



EUSALP EU STRATEGY FOR THE ALPINE REGION

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ACTION GROUP 8, EUSALP

Study

NATURAL HAZARD RISK GOVERNANCE

Status Quo in the EUSALP Region

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Federal Ministry
Republic of Austria
Sustainability and Tourism



80 million people, 7 countries, 48 regions,
mountains and plains addressing together
common challenges and opportunities



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Executive Summary

Natural Hazard Risk Governance is a rather new subject of scientific investigation. Managing natural hazards in its understanding of raising the effectiveness and efficiency of the public sector reached its limits. Therefore, there is a need for involving and empowering concerned people and institutions to take care of hazard prevention and handling events themselves. This also means, that there is a need for discussion processes where concerned people and public institutions altogether discuss and negotiate actual solutions and share responsibilities. Therein lies a certain paradigm shift from hazard management, as a more exclusively state lead task, to a governance approach, that is also able to integrate the risk perspective of natural hazards. The scientific discussion reveals the limits of using only design events and hazards probabilities for planning prevention measures, as damage potentials are not considered properly. Therefore, risk as an essential parameter for the whole discussion on how to cope with natural hazards needs to be integrated in practice.

The EU-Strategy for the Alpine Region (EUSALP) aims generally to map governance processes and capacities within the EUSALP perimeter. Action Group 8 started such a mapping for natural hazards with a focus on risk governance. The research cannot provide a holistic evaluation of governance mechanisms in all member states but instead an initial mapping, based on the expertise of the group members. Therefore, workshops with a comparative framework for assessing governance characteristics, qualities and capacities were used to receive a graphical evaluation. Results and critical aspects were discussed within the group and a comparative analysis of the responsibilities and capacities in the existing national management systems were added in the study as a basis for further projects and research.

On the whole, the initial mapping of *Risk Governance* for natural hazards within the EUSALP perimeter showed that the concept of risk gets widely discussed, but is not necessarily seen in connection with governance mechanisms. Risk gets evaluated at the moment concerning the extent it can help improve hazard management, while governance mechanisms are in place on all kind of levels and for different natural hazards. Especially in connection with flood hazards, processes which involve and empower not only institutional stakeholders but also local people or establish a regional perspective were identified. Nevertheless, there does not exist a consistent implementation of the *Risk Governance* as a concept throughout the EUSALP region. Action is instead carried by initiatives on all kind of levels and within the public as well as private sector to overcome limitations of an exclusively state-centered management approach of natural hazards. To sum up, there exists still a big potential to foster risk governance by integrating concerned people and intuitions in discussions and negotiations on measures for preparedness, response and recovery and to share responsibilities.

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List of abbreviations

ACPDR	Administration of the Republic for Civil Protection and Disaster Relief (<i>Uprava RS za zaščito in reševanje, Slovenia</i>)
AG8	Action Group 8
AlpGov	Project for implementing Alpine Governance Mechanisms of the European Strategy Alpine Region
ACPDR	Administration of the Republic for Civil Protection and Disaster Relief (<i>Uprava RS za zaščito in reševanje, Slovenia</i>)
APSFR	Areas of Potentially Significant Flood Risk
ARE	Federal Office for Spatial Planning (<i>Amt für Raumentwicklung, Switzerland</i>)
BABS	Federal Office for Civil Protection (<i>Bundesamt für Bevölkerungsschutz, Switzerland</i>)
BAFU	Federal Office for the Environment (<i>Bundesamt für Umwelt, Switzerland</i>)
BauGB	Building Code (<i>Baugesetzbuch, Germany</i>)
BayWG	Bavarian Water Act (<i>Bayrisches Wassergesetz, Germany</i>)
BMLFUW	Federal Ministry of Agriculture, Forestry, Environment and Water Management (<i>Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria until 2018</i>)
BMNT	Ministry for Sustainability and Tourism (<i>Bundesministerium für Nachhaltigkeit und Tourismus, Austria</i>)
bmvit	Ministry for Transport, Innovation and Technology (<i>Bundesministerium für Verkehr, Innovation und Technologie, Austria</i>)
BWV	Flood Control Management (<i>Bundeswasserbauverwaltung, Austria</i>)
CMI	Joint Flood Commission (<i>Commission Mixte Inondation, France</i>)
COZ	Zonal Operation Centre (<i>Centre Opérationnel de Zone, France</i>)
CLV	Local Avalanche Committees (<i>Commissioni Locali Valanghe, Italy</i>)
CPER	State-Region Planning Contract (<i>Contrat de Plan Etat – Région, France</i>)
DGPR	General Directorate for Prevention of Risks (<i>Direction Générale de la Prévention des Risques, France</i>)
DCP	Department of Civil Protection (<i>Amt für Bevölkerungsschutz, Liechtenstein</i>)
DPC	Department of Civil Protection (<i>Dipartimento della Protezione Civile, Italy</i>)
DRG	Disaster Risk Governance
DRM	Disaster Risk Management
DRMKC	Disaster Risk Management Knowledge Centre
DRR	Disaster Risk Reduction
DSC	Directorate of Civil Defence and Security (<i>Direction de la coopération de sécurité et de défense, France</i>)
DTADD	Spatial development directive (<i>Directive territoriale d'aménagement et de développement durables, France</i>)
EC	European Commission
EU	European Union
EUSALP	EU-Strategy for the Alpine Region
FAC	Federal Alarm Centre (<i>Einsatz- und Krisenkoordinationscenter, Austria</i>)
FCMB	Federal Crisis Management Board (<i>Bundesstab Bevölkerungsschutz, Switzerland</i>)
FRMP	Flood Risk Management Plan
HORA	Natural Hazard Overview & Risk Assessment Austria
IGRC	International Risk Governance Council

