitoring outcomes in order to respond immediately by taking corrective action.

In addition to these aspects, further issues were raised by the two interviewed SEA experts. Discussing the present concept, they expressed concern towards some points and partly suggested ideas for improvement. According to these two respondents, the following aspects require further development and consideration:

Assessing significant impacts at different temporal scales

While it is possible to work with climate change scenarios, the uncertainty connected to such scenarios constitutes a main challenge. Even though different climate models can be used, data and methods are always uncertain. Predicting socio-economic change is just as difficult, as many influencing factors are virtually unpredictable[240]. When using scenarios, the question has to be raised how to deal with uncertainty. In a number of areas climate models can be applied without greater problems. It depends on the situation and the context, however, whether the use of models and scenarios makes sense. When dealing with legally effective plans, for instance, taking legally binding decisions based on uncertain previsions proves difficult. Legally binding decisions on land use require a thorough evidence base, which is why assessments carried out under uncertain conditions, based on uncertain assumptions will not be legally justifiable. Hence, taking into account climate change and socio-economic changes is not exactly practicable in every day planning practice under current premises.

Whenever possible scenarios could additionally be applied. If respective data and information exists, it is certainly beneficial to include climate scenarios. However, data is not always available and usually difficult to obtain. In addition, various climate change scenarios exist, which makes is hard to choose the one "valid" scenario. Sometimes data is available, but it is not provided for data protection reasons[241]. Regarding socio-economic conditions, developments are likely to be considered, but in a more selective way. On the one hand, as part of SEA practitioners have to consider the influence of the plan on human safety and well-being. In this context, people exposed to natural hazards or particularly vulnerable groups are identified. On the other hand, local needs may influence the plan, e.g. in regard to public facilities that are required additionally due to an increasing population. The consideration of demographic forecasts often refers to public services. Risks hardly play a role in terms of socio-economic development, however – apart from the mentioned influence of the plan on human safety and quality of life (Interview SEA-I, 2015).

In the case of Poland, it can be argued that the application and consideration of climate change scenarios is more suitable for projects than for spatial plans. For instance, there used to be a regulation for the

[240] It appears that in the area of climate change, respective scenarios exist at a certain scale and can therefore be applied. However, in many other areas scenarios presumably are not available. This includes demographic development, settlement development and other socio-economic factors.

[241] Today, EU Directives such as the EU INSPIRE Directive serve to make information publicly available in selected fields of action.

construction of bridges, which required the construction of the bridge 1m above the highest level of the 100-year flood return period in order to respect uncertain predictions. Moreover, in Poland it is particularly difficult to obtain meteorological and climatological data, since the Polish Institute of Meteorology and Water Management, which has a monopoly for such data, only sells it at a very high rate. This makes climate change data practically unavailable. Due to the fact that spatial planners and SEA practitioners have problems receiving current data about the climate, they are unable to make serious assessments related to climate change. If they would ask the Polish Institute of Meteorology and Water Management for such an assessment, the costs for the whole study would be enormous (Interview SEA-I, 2015). No municipality is willing to pay such a high price for an assessment. Consequently, even if there was a more formal requirement to take climate change into account, it can be assumed that it will in fact not be realisable.

Moreover, if data is available the problem of scale prevents the data to be universally applied at every planning level. If data exists it is not certain whether it is available at the respective planning level and whether it can actually be used. Especially when dealing with disaster risk, data is sometimes missing completely or, when available, data is not always true to scale and often cannot be easily applied. In such cases the use of information about risks in spatial planning alludes to the question of validity: Using risk information at a small scale for taking legally binding planning decisions for specific plots at a large scale can hardly be valid[242]. When considering principles to assess disaster risk, their cumulative effects, additional effects caused by the implementation of the plan or effects on the plan caused by various other environmental concerns and risks, it seems difficult to emphasise all those different links in order to reach a valid conclusion (Interview SEA-II, 2015).

Furthermore, the problem with SEA for spatial plans consists in the fact that the "lifespan" of such a plan is unknown. A spatial plan is usually made with the objective to last at least two decades. However, there is no such thing as a deadline or a minimum or maximum lifespan. This is what often makes it difficult to assess long-term impacts on the plan and long-term impacts of the plan on the environment. In the Polish case study, for instance, the assessment is based just on current data. Predictions can be made on whether certain impacts are "more likely" or "less likely" but no specific statements are made on future conditions of the environment. SEA itself refers to the future and assesses what might happen in the future, but no data is included that actually describes the future (Interview SEA-I, 2015).

This means that from a theoretical point of view it makes sense to differ between the temporal perspectives and assess the future state of the environment through scenarios and models. As a general rule it is indeed necessary and as soon as scientific expertise and studies are available it should be done (Interview SEA-II, 2015). From a practical point of view, it is currently hardly realisable, however[243]. Issues regarding the granularity and detail of information, the actual derivation of relationships between different factors, the valid judging of risks can rather be considered an overextension in planning practice as it

[242] One interviewed SEA expert holds the view that it is important to work more in-depth in terms of scale, i.e. to work detailed in order to obtain valid data and information about risks: Data about the hazard level but all the more about the damage potential or affectedness of the population. This can be a great problem, unless planning at the local scale is concerned, where data about the damage potential is more exact (Interview SEA-II, 2015).

[243] In a few years, the situation may be different. If more data is available and scenarios are more reliable, a consideration of a future state of the environment may be more feasible.

proves to be difficult for practitioners to determine the relevance of relationships. Moreover, this necessitates further fundamental works (Interview SEA-II, 2015). This is why in today's planning practice it is supposed to be sufficient to consider the status quo for deducing legal aspects for land use decisions. After all, the status quo which can be analysed and assessed has consequences for the future also. Finally, there is no universal need to apply the concept, so this can actually not be made common, regular practice. For instance, the presence of future climate change scenarios is not always necessarily required in every case. Only in special cases it may be important and reasonable to actually apply climate change scenarios. Accordingly, only in specific cases where threats towards disaster risk are apparent and where the application of climate change scenarios and an integrated dealing with risks makes sense, the concept can be used (Interview SEA-I, 2015).

One possible option consists in considering solely climate projections and scenarios if they are known and to state that such information from a sectoral perspective is missing. The lack of projections and scenarios of socio-economic factors can be pointed out as a weakness, while not fully relinquish such a future perspective. It always has to be made clear, which factors have been considered for a future state. It is possible or even advisable to set priorities in terms of relevance and significance of assessed factors for the plan as well as their interactions. This would help authorities judge the plan with respect to its consequences (Interview SEA-II, 2015). Seizing systemic relationships and completing a systemic assessment is hardly ever possible.

Zero alternative and cumulative effects

Above statements regarding difficulties related to climate change and socio-economic scenarios also hold true for the assessment of the zero alternative and cumulative effects. Regarding the zero alternative, difficulties exist in assessing the evolution of the environmental baseline. Again, missing data and scenarios aggravate an assessment of the development of the environment even without implementation of the plan. In terms of cumulative effects, often the actual strength of effect cannot be demonstrated, but only basic consequences. Cumulative effects are often not well described or they are not described at all, as the system is too complex. While it is usually possible to describe single modes of action and their general effects, it is rather impossible to show the strengths of effects, their effect paths and their modes of action among one another. Lack of knowledge of the relationships between different effects prevents a comprehensive assessment of cumulative effects.

Hence, environmental reports only mention possible interdependencies. They do not include an assessment of consequences. In some cases, these aspects are only merely treated pro forma and are handled in a formalistic way according to a fixed pattern. Some environmental reports simply mention that cumulative effects or the zero alternative "have been considered". Such statements do not serve any purpose. They only extend the environmental report and turn it into a "wasteland of text" (Interview SEA-II, 2015) without providing any valuable support for decision-makers. If statements are made only to fulfil the formal requirements, they should better not be included in the first place.

This is why a proposal was made for SEA practice to treat topics such as the zero alternative and cumulative effects optional, and only if a valid and qualitative evidence base exists to judge such complex issues. An environmental assessment should be high quality in terms of content rather than fraught with meaningless statements. Accordingly, these aspects should only be considered provided meaningful statements can be made where sufficient data and information is available. When the analysis and evaluation of a zero alternative and cumulative effects prove difficult, it would make more sense if practitioners were formally not required to deal with it (Interview SEA-II, 2015).

Communication and stakeholder involvement – the question of acceptance and risk perception

The basic stages of communication between all stakeholders, including public involvement, are defined in the respective national spatial planning acts. They are formalised procedures and therefore obligatory for each spatial plan and during each SEA process. It is another issue how it finally works, however.

Designations as hazard or risk zones sometimes provoke objections on the part of the population, especially from those directly affected. This means that public involvement is mainly driven by protest from those concerned. People who are directly affected from risk-related regulations only engage out of own interest. They are not necessarily interested in contributing to a more environmental sound and resilient plan, but are mainly interested in asserting their concerns. When, how and to what extent to involve the public depends on the respective plan (Interview SEA-II, 2015). Depending on the plan, the public is more or less interested in participating.

For local spatial plans it can make sense to involve the public early, as the plan is quite specific in terms of land use decisions and directly affects the public. In general, on the one hand it is desirable that the public participates responsibly, without merely providing opposition. On the other hand, authorities should attempt to enable early participation. In order to avoid an increased workload for public authorities when facing an increased public participation, the suggestion was made to intensify informal participation processes. Informal communication with the public is sometimes more successful than formal communication. However, informal communication is hardly realisable during the SEA procedure and can constitute an additional burden. Informal communication should rather be accomplished before the SEA procedure so that results can serve as an input. Public participation makes sense during SEA, but it should be sufficient to offer participation at the end of the procedure. Instead, informal participation that happens on a voluntary basis can be offered in addition and involve the public early (Interview SEA-II, 2015).

It is important to underline, that public involvement should not primarily be about the number of people involved, but about the outcome of their involvement, i.e. the effectiveness and influence of public involvement in SEA. Public involvement should not be a means to an end. First and foremost, public involvement should contribute to improving the plan, e.g. in terms of facilitating decision-making or improving the environmental quality of the plan Accordingly, the results of public involvement, the influence of the public and their constructive input are more important than the number of people involved[244]. This is why a potential weakness in public involvement does not necessarily have to be related to the number of consultations, but to the way they are involved. As outlined in Chapter 5.1.2, possible reasons for a lack of effective forms of public involvement could be a lack of political will, weakness of the legal framework as well as lack of information on the SEA process from the public and difficulties in understanding the technical documents. Consequently, these are aspects which might need further examining in order to ensure effective public participation.

[244] In this context it was acknowledged in one interview, that public meetings and consultations are considered as a waste of time, unless constructive feedback has been provided by the public. If such meetings do not have any effect on the quality of the plan, they are rather perceived as pointless (Interview SEA-I, 2015).

One interview partner referred to the importance of the aspect of risk perception related to public involvement. Questions such as “How is risk assessed?” “To what extent is risk accepted in relation to prevention measures?” “What degree of protection is desired in connection to a specific risk with determined hazard intensity?” include normative aspects. All these aspects require a judgement, which a planning authority usually cannot determine. Instead, this has to be accomplished socially or politically. Due to a lack of evaluation standards, a consensus has to be found on what is socially acceptable and relevant[245]. Therefore, stakeholder involvement plays a crucial role for determining the relevance of impacts and for interpreting the risk (Interview SEA-II, 2015). Due to the fact that risk consists of hazard and vulnerability, the damage potential has to be evaluated. Such an evaluation of the damage potential may require an assigning of economic values to different land-uses: Agricultural land, forest areas, settlement areas etc. All these aspects have to be regarded and assessed on a case-by-case basis as there is no single valid approach. Consequently, a coordinated proposal is needed how to deal with risk, which is why the problem of disaster risk and the definition of what impacts are relevant necessitates a stakeholder-related approach.

Risk management

Risk management necessitates the operationalisation of different risk-related aspects. Different actors understand terms such as exposure, susceptibility, coping capacity, vulnerability and resilience differently. Moreover, they lack operationalisation for a systematic analysis of cumulative effects, assessment of significant impacts and monitoring. Accordingly, solutions should be found on how to operationalise these aspects in order to make them applicable in spatial planning. In some cases, e.g. when looking at the problem of heat stress, it is difficult to determine which factors are related to exposure or to susceptibility. Consequently, the operationalisation of such aspects differs. This is why it would be beneficial if there was a common approach for operationalisation in risk management and in dealing with the individual risk components. Such a standardisation is still missing. A solution can be technical conventions (see footnote no. 245). If technical conventions are established for operationalisation, legal provisions could be more easily implemented. Therefore, the question that arises is: “What are conventions for operationalising the stages of risk assessment and management and what are indicators to work with?” (Interview SEA-II, 2015).

It is possible to have various strands of operationalisation. The above proposed concept and according indicators represent one way of operationalisation. However, various other options and different indicators are conceivable. This is why conventions would be helpful that determine one way of operationalisation. This way a common approach could be provided which enables a unified dealing with disaster risk in SEA.