IMELS	Ministry of Environment, Land and Sea (<i>Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Italy</i>)
IPCC	Intergovernmental Panel on Climate Change
ISPRA	Italian Institute for Environmental Protection and Research (<i>Istituto Superiore per la Ricerca Ambientale, Italy</i>)
LAINAT	Steering Board Intervention Natural Hazards (<i>Lenkungsausschuss Intervention Naturgefahren, Switzerland</i>)
LEP	Spatial Development Programme (<i>Landesentwicklungsprogramm, Germany</i>)
LfU	Bavarian Office for Environment (<i>Landesamt für Umwelt, Germany</i>)
MEDDTL	Ministry of Ecology, Sustainable Development, Transport and Housing (<i>Ministère de la Transition écologique et solidaire, France</i>)
MOI	Ministry of Interior (<i>Ministrstvo za Notranje Zadeve, Slovenia; Innenministerium, Austria</i>)
NGO.....	non-governmental organisation
NHM.....	natural hazard management
NPO	non-profit organisation
OECD.....	Organisation for Economic Development and Cooperation
ÖROK	Austrian Conference on Spatial Planning (<i>Österreichische Raumordnungskonferenz, Austria</i>)
ÖREK.....	Austrian Spatial Development Concept (<i>Österreichisches Raumentwicklungskonzept</i>)
OWARNA.....	Optimisation of disaster warning and alerting (<i>Optimierung von Warnung und Alarmierung vor Naturgefahren, Switzerland</i>)
PAI	risk management plans (<i>Piano di assetto idrogeologico, Italy</i>)
PAPI.....	Action Programmes for Flood Prevention (<i>Programmes d'action de prévention des inondations, PAPI</i>)
PCS.....	municipal security plan (<i>Plan communal de sauvegarde, France</i>)
PLANALP	Natural Hazards Platform of the Alpine Convention
PLU	local land-use plan (<i>Plan local d'urbanisme</i>)
PPR.....	risk prevention plan (<i>Plan de prevention des risques naturels prévisibles, France</i>)
RBA.....	River Basin Authority
RBP.....	River Basin Plan
RSA.....	Report on the state of the Alps
RTM	Office for Mountain Service (<i>Restauration de terrains en montagne, France</i>)
SCOT	strategic land-use plan (<i>Schéma de coherence territoriale, France</i>)
SFDDR.....	Sendai Framework for Disaster Risk Reduction
SIA	Swiss Society of Engineers and Architects (<i>Schweizerischer Ingenieur- und Architektenverein, Switzerland</i>)
SRADT.....	Regional development plan (<i>Schéma regional d'aménagement et de développement du territoire, France</i>)
SSC.....	Sectoral development plan (<i>Schéma de services collectifs, France</i>)
UN.....	United Nations
WHG	Federal Water Act (<i>Wasserhaushaltgesetz, Germany</i>)
WLV	Austria Service for Torrent and Avalanche Control (<i>Wildbach- und Lawinenverbauung, Austria</i>)
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research (<i>Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft, Switzerland</i>)

1 Introduction

Governance as a concept to achieve good and accepted solutions in planning processes has gained an extensive focus by public authorities over the past decades. Following sectoral procedures only and excluding other relevant authorities as well as concerned people, faces certain limitations and holds also low potential to develop innovative solutions. In the professional field of **Natural Hazard Management (NHM)**, the state, represented by different public authorities, raises the level of safety for the population, thinks of ecological qualities and at the same time has to safeguard future development potentials. Coordinating relevant authorities on a national and international level to raise the efficiency of administrative procedures, has gained major attention in hazard management as well. Plenty of research on hazard management in the Alps has been conducted and information and findings for further discussions as well as evaluation have been created.¹

Nevertheless, management assignments of public authorities have their limitations and tend to exclude certain stakeholders such as concerned people, non-governmental organisations or municipalities. The concept of **Risk Governance** can help to shift the perspective, to firstly base decision-making processes on risk rather than hazard-based evaluations only and secondly to open up administrative procedures to a broader, more inclusive and transparent discussion. Risk governance mechanisms should create the possibility to involve relevant stakeholders on a bottom-up guided cooperative basis. In fact, risk governance takes place concerning managing natural hazards, but research has just recently started to pay attention to the linkage of natural hazard risk with governance mechanisms and the international discussion in this specific governance application is evolving at the moment as well. Generating a common understanding and perception of governance as well as risk poses a certain challenge. At the same time the qualitative evaluation of governance processes is demanding and it takes time for research outcomes to be considered in the regulatory framework for hazard management.

Mapping the status of **Natural Hazard Risk Governance** within the boundaries of the EUSALP region is a first step to promote an international exchange of expertise and can help to develop and shape more sophisticated and practical governance solutions to lower vulnerability and raise resilience of settlements and infrastructure.

The Division III/5, Austrian Service for Torrent and Avalanche Control (WLV) at the Austrian Federal Ministry for Sustainability and Tourism leads together with the co-lead, the Bavarian State Ministry of the Environment and Consumer Protection (Unit 56 - Water resources management in rural areas, water body ecology, torrent control; Unit 61 - Flood protection and alpine natural hazards), the EUSALP Action Group 8 for the period 2016-2019. According to the EUSALP objectives, it was decided to set a work package focus on mapping governance processes in the field of Natural Hazard Management and facilitate thereby to the objective 4 of the EUSALP strategy². To achieve this aim, the Technical University of Vienna was invited to contribute to this work package by carrying out a comparative study on the status of Natural Hazard Risk Governance in the EUSALP region.