Monitoring

In general, at regional and local level environmental data is continuously checked. Whether an analysis of environmental data is done thoroughly and comprehensively depends on the situation. Often there are no

[245] In Germany, the German Federal Agency for Nature Conservation (“Bundesamt für Naturschutz – BfN”) has developed specific indications for determining the significance of impacts as part of the EU Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora). These so-called “technical conventions” (“Fachkonventionen”) serve to judge the relevance of impacts on Natura 2000 areas and constitute an evidence-based method for interpreting the term “relevance”. While such technical conventions have been developed in Germany for Habitats Directive reporting, no such conventions exist in terms of disaster risk. They can be a valuable tool for determining the relevance or significance of impacts, however.

sufficient financial means available to enable a continuous, comprehensive monitoring of environmental data. However, new legal provisions such as the FRD legally require a review and – if necessary – an update of the preliminary flood risk assessment, the flood hazard and risk maps as well as the flood risk management plans every six years. Hence, a monitoring is legally prescribed and funding is allocated. If monitoring is not a compulsory task, authorities may ignore it.

Monitoring is also a mandatory part of SEA. This is why every environmental report has to include a reference to monitoring. However, often spatial planners and SEA experts have very little experience with monitoring. After the approval of a plan, they are not involved in the further process. This is why they are not aware of any monitoring activities on the part of the municipality. While environmental monitoring is accomplished by according, responsible institutions, spatial development-related monitoring is the responsibility of the municipality. Often this task is being neglected, however. Hence, it is a political issue whether monitoring takes place or not.

Monitoring is done at best by authorities or institutions that permanently deal with monitoring. Ideally, a mechanism exists in which the constituent provides financial means for monitoring, but responsible and relevant authorities systematically carry out the monitoring as such. Monitoring concepts for individual projects exist. However, an actual monitoring is not likely to take place (Interview SEA-II, 2015). If monitoring was compulsory, responsibilities and especially the required financial means should be better distributed. This necessitates a more centralised approach, with more central responsibilities[246]. Monitoring cannot be accomplished by each single municipality on its own.

In summary it can be concluded that these and other aspects may in fact impede an integration of risk assessment and management into SEA. Moreover, the concept needs testing and application in an actual SEA process before further conclusions can be drawn. Possible problems and difficulties that may be encountered should not, however, prevent an integration of risk assessment and management into SEA in the first place. Only practice can reveal deficiencies and weaknesses and help to continuously improve the procedure.

[246] For instance, in regard to flood risk management the river basin authorities are responsible for monitoring and also provide the funding. Monitoring would hardly be possible if each municipality had to implement their proper monitoring programme (Interview SEA-II, 2015).

Part V: Conclusion

12. Conclusion and outlook

The overall goal of this research was to analyse ways of dealing with disaster risk in spatial planning and SEA in three different national contexts. Its aim was to propose a concept for integrating the notion of disaster risk into the SEA process, thus providing an adequate evidence base for resilience-oriented decision-making. This chapter reviews and summarises the main findings related to the second guiding question. Drawing on these, recommendations are formulated and subsequently the limitations of the research are highlighted. Further open questions or newly arisen issues will be developed to questions that should be addressed in future research endeavours.

The two main assumptions made at the initial state of this research were as follows:

1) Existing regulations have different impacts on the generally given tasks of spatial planning in each of the case study sites.
2) The varying roles of spatial and sectoral planning actors and instruments in different planning cultures as well as the legal-administrative frameworks significantly influence the use of and the need for risk information in Strategic Environmental Assessment and spatial planning in the case study sites.

Based on these assumptions and the problem definition in Chapter 1, the following two main descriptive and normative guiding questions were formulated in Chapter 2:

- How is risk information used in spatial planning and SEA?
- How should risk information be used in spatial planning and SEA?

Whereas answers to the first guiding question have been provided in Chapter 10, this chapter will address the second guiding question. This question aimed at identifying whether the goals that are predetermined by the EU FRD and the EU SEA Directive are attainable through the examined “on-site” practices. Further sub-questions involved issues of how risk information should be made available so that spatial planning can fully exploit its potential within risk management approaches as well as how spatial planning or planning strategies should anticipate uncertainties. These issues will now be summarised and discussed.

Achieving the objectives of the EU FRD and the EU SEA Directive

With regard to the EU FRD, spatial planning, risk assessment and management practices are considered effective if they contribute to the reduction of adverse effects associated with floods. The objective of the FRD therefore refers to reducing the vulnerability and the damage potential. This objective can be achieved by applying and following different strategies and measures – spatial planning being only one among many. Other measures involve structural protection measures as well as early warning systems. Practices applied in the case study sites should promote the reduction of adverse effects associated with floods in order to achieve the objective of the FRD.

Related to the SEA Directive, practices in the case study site need to be tailored to identify, present and evaluate the likely significant, adverse effects on the environment. In this respect it is not only important to consider the effects of the PP on the environment, but to also take into account the potential effects of the environment – and a changing environment – on the PP. SEA intends that practices are cautious about environmental concerns. Hence, the SEA Directive itself does not evaluate a state of environment, but it provides a basis for doing this evaluation. It also provides criteria and indicators in Annex II which serve to accomplish such an evaluation. Indicators with a link to disaster risk involve in particular the probability, duration and frequency of effects, risks to human health or the environment, magnitude and spatial extent of the effects as well as vulnerability of the area likely to be affected. These indicators are to be employed in an environmental assessment. Practices in the case study sites can only be effective in terms of achieving the main SEA objective if these indicators are considered and used.

The following elaboration provides a summary of practices in each case study site and concludes whether the objectives of both directives are fulfilled. In France, neither the AZI, nor the PPR fulfil the requirements of the EU FRD, which is why separate hazard and risk maps have been prepared in order to meet the demands of the FRD. However, flood hazard and risk maps are only prepared for major river basins, which is why the Ubaye valley is not covered by such maps. Spatial planners working in municipalities of the Ubaye valley will therefore not be able to make use of them. Flood hazard maps provide information about probability and frequency (return periods), magnitude (depth or level of water) and spatial extent (flood extent) of a potential flood as an impact on the environment. Flood risk maps provide information about risks to human health and the vulnerability of the area by involving information about the number of inhabitants as well as the type of economic activity of the area potentially affected. In contrast, the French PPR does not provide such detailed information. Municipalities that have a PPR available, but no flood hazard map, are not able to define the probability, frequency, magnitude, spatial extent of flood impacts or the vulnerability towards floods as requested by the SEA Directive. If no PPR exists, spatial planners use other sources of information such as the AZI, geological maps or other maps provided at a smaller scale (1:25,000 or smaller) such as the CIPTM. AZI maps are based on one single return period only. They neither provide a direct indication about water depth or the speed of water in order to specify the hazard. Nor do they delineate the 100-year flood that commonly serves as a reference flood for flood risk management purposes. They also do not represent risk maps, but solely display areas which have been flooded in the past and which most likely can be flooded again. Geological maps solely indicate the geological conditions of the area, but neither the hazard potential, nor the risk associated with these conditions. Therefore, spatial planning in the French case study site currently has no information at hand that meets the demands of the SEA Directive. Existing risk information does not allow for determining likely significant effects on the environment according to the indicators listed in Annex II and the significance of effects of natural hazards cannot be specified. Consequently, existing risk information is not provided in a form that is suited for fulfilling the requirements of the SEA Directive.

Regarding the FRD, the PPR constitutes a purposeful instrument in spatial planning for reducing negative effects of floods. Despite the fact that a PPR does not meet the requirements of the FRD in terms of contents (consideration of three return periods, illustration of flood extent, water depth and elements at risk), it still pursues the same goal. Accordingly, the main objective of the FRD is met, as the main aim and purpose of the PPR is the very prevention of flood risks – among others – and therefore the reduction of adverse impacts arising from flood events. This is also the reason, why an environmental assessment of PPRs does not take place in most cases (see Chapter 6.3.1). However, adverse effects from floods can be reduced by various measures. Keeping areas free of development, a measure required by a red zone on the map of a PPR, is one possible option. An elevated first floor as sometimes required by a blue zone on the map of a PPR is another. In addition, more options such as determining acceptable land use types for hazard-prone areas exist. A more differentiated decision-making is prevented by the PPR.

For the Italian case study site, flood hazard and risk maps have been prepared according to the provisions of the FRD. This means that, in stark contrast to the Ubaye valley, the Fella river catchment is covered by flood hazard and risk maps. A second aspect distinguishes the Italian case study site from the French case study site. The PAI of the Fella river catchment comprises hazard maps, no risk maps. Nevertheless, the maps display hazard classes (moderate, medium, elevate, highly elevate) and do not provide more specific information about the probability, frequency, magnitude or the spatial extent of a flood or landslide event. More precisely, the geo-hydrological maps illustrate the exposure of a territory divided into these four hazard classes, while the geomorphological hazard maps additionally include elements at risk, i.e. an element of vulnerability. However, apart from the aspects related to the vulnerability of the area likely to be affected in the geomorphological map of the PAI, criteria listed by the SEA Directive in Annex II in regard to the characteristics of the effects and of the area likely to be affected are not considered. This means that the significance of effects of natural hazards cannot be determined as demanded by the Directive. Consequently, the requirements of the SEA Directive in terms of assessing the probability, frequency, magnitude and spatial extent of a flood or landslide hazard are not exactly fulfilled by the PAI. Nevertheless, spatial planning and SEA practices in the Italian case study site generally encourage measures that promote a protection of the environment.

When looking at planning practices in the Italian case study site it can be stated that, similar to the French case study site, the main objective of the FRD is met. The geo-hydrological map of the PAI provides for sufficient flood risk prevention by prohibiting development in areas designated as “highly elevate hazard” class (red zone). Accordingly, negative impacts for human health, environment, cultural heritage and economic activity are very likely to be reduced through the PAI. Again, the damage potential can theoretically be reduced in various ways and both the PAI and the geological report more or less constrain local spatial planning in its possibilities and choices. Moreover, it has to be highlighted, that the Italian case study site is characterised by a risk prevention approach that favours structural protection measures (check dams, channels, strengthened embankments etc.) rather than promoting spatial planning related reduction measures.

Like the French case study site, the Polish case study site is not covered by new flood hazard and risk maps for the same reason that such maps are only produced for larger river basins. Only former flood protection studies exist that were prepared prior to the introduction of the FRD. These flood protection studies were prepared in a scale of 1:10,000 and display the extents of floods of the 500, 100, 30, 20, 10, 5 and 2-year return periods (see Chapter 8.3.2). Hence, these maps provide information about both, probability of occurrence and spatial extent of negative effects. Flood protection studies do not provide information about possible depths or flow velocities of water, however, and therefore do not entail an element of magnitude of flood events. Furthermore, they do not include elements at risk. This means that both the probability of effects as well as the spatial extent of the area likely to be affected by these effects can be determined according to the SEA Directive. Consequently, during an environmental assessment, it is possible to assess adverse consequences of potential flood events on the PP in terms of areas exposed to floods and the probability of occurrence of flood events. The results can then inform decision-making and help find adequate measures. Flood protection studies can therefore help reduce adverse effects on the environment resulting from flooding. They even allow for more target-oriented decisions, as their provisions are not as restrictive. Due to the fact that the RZGW has to approve all local spatial plans, it ensures that reasonable planning decisions are taken which do not disregard the given hazard potential. In this respect, the main objective of the FRD can be accomplished through existing practices. The main difficulty consists in choosing the one appropriate probability of occurrence from among the many flood lines determined in the maps of the flood protection studies.

Concerning landslide hazards, experience with the new landslide hazard maps that are provided by SOPO are not well advanced yet. Previous information about landslides was fragmented and based on individual disconnected studies. As explained in Chapter 8.1, the new SOPO maps display landslides according to four different activity levels. The maps also contain detailed information about the landslide relief, i.e. main scarps, trenches and thresholds as well as their height. Return periods are not assessed. Providing information about different return periods is not reasonable, as the probability of occurrence of a landslide can hardly be expressed in terms of return periods. In terms of spatial extent, only the actual extent of the landslide is illustrated on the maps, i.e. the current dimensions of the landslide. However, no information is given about the potentially affected area. The given information is not considered suitable for spatial planners to adequately assess the consequences. While it is uncontested that active landslides should be excluded from any development, problems appear when buildings already exist in the area at risk and in regard to those areas where the landslide risk is relatively low and even geologists are not certain whether new construction should be allowed or not. For spatial planners it is difficult to deal with this kind of information in such cases. The criteria of the SEA Directive are hence not fully considered. The only aspect that meets one of the indicators of Annex II is the height of the landslide, which allows drawing conclusions on its magnitude.

Making risk information available to spatial planning in an adequate and decision-supporting way

In Chapter 8.1.1 it was noted, that in the French case study site the new flood hazard maps can be a valuable support for the elaboration of the SCoT and the PLU, as they allow an assessment of the actual hazard situation, even for extreme events. In contrast to the PPR, which stipulates planning provisions, flood hazard maps allow for weighing up different interests, at least in areas outside of flood plains. Flood hazard maps, both old and new ones, are prepared at a scale of 1:25,000. Such a scale causes difficulties when being used in local land use planning, which is done at a scale of about 1:5,000. This is why downscaling the information will be necessary, which might not always be easy to achieve due to the problem of spatial scale (see Chapter 4.2.2). The PPR does not allow for target-oriented, balanced planning decisions and determines decisions a priori. Hence, the provisions of the PPR constrain planning decisions and do not leave much room for balancing different interests. Due to the fact that the PPR predetermines planning-related decisions, spatial planning itself is not able to make use of all the different options and is partly constrained in its basic tasks.

The French State puts great emphasis on the prevention of risks and a precautionary planning and development approach. Hence, the PPR is considered a good instrument for the French planning practice. It provides not only prevention and precaution in the face of future risks, but it also supports planning practice at the local level by providing understandable provisions at an adequate scale. If the main objective of the French risk approach consists in preventing and reducing negative effects from disaster risk, the PPR is considered adequate. However, given different institutional settings, such a risk-preventive approach is not necessarily suited to be transferred to other EU countries. In decentralised countries, for instance, this approach might not work well, as municipalities will hardly accept such an extreme top-down approach. Moreover, municipalities that do not have a PPR available encounter difficulties in dealing with risk in spatial planning. Here, an adequate information base is missing.

In the Italian case study site, the same problem arises with regard to the new flood hazard and risk maps: As these are prepared at a scale of 1:25,000 they are hardly usable for making local spatial plans due to an incompatibility of scales. The PAI is the main source of risk information. Just like the PPR, it involves provisions for local spatial planning and limits the weighing up of different concerns. Again, planning practice is constrained by sectoral provisions. The results of the empirical study revealed, however, that spatial planners are not responsible for dealing with risk information. This task is accomplished by sectoral experts and/or scientists and via a geological report. This is why spatial planners do not use risk information for balancing interests, but only use it to assess likely constraints of the territory and estimate basic planning options. The actual evaluation is done by sectoral experts. In general, spatial planners seem to care little about risk information.

The Italian approach to disaster risk reduction in spatial planning corresponds to the urbanism tradition, which is characterised by control through zoning and legal codes and a strong architectural focus (see Chapter 4.1). It is therefore not surprising that spatial planners – which are often trained as architects – do not have any responsibilities in handling disaster risk. For the general purpose spatial planning is supposed to fulfil, existing structures seem appropriate. This does not imply, however, that there is no need or room for improvement. In order to make planning more integrated and comprehensive, a better knowledge base for spatial planners about risk-related problems as well as a better coordination and closer cooperation between the different actors is desirable. Again, the Italian approach is most likely not easily transferable to other EU countries, due to prevailing circumstances characteristic of the Italian planning approach. In other countries spatial planners have more central roles in relation to disaster risk. In such cases it would not be possible to undermine their competences.

While risk information provided at a value level (PPR and PAI) is certainly convenient for spatial planning practices, it does not provide details specific enough to allow for fully assessing the state of the environment as part of the SEA. This has further consequences for the comparison of alternatives, the determination of measures to avoid, reduce and compensate or the selection of "no-regret" or "win-win" measures as well as the integration of the assessment results into decision-making processes. When certain elements are missing in the assessment, there can hardly be any comprehensive decision-making. Sectoral-planning influences spatial planning practices in the French and Italian case studies in a prevention-oriented manner. In both case study sites sectoral planning instruments provide for maximum precaution. Here, the prevailing risk culture of representing precaution and prevention seems to guide the planning culture into the same direction. Spatial planning is therefore not particularly flexible or open in dealing with disaster risk, but has to follow the provisions of sectoral planning tools, measures and regulations. Its potential within risk management is therefore limited to a certain extent, as existing risk information is not made available in a way which encourages the weighing up of interests and the choosing of the best option available.

In the Polish case study site SEA and spatial planning practices differ from the French and Italian examples in the sense that risk information is provided as factual statements. The sources of information do not involve any evaluation. This requires more competences and a more important role for spatial planning and for spatial planners as such. The lack of normative statements requires a different planning approach. Spatial planners need to develop an evaluation standard in order to assess potential consequences of the plan and to attach a value to different concerns. This approach puts higher demands on the contents of risk information. Risk information needs to be presented in a way that enables spatial planners to adequately assess the situation. However, maps of the former flood protection studies and especially landslide hazard maps encompass a number of difficulties which hamper an assessment (see above). Attention should be paid at either providing risk information that meets the needs of spatial planners or to provide for a decision-framework which supports plan-making by enabling a more cooperative and collaborative approach. Such a decision-framework can be represented by SEA.

Anticipating uncertainty in spatial planning

All three case study sites show a precautionary planning approach. The precautionary principle is well-established, especially in France. In uncertain environments, decisions are taken in favour of precaution rather than of risk. Apart from applying the precautionary principle, no particular solutions for dealing with uncertainty in spatial planning were mentioned in the interviews. Interview partners often acknowledged that they encounter difficulties considering and dealing with uncertainty and that they can only consider what they know – or what the most recent scientific expertise in this field is. The examined case study sites lead to the conclusion that specific ways of anticipating uncertainty have not been determined yet.

The concept of resilience as one way of dealing with uncertainty therefore remains unnoticed. By choosing low or no-regret measures, spatial planning can prepare for both favourable as well as unfavourable developments associated with climatic and socio-economic changes. Such measures will not be to a great detriment of a municipality, no matter how the situation develops. A resilient approach to disaster risks requires the consideration of different measures and options. Moreover, as mentioned in Chapter 11, decisions taken under conditions of uncertainty have to be considered and assessed within the weighing up process and compared with different planning alternatives. If the weighing up as such is restricted, the consideration of different alternatives and options is equally limited. This way of choosing the best option available is not always supported in each of the case study sites, which is why the implementation of no-regret measures is often hampered in the first place.

A further reason of why implementing no-regret measures is difficult is the fact that decision-makers often address the more apparent and pressing problems first (e.g. outmigration and a decreasing population in the Fella river catchment, the abandonment of the barracks in Barcelonnette by the French army and a decreased population, the satisfaction of public and private construction claims in the Polish case study site). On the one hand this means they try to solve risky situations with immediate measures. Evidence for this statement is taken from the Italian case study site, where enormous structural mitigation measures have been built as an immediate response to the devastating flood in the year 2003. On the other hand, other municipal problems are considered more important and are seen to require solutions first. This is why disaster risk and climate change aspects are often neglected. Disaster risk reduction and climate change adaptation do not seem to be among the top priorities. In addition, decision-makers prefer solutions that are “visible” to the public. They often believe that prevention measures such as structural protection measures or the establishment of an early warning system, are more accepted by the public. By implementing “visible” measures decision-makers can prove that they care and that they try to improve the situation. When considering the fact that decision-makers are usually politicians with a vested interest in getting re-elected, they usually focus their efforts on strategies which present them in the proper light and which conform with the perceptions of the public.

Public acceptance is crucial for establishing planning strategies that anticipate uncertainty. After all, planning decisions have to be justified. Acceptance of planning decisions differs depending on the sources of risk information used as well as people's perception of risk, attitude towards disasters and personal estimate of a danger. This means that in different planning systems and cultures public acceptance of planning decisions varies. Likewise, ways of dealing with uncertainty differ. The French and Italian case study site with their rather regulatory, top-down approaches require a different solution than the Polish case study site where more decentralised structures exist. While in France and Italy decisions are predetermined by law and might therefore be more easily enforceable by decision-makers, in Poland the weighing up of different concerns needs to be completed in a scientifically and methodologically sound way. Here, enabling sufficient stakeholder involvement in order to determine the prevailing risk perception is all the more important. On the other side, current practices in France and Italy rather impede the selection of low or no-regret measures. Due to the predominantly sectoral planning approaches, a comprehensive, integrated approach is not closely encouraged. In France, the PADD of the PLU now constitutes a tool which could foster a resilience-oriented approach. In addition to sustainable development it could also integrate aspects of resilience and hence make a consideration of low or no-regret measures possible. More practical experience with the PADD is required, however, in order to examine its potential. In the Italian case study site, a resilience-oriented planning approach at the local level is hampered by a planning practice that is characterised by small scale solutions and spatial planners missing to adopt a more integrated perspective. While there is no doubt about the importance of scientific expertise and the review provided by experts, enabling a better coordination and cooperation between all actors involved could help to consider the "bigger picture". This way, also aspects that promote resilience planning could be introduced. The Polish planning system as well as the role of spatial planners in Poland leave more options open. Here, planning towards resilience and sustainability depends on political will as well as public perception. Raising awareness for the need for resilience planning can be a means to establish more resilience-oriented planning decisions. This concerns various stakeholders, including decision-makers, private investors and the wider public. This way, the current practice of realising single investment projects through building permits rather than realising planning through local spatial plans, might be reduced.

Due to existing differences in planning and risk cultures, no universal statement on how uncertainty should be anticipated in spatial planning can be made. In contrast, individually tailored solutions are required that respect the prevailing risk perception and public acceptance. In general, uncertainty is an issue, spatial planners and decision-makers defy dealing with in further detail. This is why efforts should be made to provide the relevant actors with adequate support. Examples can be according guidelines or the application of procedures where aspects of uncertainty and resilience can be treated.

SEA was proposed as an instrument which can be supportive of such ambitions in various aspects. For instance:

- The SEA procedure can provide additional opportunities to enable public participation to the end of achieving public acceptance of decisions;

- The mandatory environmental report constitutes a good way of making decision-making transparent and informing about environmental problems, thus helping raise awareness;
- SEA may consider different stakeholder perceptions and integrate them into the decision-making process;
- SEA enables the involvement of different stakeholders and can enable an improved coordination and cooperation as well as a more comprehensive perspective within the decision-making process.

Concept for integrating risk information into SEA

In Chapter 11 a concept was introduced which outlines how to integrate risk assessment and management issues into the SEA stages. It draws on expected benefits the SEA procedure can imply for risk reduction that were elaborated in the preceding chapters. Although the concept was generally rated positive and useful, it cannot be fully applied without adjustments. While it should be used as a supporting element during the SEA procedure, some aspects require revision. The main point of criticism is that, from a practical point of view and in consideration of todays' state of scientific expertise, a distinction between the two temporal perspectives is hardly realisable. This means that, from a theoretical point of view, the future state of the environment should be assessed through scenarios and models, if possible. However, a reasonable judging of risks by considering both, current and future states of the environment can be expected too much in planning practice. Consequently, the assessment of the zero alternative taking account of climatic and socio-economic changes is hardly possible. This holds also true for the assessment of cumulative effects. Indeed, it proves difficult for practitioners to determine the relevance of relations between different effects and therefore the significance of cumulative effects. Both aspects demand further fundamental works in terms of providing significant and justified scenarios to be used. It was suggested to address the zero alternative and cumulative effects optionally. Provided a valid and qualitative evidence base exists to judge such complex issues, respective assessments can be made. The quality of the content of an environmental assessment and the accompanying report is more important than a superficial treatment of all required aspects.

The concept was discussed with two SEA experts from two different countries with practical knowledge from two different planning systems. After providing both with the developed concept they provided valuable feedback and suggestions for improvement, which were outlined in Chapter 11.3. SEA is an already existing procedural framework that exists in every EU Member State. National approaches of SEA implementation are required to meet the provisions of the EU SEA Directive, which is why conformity in SEA application exists to a certain extent. The concept was therefore developed with the aim to be equally considered by and employed in different planning systems and to be non-contextual. Obviously, advantages of an integration of risk assessment and management into SEA differ between the case studies and depend on the respective ways of dealing with risk information in spatial planning. Accordingly, other EU Member States will most likely also reveal proper advantages and disadvantages from following the ideas of the concept.

The countries examined as part of this work represent only two legal- administrative families: The Napoleonic and the Eastern European family. Although EU Directives require a minimum level of consistency among the case study sites and SEA should be carried out in a very similar way in other EU countries, the question remains which problems and deficits in connection to disaster risk reduction exist in other EU countries and how SEA can be a helpful supporting procedure in overcoming these problems. Future research could therefore be directed towards examining similar aspects in countries representing the other legal-administrative families (Germanic, Scandinavian and British). It could even be contemplated to carry out a similar examination in non-EU and non-European countries.

Furthermore, the case study sites have initially been selected for their exposure to floods and landslides. Accordingly, this study focused on dealing with disaster risk caused by floods and landslides. However, further natural hazards are spatially relevant and need to be considered in spatial planning practice. This holds also true for technological hazards. For every hazard is different, spatial planning is likely to have different ways of dealing with other types of hazards such as earthquakes for instance. Future research should also put its focus on other types of hazards.

Finally, further research could be directed towards examining an actual application of the concept with a practical example. This way, spatial planners could provide a feedback on the practicalness, helpfulness and support of the concept regarding the single steps of the SEA process. Moreover, further insights could be gained and conclusions made to what extent the concept can contribute to the quality of environmental assessments.