¹ Specific funding programmes by the European Union like the Alpine Space programme help to carry out research and cooperative activities. Online: <http://www.alpine-space.eu>, 27.02.2018.

² Objective 4 – Improving cooperation and the coordination of action in the Alpine Region. Online: <https://www.alpine-region.eu/objectives>, 18.08.2017.

The authors of the study proposed following structure consisting of **four work packages** that frame the research:

[1] Natural Hazard Management and Risk Governance: The first part of the study aims to provide a comprehensive overview of relevant institutions and responsibilities in the field of natural hazard management. The focus is set on the area covered by EUSALP and captures a mainly national perspective, since a comparison on a regional level would be too extensive. The examined natural hazards are only those who are relevant for alpine areas, can be delimited in maps (**floods, avalanches, torrents, rockfall, landslides**) and are relevant for governance processes. The analysed governance aspects are set in the field of preventive measures and therefore determine a certain focus. Only institutions and responsibilities that are working with the listed hazards will be displayed. The basic differentiation will be undertaken by the characteristics of measures (**spatial planning, structural/non-structural measures, disaster control**).

This work package will be complemented by a presentation of existing hazard and risk maps throughout the EUSALP region as information on hazards/risks is an essential basis for developing preventive measures and have a well-grounded basis for decisions.

[2] Prevention and Governance: This work package aims to provide a governance mapping on the existing governance aspects within procedures and coordination towards the implementation of preventive measures. The assessment on the status quo of risk governance is made by experts in workshops within EUSALP AG8 meetings as well as guided feedback loops within national delegations

[3] Risk Governance – Good Practice: Due to the fact that governance aspects can be found in almost every normative procedure to a certain extent, one aim of the study is to display good practice examples from every member state within the EUSALP region to depict the characteristics, capacities and qualities of governance concerning the implementation of measures to reduce risks and raise resilience. The good practice examples are provided by the PLANALP working group of the Alpine Convention.

[4] Supervision: The authors of the study are external experts, participating in the EUSALP AG8 (until 09/2018) and are assigned to gather relevant publications, conduct workshops, give expert input and document the risk governance status quo analysis via this report.

The EUSALP perimeter represents the study area which includes 48 regions of eight nations. The study considers national as well as regional/provincial specifics on hazard management and risk governance to a certain extent. The basic comparative framework for identifying relevant institutions and their responsibilities gets depicted on a vastly general level, aiming to identify national specifics and provide a comparative overview. Monaco is not included in the comparative analysis, due to its size and minimal exposure to the relevant natural hazards no relevant contributions would have been possible.

Figure 1: EUSALP – EU Strategy for the Alpine Region



Source: EC, 2017a.

The EUSALP action groups are fairly new platforms. AG8 was established in close cooperation with the existing working group on natural hazards PLANALP of the Alpine Convention to take advantage of existing networks and expertise. The upcoming 7th Report on the State of the Alps of the Alpine Convention is dealing with risk governance as well and makes use of the common knowledge in both working groups to achieve valuable and relevant outcomes.

1.1 International Framework and Guidelines

There are extensive scientific and political discussions on aspects of natural hazard mitigation, disaster risk management and risk reduction on global, regional as well as local level. Especially on international level specific strategies and policies have been formulated. The necessity for action derives partly from the simple fact that the number of people exposed to natural and other hazards is growing, because of a general growth of population, rapid urbanisation and climate change. Therefore, adaptation and management strategies on all institutional levels are needed and also the integration of concerned people and local stakeholders gain in importance.

UNITED NATIONS – SENDAI FRAMEWORK

The United Nations and their special agencies have a tradition of developing frameworks and guidelines on a global level to foster a sustainable development and reduce different natural, societal and technical risks.³ The first global referential framework dealing with disasters was the **Hyogo Framework for Action 2005-2015**, adopted in 2005 during the 2nd World Conference on Disaster Reduction.⁴ Following the Yokohama Strategy from 1994, the overall idea of the Framework was to reduce disaster risks through systematically integrated policies, plans and programmes on all levels. The five specific objectives were:

- Conclude and report on the review of the Yokohama Strategy

³ e.g. Millennium Development Goals (<http://www.un.org/millenniumgoals/>, 27.02.2018), Sustainable Development Goals (<http://www.un.org/sustainabledevelopment/sustainable-development-goals/>, 27.02.2018), New Urban Agenda (<http://habitat3.org/the-new-urban-agenda/>, 27.02.2018).

⁴ United Nations, 2005.

- Identify specific activities aimed at implementing relevant provisions of the Johannesburg Plan
- Share good practices and lessons learned to further disaster reduction
- Increase awareness of the importance of disaster reduction policies
- Increase the reliability and availability of appropriate disaster-related information to the public and disaster management agencies⁵

Enhancing governance for disaster risk reduction is within the Hyogo Framework for Action 2005-2015 one aspect in the general considerations of the priorities for action 2005-2015. In 2015 the Hyogo Framework was followed by the **Sendai Framework for Disaster Risk Reduction 2015-2030** (SFDDR)⁶ extending the planning horizon to 15 years and taking lessons learned from the Hyogo Framework into account. In fact, disasters continued worldwide to take a heavy toll. Between 2005 and 2015, more than 700 thousand people have died and approximately 23 million have lost their homes as a result of disasters.⁷ Natural disasters are accountable for a large share of fatalities⁸ and economic losses. The urgent need for enforcing the disaster reduction framework to effectively protect people, communities and countries, their livelihoods, health, cultural heritage, socioeconomic assets as well as ecosystems was obvious.⁹ The four identified key priorities for action are:

- (1) Understanding disaster risk
- (2) Strengthening **disaster risk governance** to manage disaster risk
- (3) Investing in disaster risk reduction for resilience
- (4) Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction¹⁰

Interestingly, disaster risk governance (DRG) experiences, in comparison to the Hyogo Framework, receive a certain focus and enhancement. DRG is identified to be of great importance on regional, national and global levels to manage disaster risk effectively and efficiently. It is further proposed that “clear vision, plans, competence, guidance and coordination within and across sectors, as well as participation of relevant stakeholders, are needed”.¹¹ To achieve the prioritized aim, measures on national and local, as well as on global and regional levels, are identified. This also means that the framework can be applied worldwide to all kinds of regions and disaster risks. The Alps are a region of special interest to disaster risk reduction. Firstly, the topography poses a limiting factor to anthropocentric land uses. Human needs have to be fulfilled on a small share of land. All kind of activities such as housing, agriculture, manufacturing, recreation, mobility etc. take place mostly in narrow valley floors. This leads to a situation of intensified conflicts in land uses and raises disaster risk widely due to the proximity of potential hazardous land uses to residential areas etc. Secondly, a multitude of different natural hazards poses a serious threat to lives and property in many places. Most important for the central alpine areas of Europe are avalanches, debris flows, floods, rockfall and landslides. In addition, upstream-downstream relations play an important role and intense human activities in upstream areas lead to changing disaster risk in

⁵ United Nations, 2005, p. 3.

⁶ United Nations, 2015.

⁷ United Nations, 2015, p. 10.

⁸ e.g. the tsunami on the 26th of December 2004 alone killed more than 230.000 people and the tragedy of a failing warning and evacuation system became obvious. Timeline of the event online: <http://www.zeit.de/wissen/umwelt/2014-12/tsunami-indischer-ozean-flutwelle-jahrestag>, 12.09.2018.

⁹ United Nations, 2015, p. 10.

¹⁰ United Nations, 2015, p. 14.

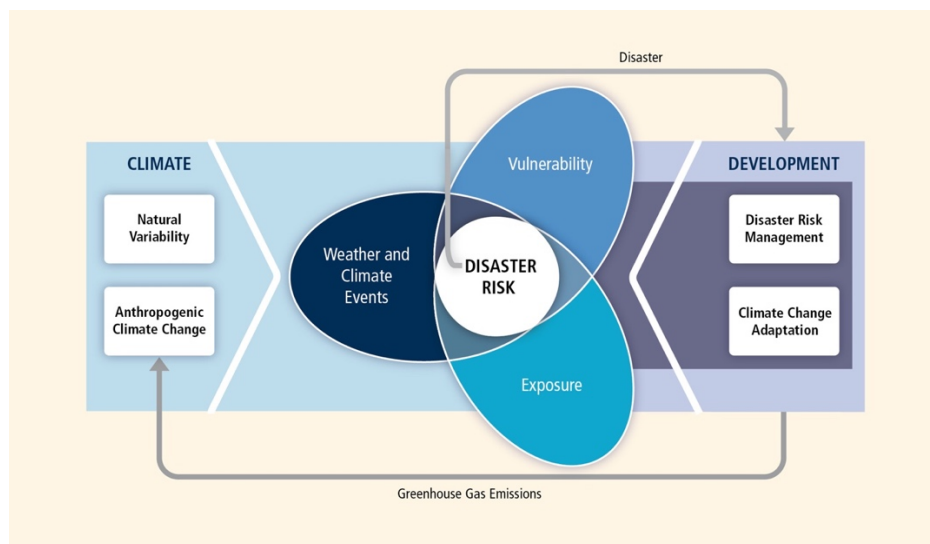
¹¹ United Nations, 2015, p. 17.

downstream communities. The SFDDR does not promote a completely new approach to disaster risk reduction thinking of all the policies and efforts already in place in the EUSALP region but provide a global framing for the shift to a more integrated and risk-based management of disasters.¹²

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Coming from a climate change perspective, the Intergovernmental Panel on Climate Change (IPCC) is contributing to the **Disaster Risk Reduction (DRR)** discussion as well. Figure 2 illustrates the core concept of the Special Report on Managing the Risk of Extreme Events and Disasters to Advance Climate Change Adaptation.¹³ The concept clearly depicts the linkage of human development to a changing climate and a resulting shift in disaster risk that needs effective counter policies.

Figure 2: Disaster Risk definition by the IPCC



Source: IPCC, 2012, p. 2.

The dimensions of DRR lead to the conclusion that policies and measures to reduce the actual disaster risk are most efficient when addressing not only singular fields, but instead foster combined approaches taking different perspectives into account and also set a certain focus on risk governance. This especially means not to involve only established institutions that have legal obligations in hazard management but instead all kind of relevant stakeholders that could contribute to a higher resilience or lower vulnerability and exposure. Such actors could be e.g. farmers, that change the crop rotation or employees in skiing resorts that replant skiing slopes. The sum of many individual measures definitely makes a difference on the large scale. It is furthermore important to implement measures that produce co-benefits in the first-place, that help address other development goals (improvements in livelihoods, human well-being, biodiversity preservation, minimized the scope for maladaptation). These so called “low regret measures” include in relation to natural hazards for example a warning system, risk communication, land use planning as well as land and ecosystem management.¹⁴

¹² WAHLSTRÖM, 2015.

¹³ IPCC, 2012.

¹⁴ IPCC, 2012, p. 14.