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Expert interviews

French case study (F)

Interview F-I (spatial planner, consultant), 2013	Embrun, France, June 27th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-II (2 spatial planners, consultants), 2013	Gap, France, June 28th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-III (spatial planner, consultant), 2013	Marseille, France, July 12th, 2013, oral interview conducted by author, interview conducted in French (no translation provided), recorded, transcribed by translator
Interview F-VI (representative of the Departmental Directorate Hautes-Alpes, spatial planning unit), 2013	Gap, France, June 28th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-V (2 representatives of the Departmental Directorate Alpes-de-Haute-Provence, spatial planning and disaster risks units, 2013)	Digne-les-Bains, France, July 10th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-VI (representative of the Regional Council Provence-Alpes-Côte d'Azur, disaster risk unit), 2013	Marseille, France July 11th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-VII (representative of the RTM), 2013	Barcelonnette, France, July 3rd, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-VIII (environmental assessment consultant), 2013	Chabottes, France, July 8th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-IX (natural risk consultant), 2013	Aix-en-Provence, France, July 11th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-X (Representative of the Regional Directorate of Environment, Development and Housing), 2013	July 5th, 2013, interview via skype conducted by author, interview conducted in French (translation provided), recorded and transcribed; interview later completed via e-mail
Interview F-XI (representative of the municipal council), 2013	Barcelonnette, France, June 26th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed
Interview F-XII (representative of the municipal council), 2013	Jausiers, July 2nd, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed

Interview F-XIII (representative of the municipal council), 2013	Faucon-de-Barcelonnette, July 8th, 2013, oral interview conducted by author, interview conducted in French (translation provided), recorded and transcribed

Polish case study (P)

Interview P-I (spatial planner, consultant), 2013	Krakow, Poland, September 5th, 2013, oral interview conducted by author, interview conducted in English, recorded and transcribed
Interview P-II (spatial planner, consultant), 2013	Krakow, Poland, August 22nd, 2013, oral interview conducted by author, interview conducted in German, recorded and transcribed
Interview P-III (representative of the voivodeship office, spatial planning unit), 2013	Krakow, Poland, August 23rd, 2013 oral interview conducted by author, interview conducted in English, recorded and transcribed
Interview P-VI (representative of the Regional Environmental Protection Agency), 2013	Krakow, Poland, August 29th, 2013, oral interview conducted by author, interview conducted in Polish (translation provided), recorded and transcribed
Interview P-V (representative of the Polish Geological Institute), 2013	Krakow, Poland, September 4th, 2013, oral interview conducted by author, interview conducted in Polish (translation provided), recorded and transcribed
Interview P-VI (2 representatives of the Regional Water Management Board), 2013	Krakow, Poland, September 4th, 2013, oral interview conducted by author, interview conducted in Polish (translation provided), no recording for legal reasons

Italian case study (I)

Interview I-I (spatial planner, consultant), 2013	Torreano, Italy, April 22nd, 2013, oral interview conducted by author, interview conducted in Italian (no translation provided), recorded and transcribed; interview completed by e-mail
Interview I-II (spatial planner, consultant), 2013	Tolmezzo, Italy, April 17th, 2013, oral interview conducted by author, interview conducted in Italian (translation provided), recorded and transcribed
Interview I-III (2 geologists, consultants), 2014	Malborghetto-Valbruna, Italy, March 6th, 2014, oral interview conducted by student group from TU Dortmund University, interview conducted in Italian (translation provided), recorded and transcribed by student group
Interview I-IV (representative of the regional office, Friuli Venezia Giulia, soil defence department), 2013	Trieste, Italy, April 18th, 2013, oral interview conducted by author, interview conducted in English, recorded and transcribed
Interview I-V (representative of the Water Basin Authority for the rivers Isonzo, Tagliamento, Livenza, Piave, Brenta-Bacchiglione), 2013	Venice, April 23rd, 2013, oral interview conducted by author, interview conducted in Italian (translation provided), recorded and transcribed

Interview I-VI (representative of the regional environmental protection agency, Friuli Venezia Giulia), 2013	Udine, Italy, April 17th, 2013, oral interview conducted by author, interview conducted in Italian (translation provided), recorded and transcribed
Interview I-VII (representative of the regional office, Veneto)	June 6th, 2013, e-mail contact in Italian
Interview I-VIII (3 representatives of the regional office, Friuli Venezia Giulia), 2014	Trieste, Italy, March 5th, 2014, oral interview conducted by student group from TU Dortmund University, interview conducted in Italian and English (translation provided), recorded and transcribed by student group
Interview I-IX (representative of the municipal council), 2013	Malborghetto-Valbruna, Italy, April 15th, 2013, oral interview conducted by author, interview conducted in Italian (translation provided), recorded and transcribed

SEA experts

Interview SEA-I (Polish SEA expert, consultant), 2015	September 14th, 2015, interview via skype conducted by author, interview conducted in English, recorded and transcribed
Interview SEA-II (German SEA expert, consultant), 2015	September 15th, 2015, interview by phone conducted by author, interview conducted in German, recorded and transcribed

Appendix

Appendix

Appendix 1: Interview guides

a) Interview guide spatial planning

Risk information and spatial planners as actors:

Could you describe some examples of how your office is involved in managing flooding and landslide risks? How do you consider disaster risk in your work?

Can you describe what kind of information you need for taking into account disaster risk when making a local land use plan? For which types of hazards do you need information?

Have you ever had the impression you need more information about disaster risk than you actually have at your disposal?

Within the scope of your tasks, are you satisfied with the existing regulations for risk assessment? Are you satisfied with the risk information you currently receive and work with?

Is the content of the information about hazards and/or risks you currently use understandable for you?

Can you describe how you handle a lack of risk-related information? Are there issues this causes that you must overcome?

Planning process:

Could you elaborate on your use of future prognoses or scenarios? How do you consider climate change?

Is it a problem for you to manage the paradox between having a static risk map to use for making long-term decisions in spatial planning?

Do you think considering the problem of uncertainties is important for your work? Are you able to identify uncertainties in the provided information about risks? How do you deal with uncertainties?

Regarding monitoring and evaluation: Can you describe the evaluation process for spatial planning measures? Are planning measures for risk prevention reviewed and adjusted?

Do you consider disaster risk as a topic in SEA? Do you use risk information in SEA?

Do you know of any informal planning instruments within the area or region that involves aspects of disaster risk reduction?

Communication and consultation:

Could you describe the level of cooperation (informal interactions) and coordination (formal interactions) between your office and those entities you work with most closely?

Is information communicated in formal procedures only or also informal discourse processes (e.g. stakeholder dialogue, mind mapping, workshops, world cafés etc.)?

How are stakeholders involved in the planning process? What are ways in which the public can be involved in planning for risk prevention? How useful do you consider stakeholder involvement?

Are you – in your role as a planner – involved and consulted within actions related to the EU Flood Risk Directive (i.e. flood hazard and risk mapping, flood risk management plans)?

Closing question: Is there anything we did not ask that you feel is important to communicate?

b) Interview guide sectoral planning

Could you describe some examples of how your office is involved in managing flooding and landslide risks?

Are future changes (climate change, land use change, socio-demographic change) taken into account and reflected in risk information?

How is the problem of uncertainty taken into account and how is it communicated to the end-users?

Who are the end-users of the information about disaster risk you provide?

In your opinion, is it important to have a binding hazard/risk map or plan for risk prevention in order to promote successful risk management in spatial planning?

Either from your past experience or in general: What kind of risk information do you think spatial planners need for their work? In your opinion, what risk information are they interested in?

Do any of the ways in which you communicate risk information with other authorities or actors, spatial planners in particular, involve an exchange of information or knowledge?

Could you describe the level of cooperation (informal interactions) and coordination (formal interactions) between your office and those entities you work with most closely?

Could you describe how you communicate risk-related information to the public? What kind of information do you communicate? What are the most important means of communication between you and the public?

What are ways in which the public can be involved in assessing and managing risks?

Are spatial planners one of the stakeholder groups that are involved in the production of hazard and/or risk maps?

<u>Additional questions for SEA experts and representatives of environmental protection agencies</u>:

Do you consider disaster risk as a topic in SEA? Do you use risk information in SEA?

Are future changes (climate change, land use change, socio-demographic change) anticipated in SEA? Is uncertainty considered in SEA?

Do you think SEA that integrates risk assessment or information about risks is a good tool to inform land use planning and support risk prevention?

In your opinion, are the results of SEA that refer to risk assessment and management sufficiently considered in local land use planning?

Closing question: Is there anything we did not ask that you feel is important to communicate?

Appendix 2: Maps

2.1 French case study site

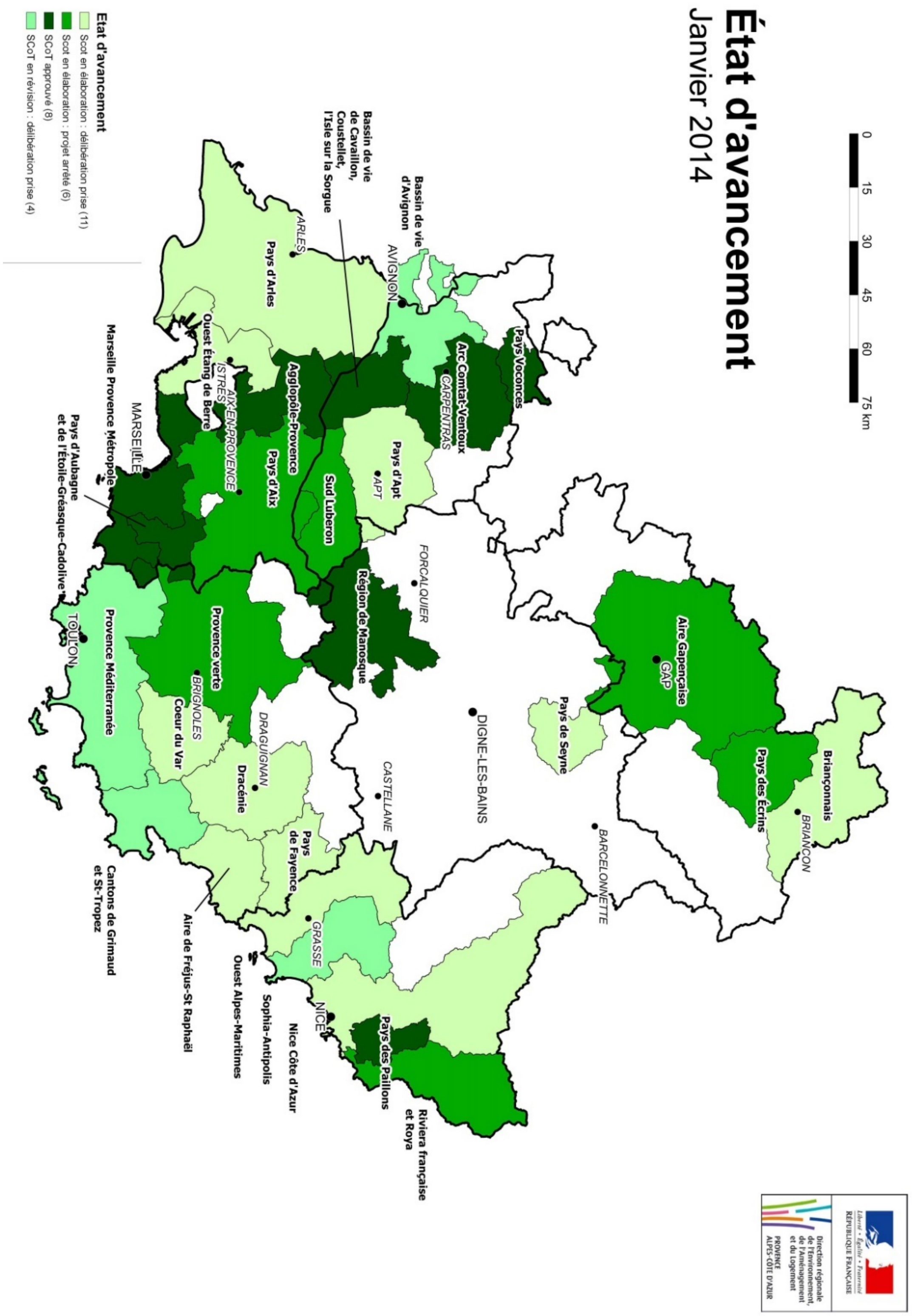

Figure 1 Progress of existing SCoTs in the region Alpes-Provence-Côte d’Azur (Source: DREAL PACA, 2014)

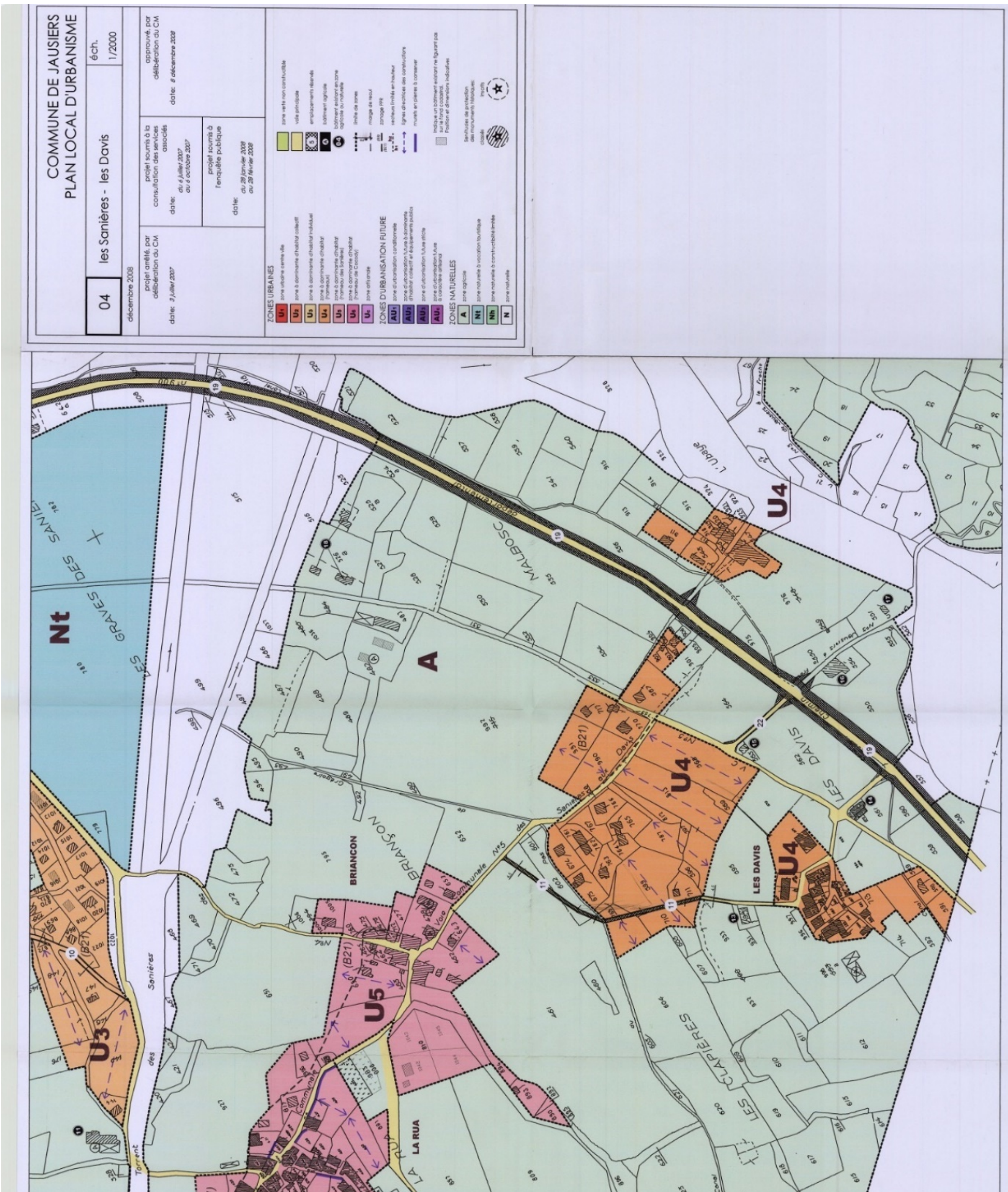

Figure 2 PLU of the municipality of Jausiers (Source: Commune de Jausiers, 2008a)

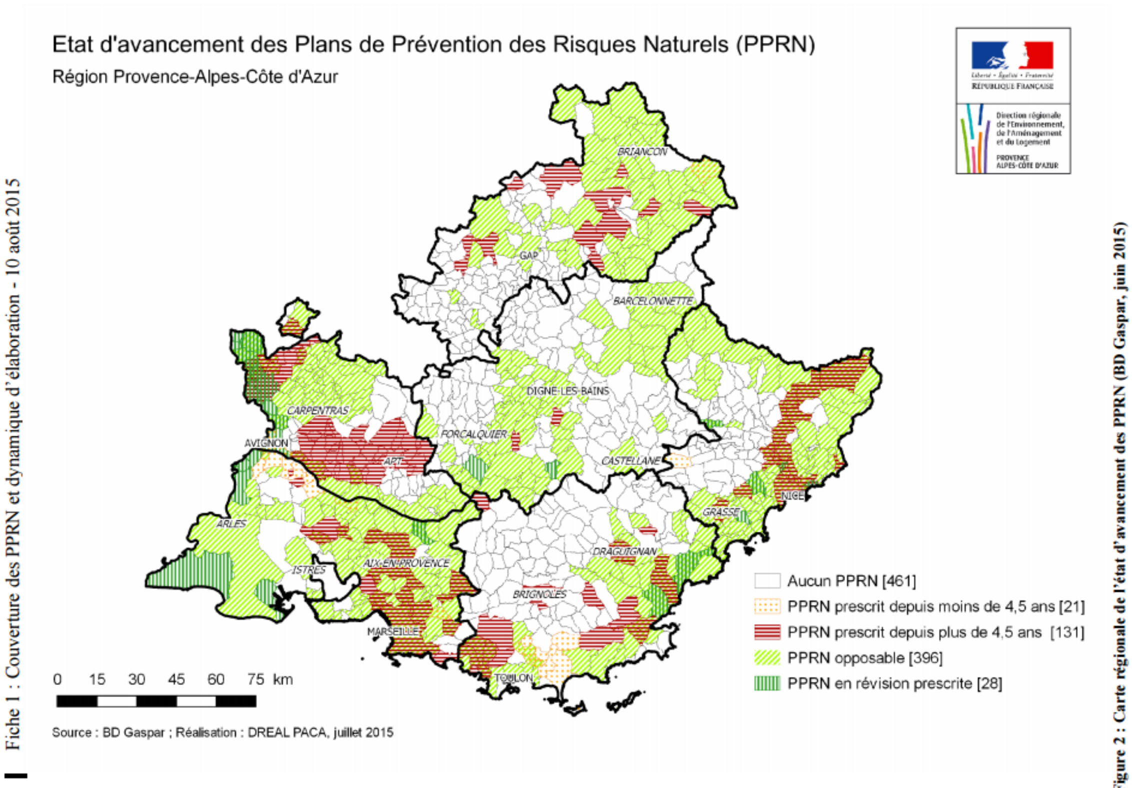

Figure 3 State of progress of PPRNs in the Provence-Alpes-Côte d'Azur region. White: no PPRN available; Orange dots: PPRN prescribed for less than 4.5 years; Red stripes: PPRN prescribed for more than 4.5 years; Light green: legally binding PPRN; Dark green: PPR (Source: DREAL PACA, 2015, p. 5)

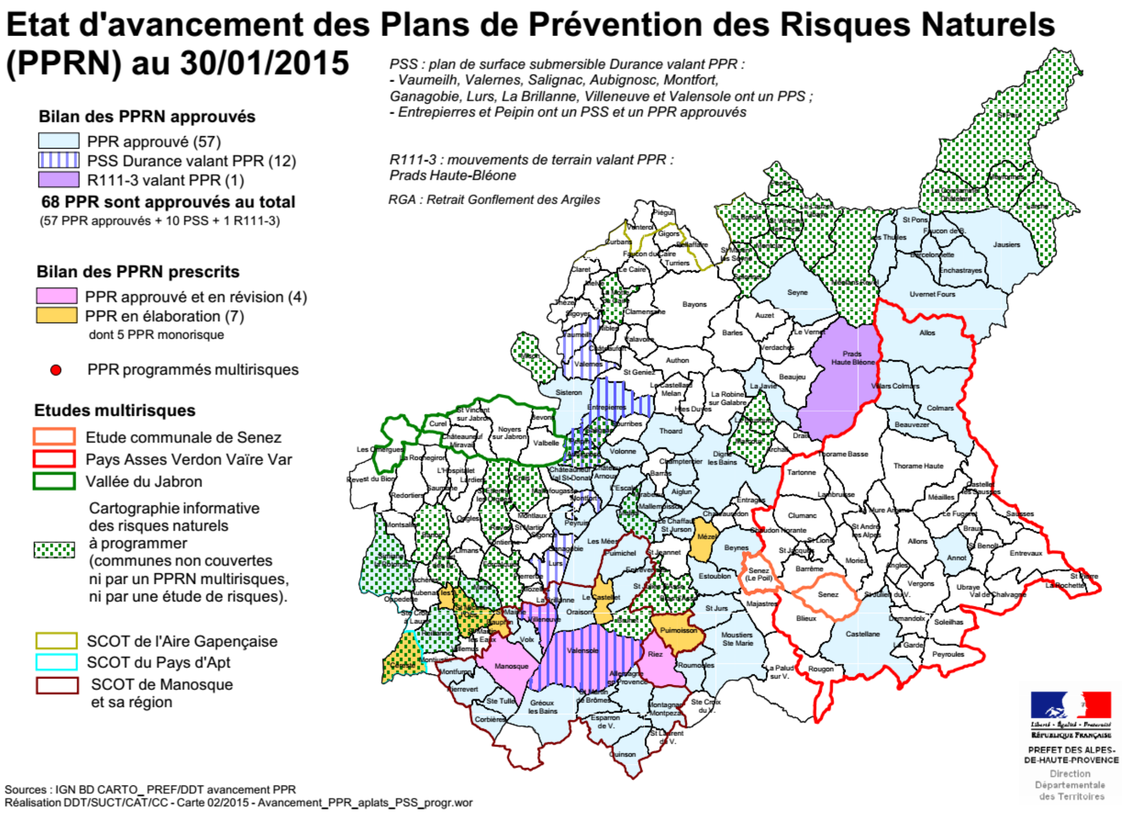

Figure 4 State of progress of PPRNs in the Department Alpes-de-Haute-Provence (Source: DDT 04, 2015)

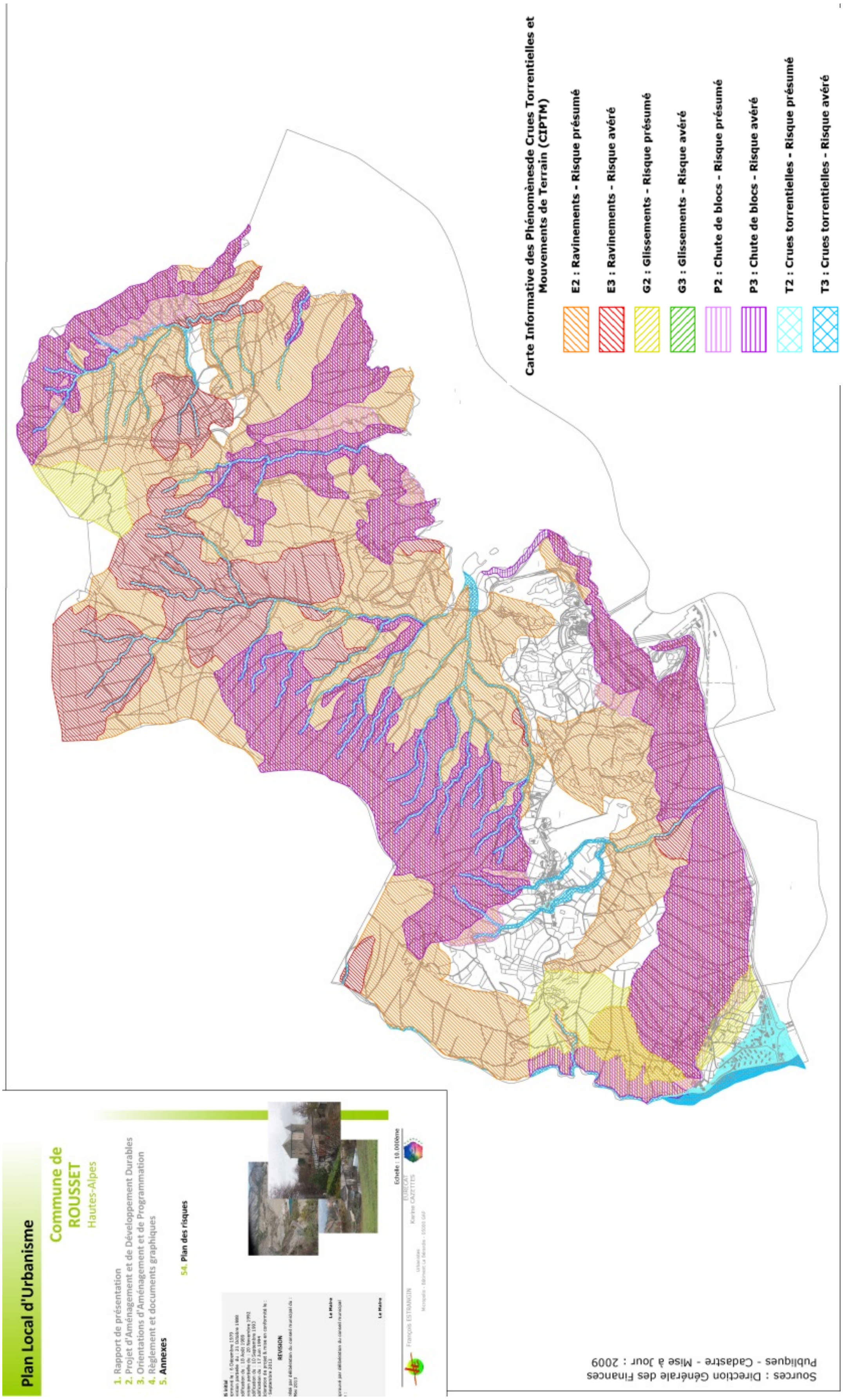

Figure 5 CIPTM of the municipality of Rousset in the Department Hautes-Alpes, included as Annex to the PLU (Source: Estrangin and Cazettes, 2009)