EUROPEAN UNION

The efforts in the field of disaster risk reduction within the European Union are numerous and manifold. In fact, there are two policies to be distinguished. First, the regulation and harmonisation of national policies by legal acts, such as regulations which are directly binding for the member states and directives that need transformation in national laws. Second, the facilitation of integrative efforts funded by a set of research, application programmes and macro-regional strategies that aim at intensifying international cooperation and communication.

The EU Strategy for the Alpine Region is a fairly new integrative framework endorsed by the European Council to address common challenges in the Alpine area. Nine different thematic action groups are working on topics related to three action-oriented thematic policy areas (Economic Growth and Innovation, Mobility and Connectivity, Environment and Energy) and one cross-cutting policy area (Governance, including Institutional Capacity).¹⁵ By installing Action Group 8 – working to improve risk management and to better manage climate change including major natural risk prevention – disaster risk reduction and risk governance receive certain attention in the strategy. Supported by the AlpGov funding programme, the implementation of “Alpine Governance Mechanisms” of the EUSALP region is a major focus.

Thinking of regulations and directives, the **Flood Directive**¹⁶ of 2007 takes a crucial role as starting point for a shift of national policies, harmonisation of measures and international exchange within the European Union. First of all, flood risk as a term gets defined as “...combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event”¹⁷ and thereby helps to generate a common understanding and promotes a risk based flood assessment and management. Based on Flood Hazard Maps and Flood Risk Maps, every member state did develop a Flood Risk Management Plan for areas with potentially significant flood risk (APsFR).

On the policy level of the European Union DRR plays an important role as well. The Commission’s department for European Civil Protection and Humanitarian Aid Operations is active worldwide with actual projects and funding in different fields with DRR being an important one.¹⁸ The European Commission also quite recently introduced a new science hub, the **Disaster Risk Management Knowledge Centre**, which is a focal point of reference in the European Commission and supports the work of the member states as well as European Commission services within and beyond the EU. The recently published *Science for Disaster Risk Management* report illustrates the need for an intense exchange on scientific as well as practitioners’ level on DRR and disaster risk management to share ideas and solutions.¹⁹

ALPINE CONVENTION

The Alpine Convention is an impressive example of managing common problems and challenges in the Alps in a comprehensive manner. Based on international treaties between

¹⁵ EUSALP, 2017.

¹⁶ Directive 2007/60/EC of the European Parliament and the Council of 23 October 2007 on the assessment and management of flood risks.

¹⁷ Art. 2 Directive 2007/60/EC.

¹⁸ Online: http://ec.europa.eu/echo/what/humanitarian-aid/risk-reduction_en, 08.01.2019.

¹⁹ DRMKC, 2017.

the Alpine Countries Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia, Switzerland and the EU it encompasses besides the framework convention nine specific protocols and two ministerial declarations. Deriving from ideas and intense discussions in the 1980s, the convention entered into force in 1995 and represents a legally binding international treaty for the protection of the Alps and a well-adjusted sustainable development.²⁰ References to the danger that natural hazards pose, can be found throughout the treaties text. Natural hazards appear to be especially linked to spatial planning²¹, mountain forest management and climate change adaptation. The conventions protocols indicate the necessity of an integrative approach to dealing with risks and effects of natural hazards. Governance as a term though is only mentioned once stating that the "...participative method of risk governance in the planning process" should be used to reinforce the adaptation capacity to climate change.²² The convention itself provides a rather rigid legal framework but already includes the idea of integrative, inter-sectoral efforts in dealing with natural hazards.

All in all, natural hazards are at the moment intensively discussed in connection with climate change and necessary adaptation in many fields. In the Alps, changing hazard intensities and higher probabilities for certain events can be observed already scientifically. Every member state within the EUSALP region has already established a state led hazard management system. This management system is composed of many different tasks that are normally performed by public authorities and follows established legal regulations. These regulations are generally based on an administrative top-down approach for planning and implementing countermeasures. The above listed frameworks, guidelines and policies pose to a certain extent a challenge to national regulatory frameworks demanding diversification of instruments and an adaptation to modern principles of government. In the first place, this means fostering governance and bottom-up strategies that involve relevant stakeholders from different levels and backgrounds. Another fairly new aspect is the shift in perception from hazard zones to risk evaluations, that takes potential harm and damages into account and changes the decision-making processes extensively.

1.2 Governance

The term governance nowadays seems to be omnipresent in politics and administration. Legal regulations are sensed to be not efficient and sufficient, so other ways of coordination, cooperation and negotiation need to be established. The term governance derives from political science and found its way to actual and recent political discourses. Nations are challenged by the complexity of social issues that simply cannot be met with inflexible hierarchical structures only. The plurality of competing interests and preferences needs "...horizontal coordination and cooperative policy-making cutting across institutions, sectors and territories."²³ This vertical and horizontal dimension including all kind of relevant stakeholders is essential to governance. Constructing policy networks and collaborative relations, besides formal procedures, recognises the need for alternative governing structures. Following aspects concerning structures, actors and modes of policy-making are most relevant for understanding governance:

²⁰ Alpine Convention, 2010.

²¹ e.g. Protocol: Spatial Planning and Sustainable Development: Art. 8 2 e) "...determining the areas subject to natural hazards, where building of structures and installations should be avoided as much as possible".

²² Alpine Convention, 2010, p. 191.

²³ BENZ and PAPDOPOULOS, 2006, p. 2.