2.2 Polish case study site

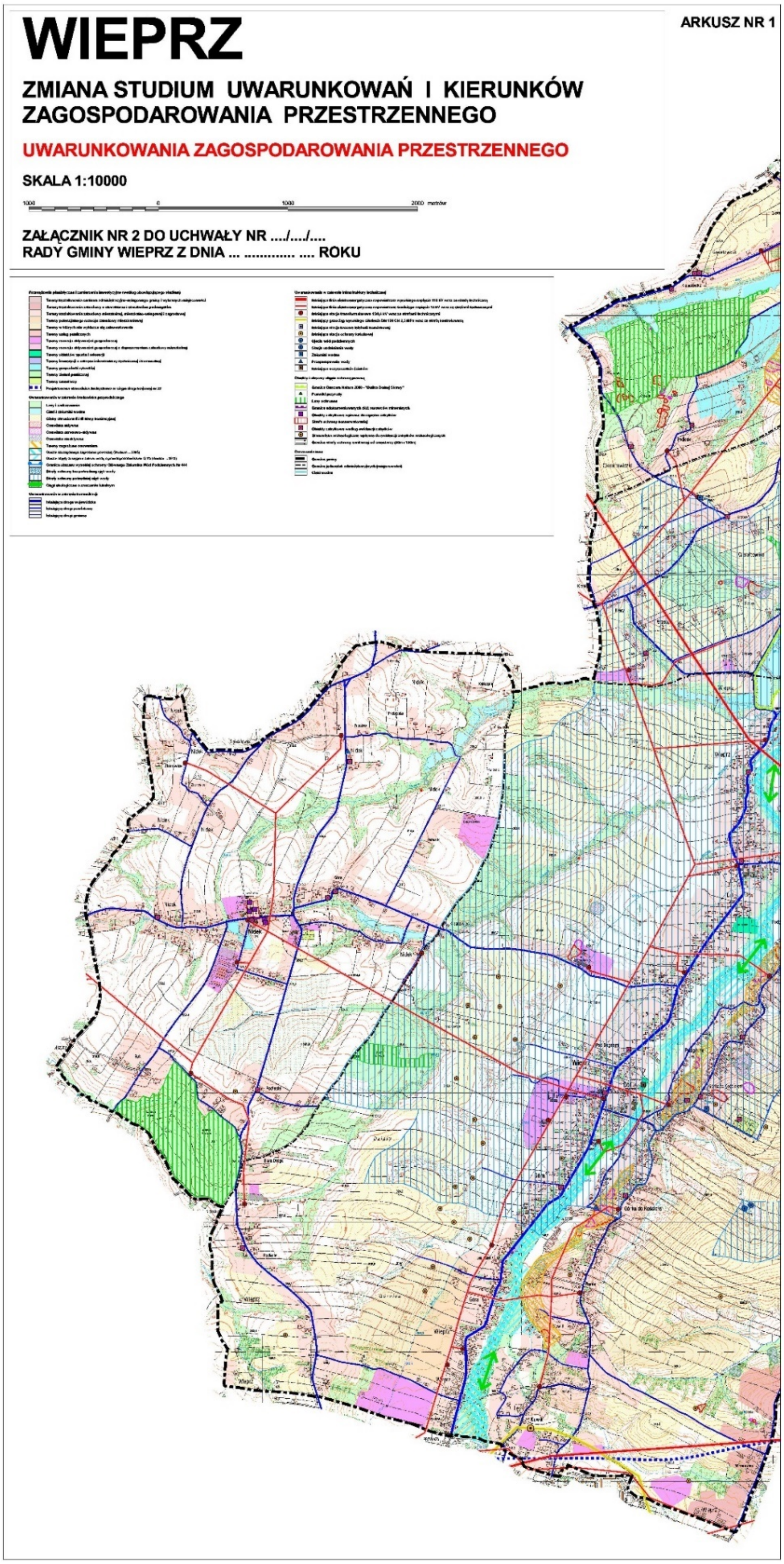

Figure 6 Extract of the the Study of Determinants and Directions of the Local Space Economy, municipality of Wieprz (Source: Instytut Rozwoju Miast, 2014a)

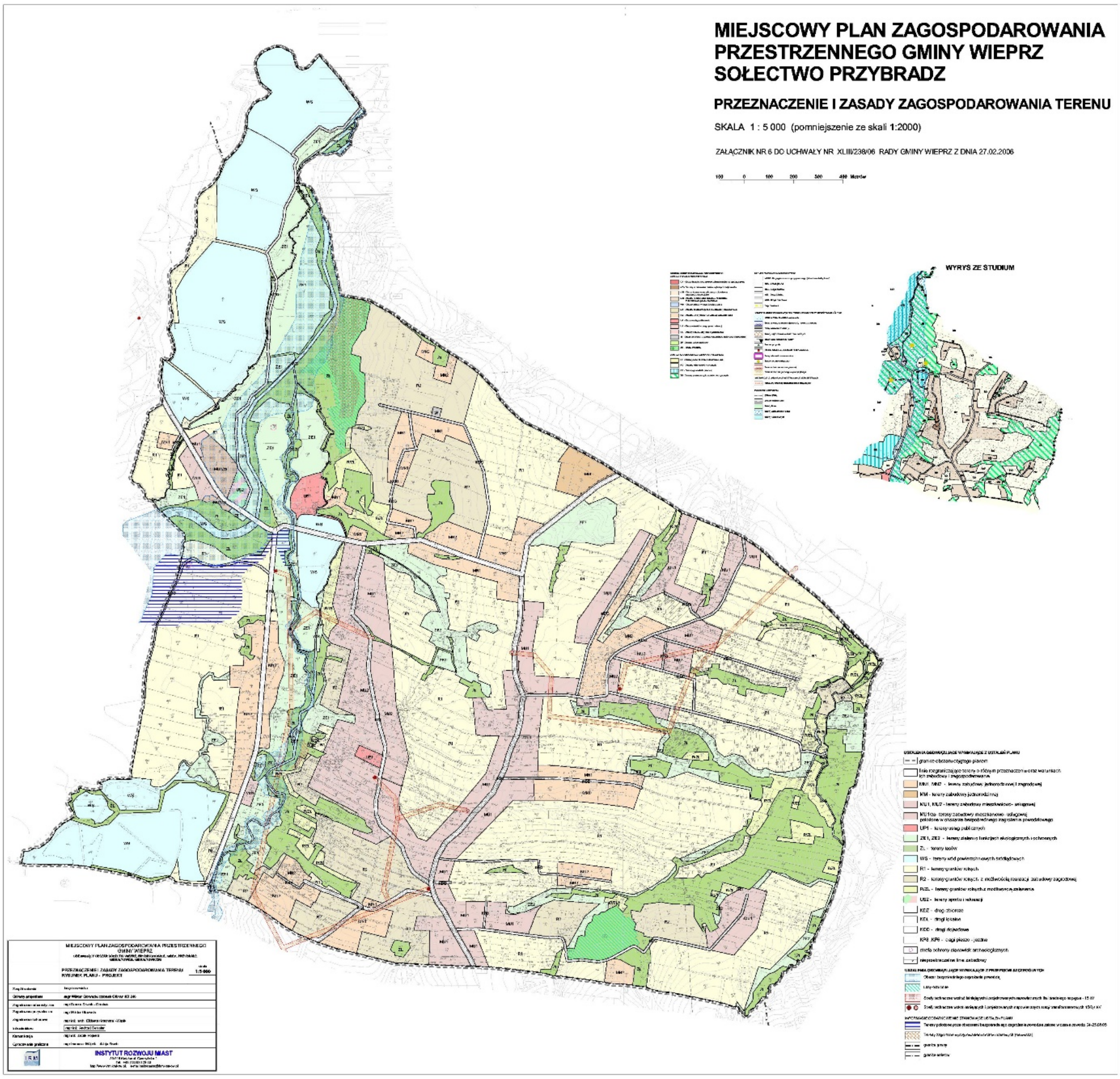

Figure 7 Local Plan of Physical Development, municipality of Wieprz, village of Przybradz (Source: Instytut Rozwoju Miast, 2006)

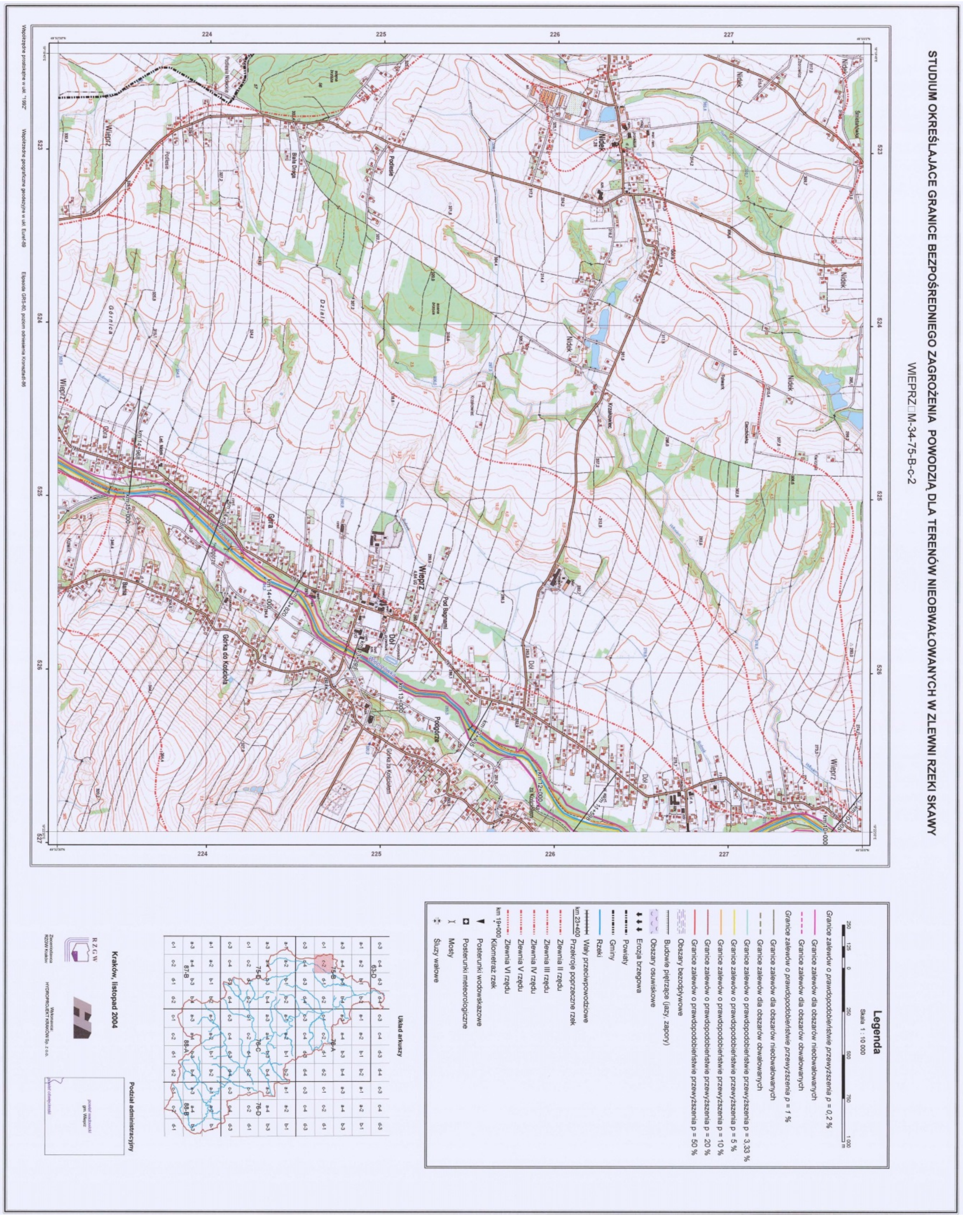

Figure 8 Example of a Study of Flood Protection (River Skawa) (Source: RZGW Kraków, 2004)