- **Boundaries of decision structures:** are defined in functional terms and not so much in territorial dimensions
- **Different actors:** such as experts, public actors and representatives of private interest
- **Collective actors:** consisting of individuals, that formulate issues and preferences
- **Plurality of decision centres:** within the governance process with a lack of a formalised clear hierarchy
- **Decision-making:** with less formal modes, that can be itself part of the negotiation within the process²⁴

Governance can therefore be described through attributes such as network-like, non-hierarchical, flexible, boundary-spanning or non-governmental. Nonetheless, public institutions usually have an important role by setting the framework conditions and defining accredited actors and aims of governance processes. So, the "...interplay of formal and informal patterns...constitutes the dynamics of governance."²⁵ The possible application of the governance concept is manifold and besides the theoretical discussion put actively to the test in connection with different state assignments. Governance is often perceived as a strategy in settling conflicts but can more interestingly be used to develop holistic and accepted solutions for challenging tasks such as the protection of the people against the effects of natural hazards. The use of the term governance in this report will due to the research topic strongly focus on the dimension of public administration. There is a wide discussion on how to define and characterise governance. Does the term just supplant 'government' or does it really have a distinct meaning? Governance as a cooperative organisation of the state in government reforms became on vogue especially in the 80's/90's and besides implementation a huge focus in research work on governance took place.²⁶ This explains the variable understanding of the term governance depending on the field it is used in. The term itself was introduced in political science in the 1930s and described the vertical as well as the horizontal structures of coordination and interaction within companies nowadays known as corporate governance.²⁷

The implementation of preventive measures against the effects of natural hazards is basically a state assignment and has a strong institutional and legal framework. Nevertheless, the outcomes of these elaborate procedures are not flawless and so governance as an alternative concept of steering and coordinating relevant actors has found its way into the public sector. Essential in this context is the term "good governance", which brings a normative meaning to governance and aims to improve the way of governing as well as to reduce state commitment in favour of civil society.²⁸ The concept of state organisation shifted from the 90s on towards an inclusive "active state" in many nations with a certain institutionalisation of participation and governance and outpacing management ideas deriving from business administration.²⁹ Governance as an approach can be implemented on different levels, such as local, regional, national or transnational as well as in different sectors. This makes governance ubiquitous nowadays within public administration. As opposed to the management approach that tries to raise efficiency, governance aims to involve relevant stakeholders and develop innovative and accepted solutions for certain challenges. Main constraints are the selection of relevant stakeholders as well as the mode of operation. Because governance in public administration

²⁴ BENZ and PAPDOPOULOS, 2006, p. 3.

²⁵ BENZ and PAPDOPOULOS, 2006, p. 3.

²⁶ RHODES, 2000, p. 55ff.

²⁷ BENZ, 2004, p. 15.

²⁸ BENZ, 2004, p. 18.

²⁹ JANN and WEGRICH, 2004, p. 196ff.

usually aims to develop solutions for clearly defined assignments within a certain time period, the process design is strongly influenced by official institutions. This initial process design can lead to criticism regarding the transparency and legitimation of the initiators.

Governance is used at different levels. Relevant for this study are especially the regional and local implementations. Regional governance has a broad application within subnational cooperation and coordination exceeding administrative boundaries. Therefore, regional governance is usually not embedded in existing institutional frameworks but uses rather different institutional networks to develop solutions for challenges in spatial development. Concerning land use planning municipalities have widely a planning monopoly and regional coordination poses an important task.³⁰ Local governance can usually be seen as set within the boundaries of municipalities that aims to include the local people into public assignments by participatory approaches.³¹ This local governance is especially at risk to try and raise legitimacy and efficiency of decisions within the administration by participation and perceive the involvement of people as consultation instead an integrative part in the decision finding process.³² When analysing governance processes, looking at different levels and institutional frameworks is essential for the understanding. The methodology will provide a model that will help to do so and take a closer look at risk governance in the field of natural hazard management.

On the whole “governance” is not a single theory or model with everlasting principles and characteristics. It is rather a vague and inclusive concept with different approaches and theories and therefore finds application in a variety of fields in which aim to analyse complex structures of collective action.³³

1.3 Natural Hazard Risk Governance

Governance in the context of natural hazards and risks poses a rather new perspective in science as well as actual practice. Risk as a product of probability and potential costs/loss of money or even lives is a well-established concept in various sectors. Insurances base their decisions on risk calculations, economic activities that mean a certain threat to society and the environment (e.g. oil production, mining) or the management of nuclear power plants use the risk governance concept. Managing the effects of natural hazards on human activities is therefore one possible area of application. In most central European nations, NHM experiences a shift in understanding towards risk based decision-making processes. Risk becomes a more and more established concept as basis of evaluating the efficiency and effectiveness of state interventions such as the implementation of preventive measures against natural hazards. Especially referring to coastal hazards (Tsunamis, sea level rise etc.) there are numerous publications and even specialised scientific journals such as the “Journal of Risk and Governance”. The focus on risk governance in NHM in central Europe is comparatively new because national regulatory frameworks have already been existing for a long time. However, especially in the Alps, research focuses increasingly on risk in the context of climate change mitigation and adaptation. An integrative analysis on natural hazard risk governance though, does not exist so far. To generate a common understanding and clarify the meaning of terms, the current state of research will be briefly discussed.

³⁰ WALK, 2008, p. 42f.

³¹ WALK, 2008, p. 44ff.

³² WALK, 2008, p. 51.

³³ BENZ, 2004, p. 27.

RISK GOVERNANCE

Like the previous discussion on governance has shown, the understanding of risk governance is based on an extensive international exchange of ideas and perspectives. Therefore, there is no mutual common understanding and definition of the concept. Thinking of natural hazards, the actual threat can be experienced by the concerned people directly and constantly. Past events shape the common memory, risk awareness and strongly involve local people and communities. A possible definition by Bruna de MARCHI states, that risk governance "...can be described as the various ways in which all interested subjects manage their common risk affairs...".³⁴ This definition is rather simple, but holds the essential two parameters for risk governance: A common problem of concerned stakeholders (local people, authorities, NGOs etc.) and a permanently evolving discussion and negotiation network that helps to deal with expected negative effects. The discussion on risk governance is now not only taking place in sectoral perspectives but also on different spatial levels.

In the international discussion, the Organisation for Economic Co-operation and Development (OECD) sets a focus on risk governance and published recommendations on the governance of critical risks. The OECD council recommends "...that Members establish and promote a comprehensive, all-hazards and transboundary approach to country risk governance to serve as the foundation for enhancing national resilience and responsiveness".³⁵ To achieve this goal, national strategies should be adopted and leadership at national level has to be assigned. Partnerships with the private sector should be established and the awareness of critical risk needs to be raised to mobilise households, business and international stakeholders to attract investments in risk prevention and mitigation.³⁶ Besides the general recommendations, the OECD also provides good practice examples from different member states on its homepage.³⁷

The scientific discussion on risk governance is diverse and contradictory to some extent. In the context of this study, governance is understood as the multitude of actors and processes that negotiate collectively binding decisions and risk governance translates this principle to risk-related policy making. Thinking of natural hazards, a rather simple risk perception based on the product of probability and effects is reasonable while many other societal risks are far more complex and can only be analysed in a systemic way.³⁸ To mainstream the international discussions on risk governance, the non-profit foundation for International Risk Governance Council (IRGC) was established.³⁹ The network provides basic information, publications and a risk governance framework. This framework basically distinguishes between analysing and understanding a risk and provides a comprehensive and flexible toolkit to help identifying, understanding and addressing essential parameters in risk governance processes. (see Figure 3)

Figure 3: IGRC Risk Governance Framework

³⁴ MARCHI, 2015, p. 150.

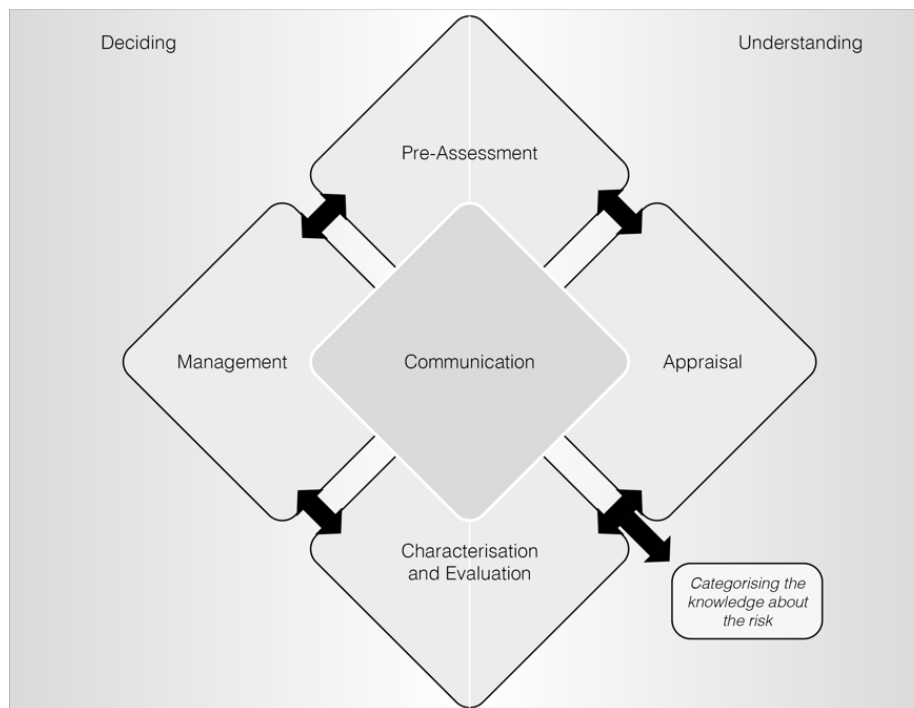
³⁵ OECD, 2014, p. 4.

³⁶ OECD, 2014.

³⁷ OECD, 2017.

³⁸ RENN et al., 2011.

³⁹ IGRC, 2017.



Source: IGRC, 2012, p. 8, own adaptation.

Aside from international discussions, national efforts to establish risk as a valuable concept to develop innovative solutions and for decision making are in progress. Especially in the context of climate change adaptation national strategies have been formulated and adapted. Switzerland passed a National Adaptation Strategy in 2012.⁴⁰ Austria adopted in the same year the Austrian strategy for adaptation to climate change.⁴¹ Risk management and reduction is omnipresent in these strategies and represent a central theme.

NATURAL HAZARD RISK GOVERNANCE

Establishing risk as a basis in decision making in the field of Natural Hazard Management is strongly based on single national efforts so far. The European Union implemented with the Flood Directive a more integrative approach to flood management and thereby promotes risk governance. Referring to the given definition of risk governance above, *Natural Hazard Risk Governance* can be understood as the various ways in which all interested subjects manage their common risk affairs connected to natural hazards. In the international risk governance discussion, natural hazards represent only one possible application. The understanding of risk herein is rather simple, based on the product of event probability and damage potential. In this context, natural hazard risk governance is in the first place about governance processes using the risk concept as a basis for decision making and development of solutions for prevention. The actual challenge is a comparative mapping of such governance processes. The usage of a framework that evaluates the intensity of coordination, cooperation and integration such as proposed by WALKER et al. poses a possible solution to tackle this analysis.⁴²

⁴⁰ BAFU, 2012.