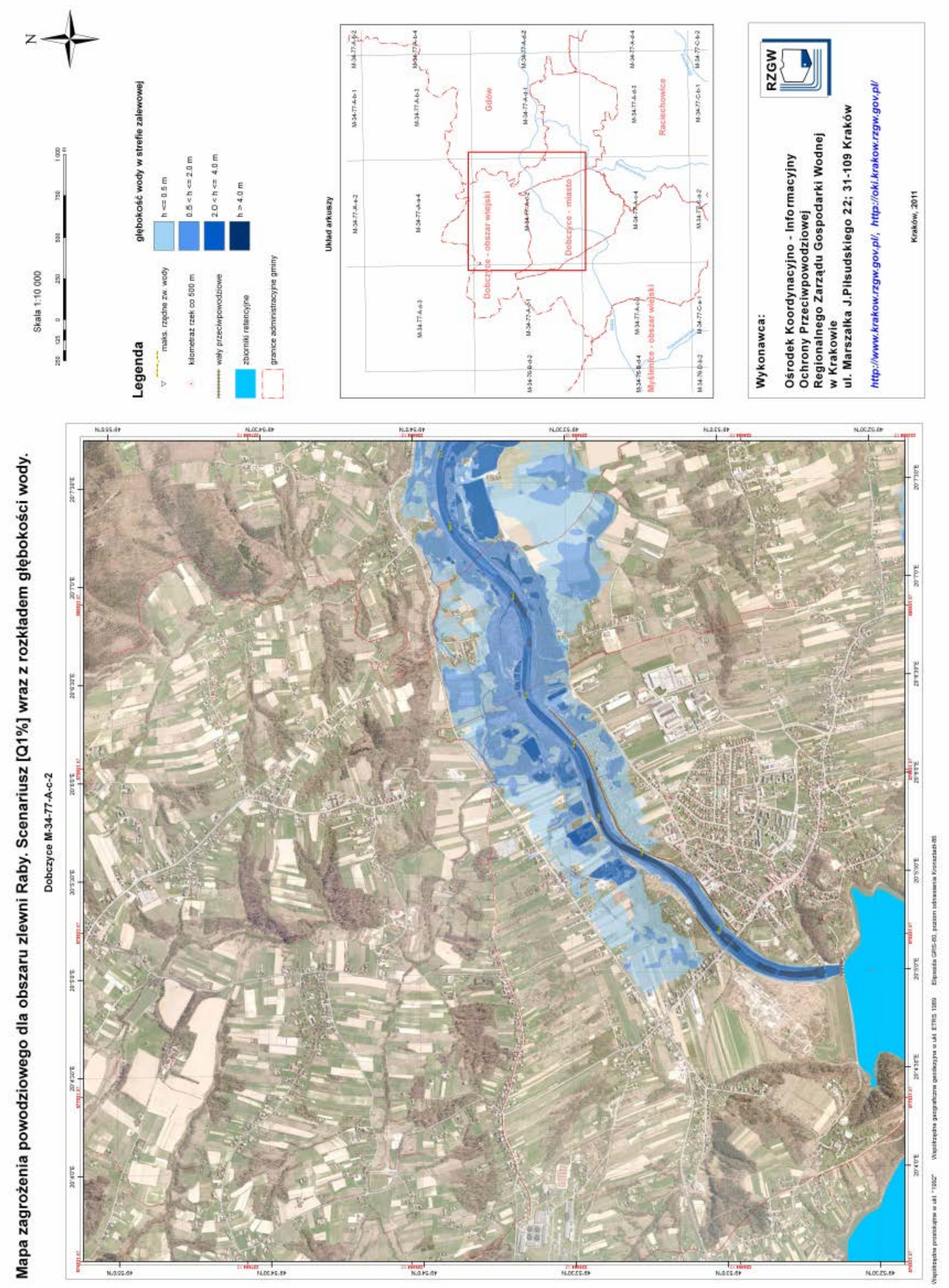

Figure 9 Flood hazard map for the municipality of Dobczyce according to the provisions of the EU FRD (Source: RZGW Kraków, 2011)

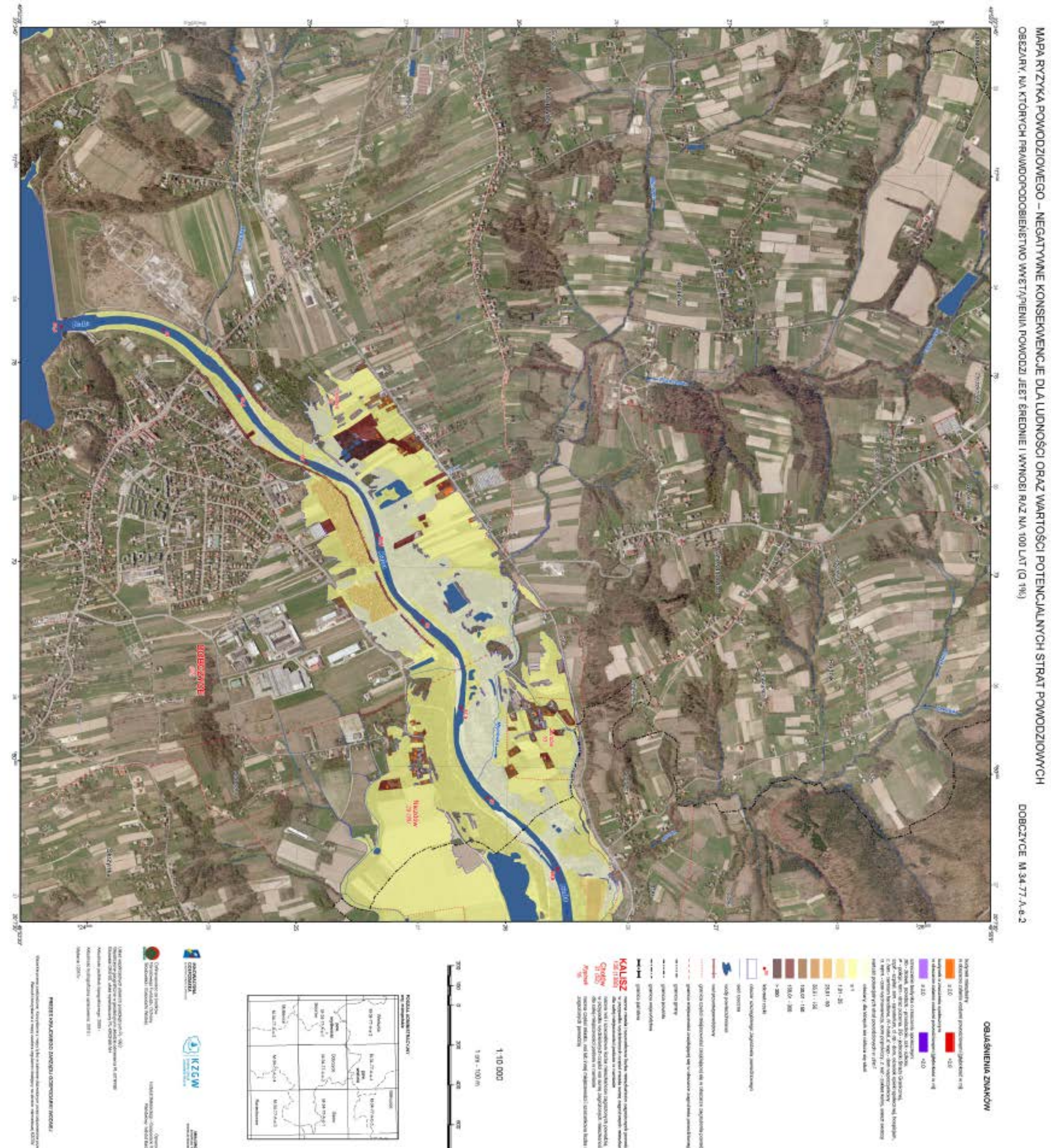

Figure 10 Flood risk map for the municipality of Dobczyce according to the provisions of the EU FRD (Source: RZGW Kraków, 2013)

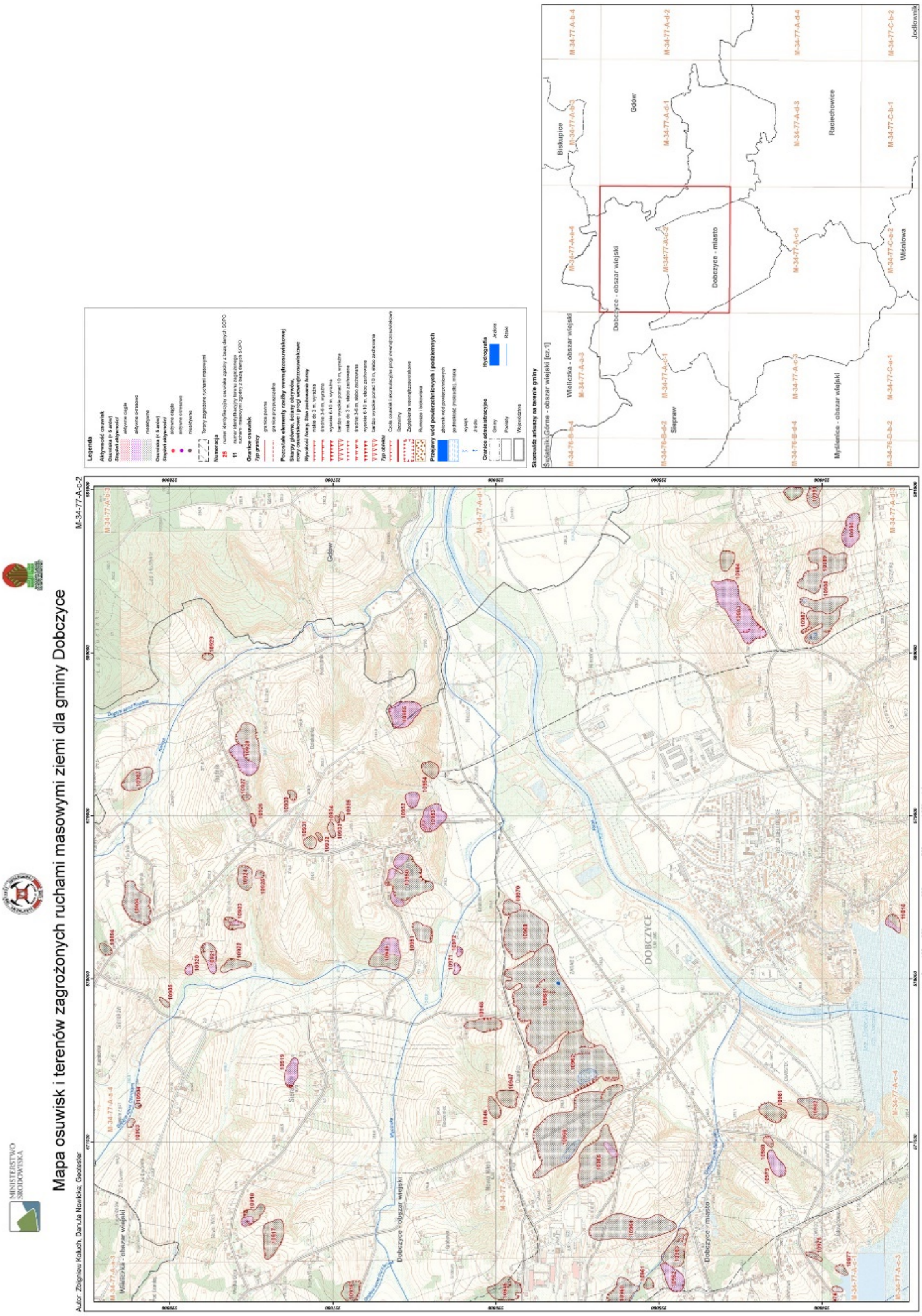

Figure 11 Landslide hazard map for the municipality of Dobczyce (Source: PIG-PIB, 2010)

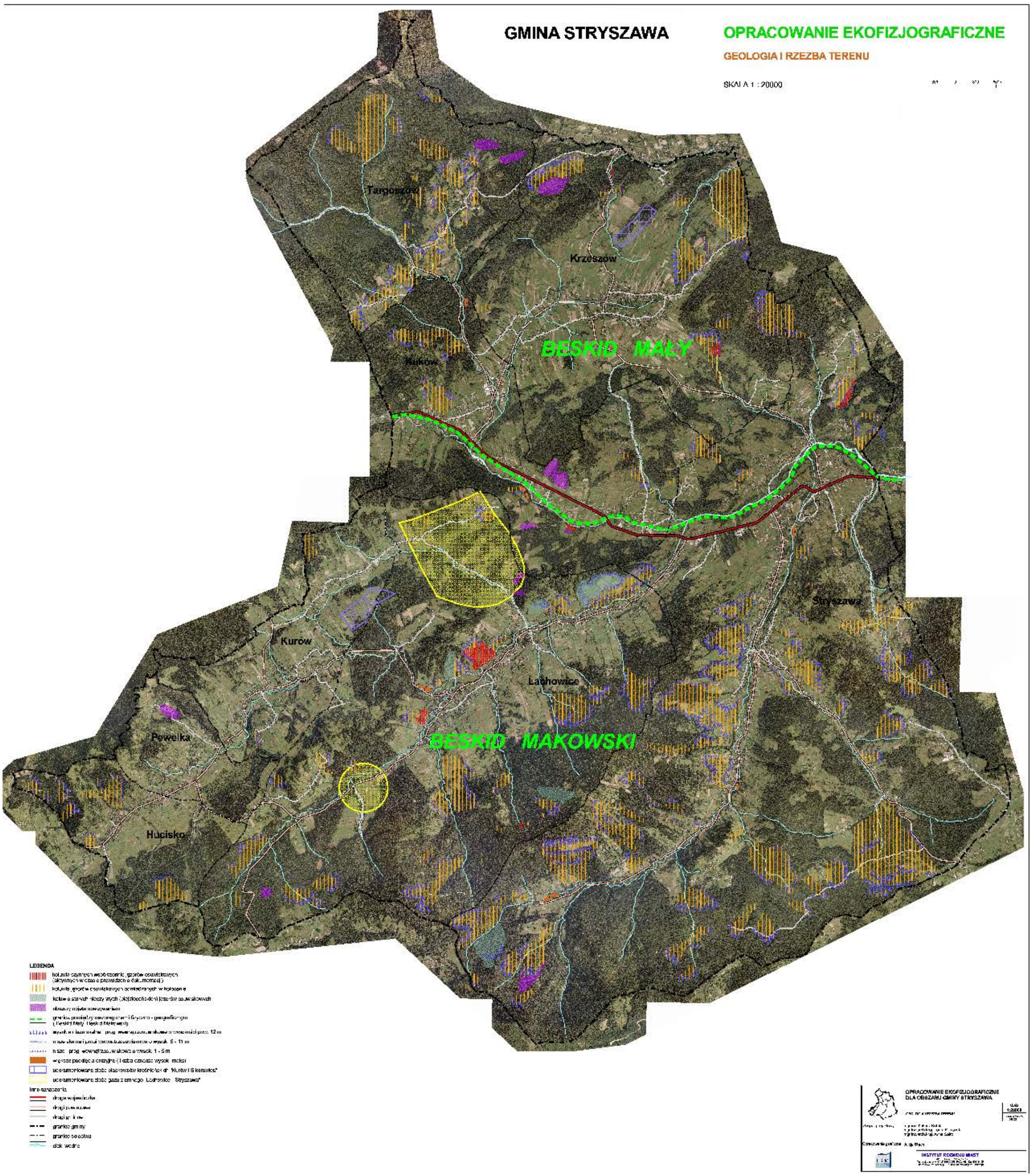

Figure 12 Map of geology and relief for the ekofizjografia of the municipality of Stryzsawa (Source: Instytut Rozwoju Miast, 2012)

2.3 Italian case study site

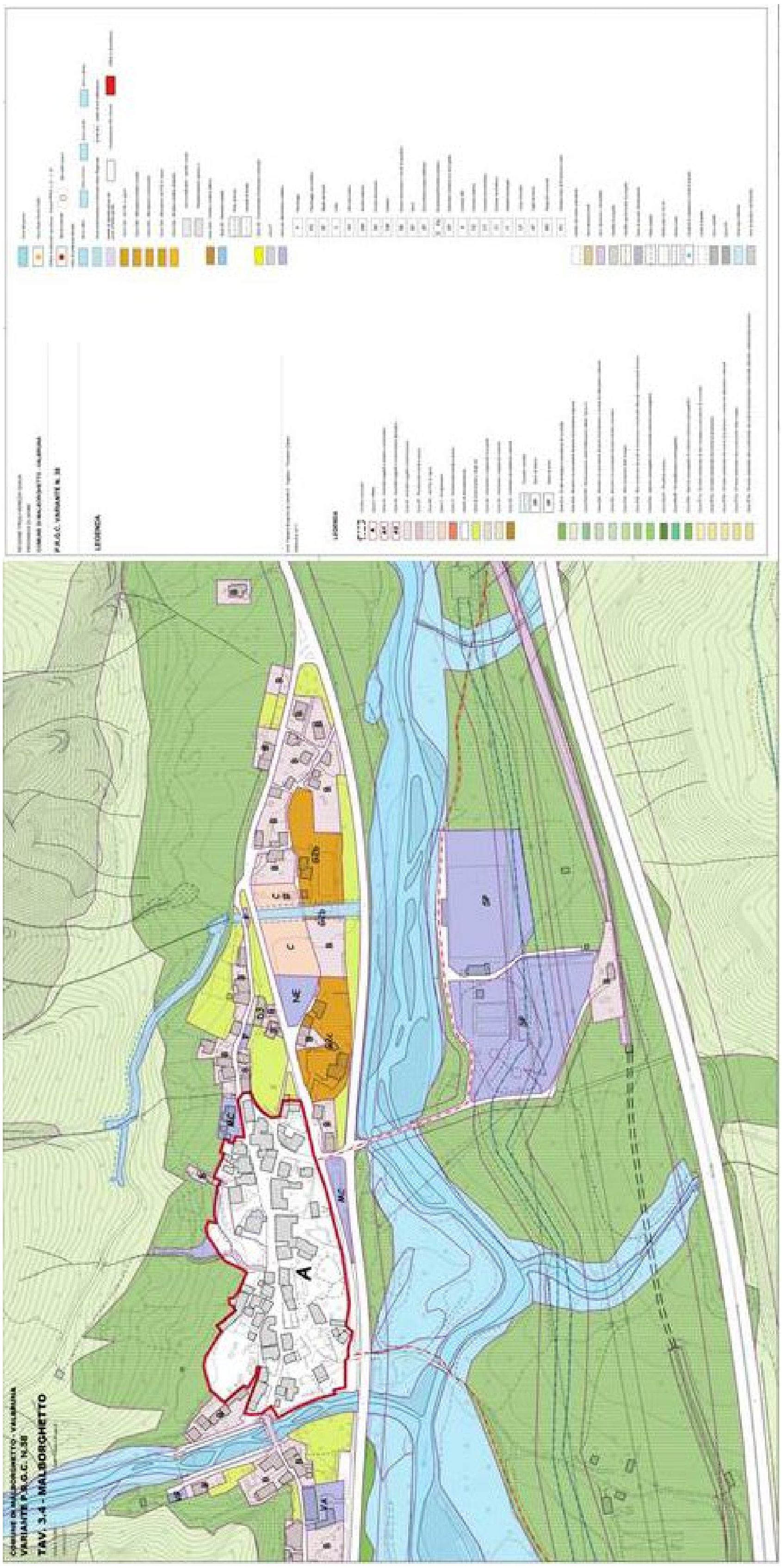

Figure 13 PRGC of Malborghetto-Valbruna, Variante no. 38, Tav. 3.4 – Malborghetto (Source: Comune di Malborghetto-Valbruna, 2011)

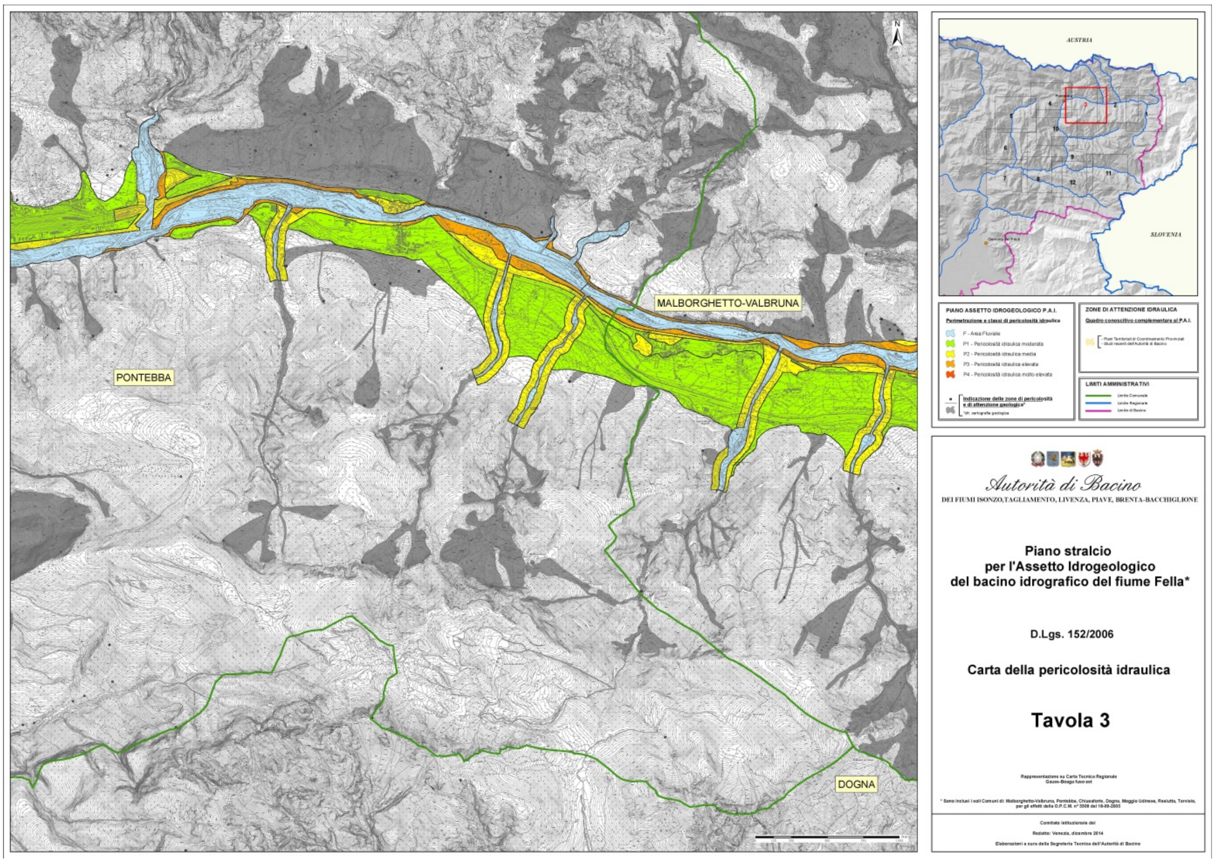

Figure 14 PAI - Map for hydro-geological hazards for the Fella river basin, Table 3 (Source: ADB, 2014b)

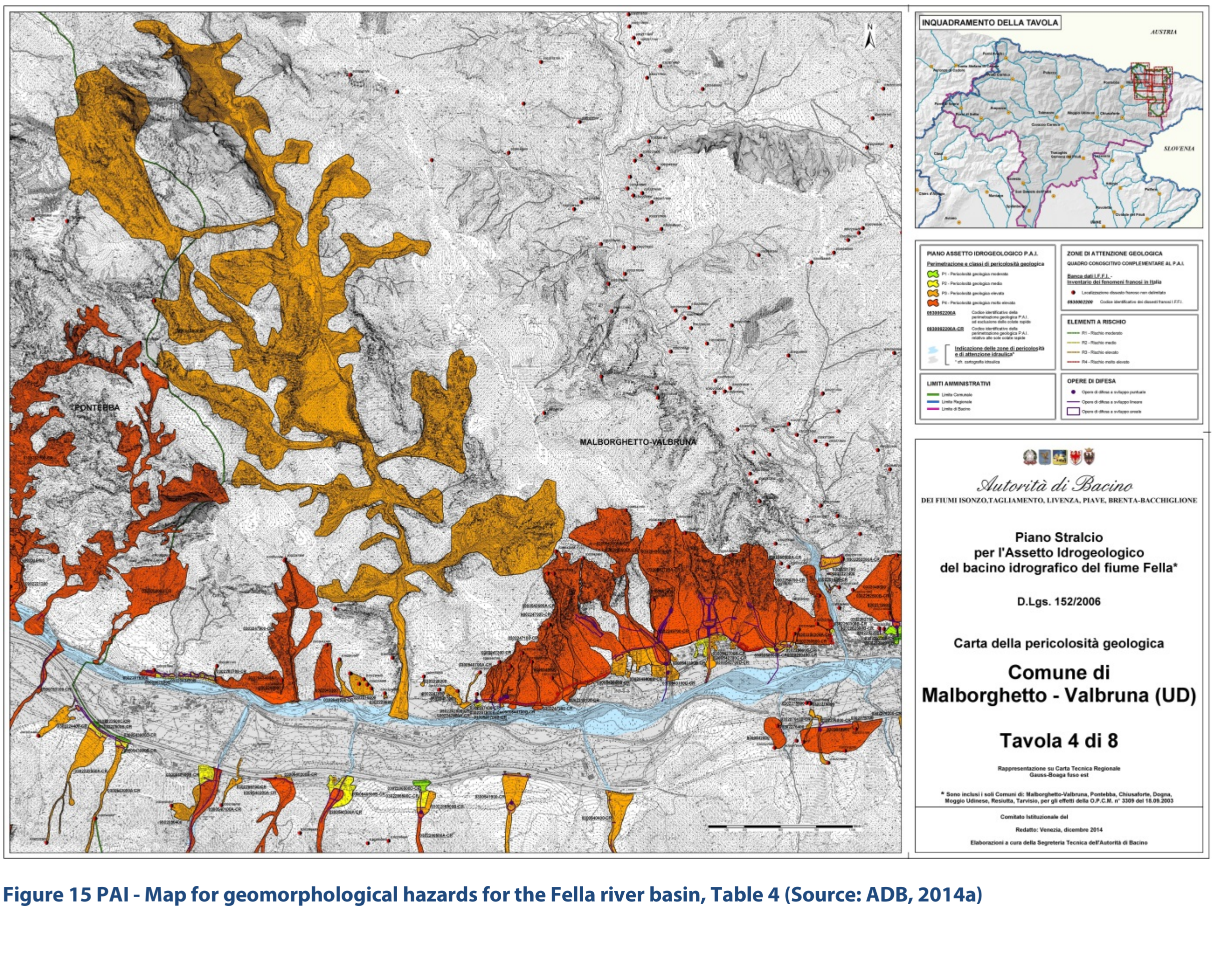

Figure 15 PAI - Map for geomorphological hazards for the Fella river basin, Table 4 (Source: ADB, 2014a)