⁴¹ BMLFUW, 2012.

⁴² WALKER et. al., 2014.

2 Methodology

The study aims to provide a basic comparison of preventive measures against natural hazards in the EUSALP region with a focus on governance qualities and capacities in existing processes. This leads to the necessity of a qualitative research approach for analysing existing procedures, initiatives etc. The study therefore relies on the support and input of the members of EUSALP AG8 as well as the input of the working group on natural hazards of the Alpine Convention: PLANALP. The results of the two-years lasting discussion process summarized in this study report should serve as a basis for further discussion and projects within EUSALP AG8 as well as other action groups.

The study is compiled out of three main sections. The first section provides an overall analysis of relevant stakeholders and institutions in NHM with a specific focus on the legal framework (authorities, responsibilities).^[1] The second section presents the status of hazard and risk mapping for different natural hazards and countries.^[2] The concluding section aims to provide an initial risk governance mapping as well as good practise examples.^[3]

In detail, the methodology of the study is designed as described below:

[1] As starting point for the analysis of the natural hazard risk governance status quo, a stakeholder analysis is performed and serves as basis for an initial governance mapping. At first, relevant regulations, guidelines, documents, reports will be collected from each AG8 member on an online platform and kept available for the AG8 members throughout the project. This pool of information is a first self-assessment on actual and concrete efforts in the field of risk governance and helps to sketch stakeholder responsibilities and networks. This draft will be supplemented by official documents of administration and scientific publications in desktop research. Due to the complexity and sheer quantity of different regulations and stakeholders, only an overall and focused stakeholder analysis will be possible. First of all, the public authorities will be engaged in implementing preventive measures in the national NHM systems and their actual responsibilities will be identified. Recognising different legal origins, a distinction between authorities responsible for **spatial planning, structural/non-structural measures** and **disaster control** is introduced. This fosters a focus on the role of state authorities in risk governance application. Public authorities hold a vital role in organising, structuring and ministering governance processes.

[2] **Mapping natural hazards** plays a crucial role in planning countermeasures and adapting spatial development policies to existing threats. The intersection of hazardous areas with the building stock, land-use and infrastructure to calculate risks and use them as basis for decisions on prevention measures is rather new. The section aims to provide a basic overview over the existing national modes of hazard and risk mapping and identifies major shifts that have been performed towards a risk management. Furthermore, the interrelation of hazard and risk maps to the planning of structural measures, spatial planning and disaster control will be analysed briefly. Information are partially provided by the EUSALP AG8 members and complemented by desktop research.

[3] Based on the stakeholder analysis and the comprehensive collection of documents an ongoing discussion with the EUSALP AG8 members within the project period will be performed. Using the semi-annual group meetings, workshops, guided discussions and written feedback should help to get a first idea of the actual status quo of risk governance in the member states. This open forum is committed to assess the importance of risk governance

process as well as the characteristics and capacities in certain fields of hazard prevention. Due to extent of the EUSALP region only an overall comparative analysis is possible, but it will be complemented with good practice examples from the member states. These examples should show the various fields of application for governance, that already exist. To guarantee the comparability on a national level a certain theoretical background is necessary. The evaluation of single contributors in feedback loops, workshops or discussions need to be rated in a certain framework and with consistent parameters. The study design in fact provides two different assessment frameworks due to the simple reason that the general discussion on risk governance in a nation or per natural hazard cannot state the same in-depth evaluation as an analysis of single governance processes. For the qualitative assessment of good practice, examples *BRESSERS* & *KUKS* provide a basic scheme, breaking down governance into following aspects:⁴³

Table 1: Governance characteristics, qualities and capacities

GOVERNANCE CHARACTERISTICS	
Level	international, national, regional, local
Organisation	institutional establishment, informal cooperation
Actors	International organisations, federal state, provinces, municipalities, NGOs, ministries, local people, certain other authorities etc.
Problem Perception and goal	disaster driven, preventive measures, risk reduction, securing retention areas etc.
Strategies	long term/short term effects, strategic approach, ad-hoc solution(s)
Instruments	single instrumental vs. multi-instrumental
Resource and organisation of implementation	financing for implementation, voluntary/mandatory cooperation, formal vs. informal organisation etc.
GOVERNANCE QUALITIES/CAPACITIES	
Extent	single/multi-level, single/multi-actor, within state authorities, involving local people/NGOs
Coherence	consideration of multiple problem perceptions/multiple actor responsibilities in implementation
Efficiency	cost-benefit analysis, resource input and outcome, evaluation of program/project
Effectiveness	achievement of key aims
Equity	mechanisms for compensation (efforts, costs etc.)
Legitimacy	institutionalised vs. informal, relevant legal basis, degree of transparency

The evaluation pattern allows the members of EUSALP AG8 to self-assess provided good practice examples and to deliver a certain judgement on the degree and intensity of governance in specific projects. The good practice examples will be also used for the risk governance status quo analysis.

⁴³ *BRESSERS* and *KUKS*, 2013.

The second assessment framework is an adapted design from Gordon *WALKER*⁴⁴ and Fiona *TWEED*⁴⁵, compiled in the EU-funded CapHaz-Net, that should help profiling some of the key dimensions of natural hazard governance. The aim is to capture the variability and dynamism of governance in a simple structure that is applicable on different levels (international, national, regional, local).⁴⁶

Table 2: Draft – Governance Profiles

<i>high magnitude</i>	ASSESSMENT				<i>low magnitude</i>
strong national policy framework					weak national policy framework
strong role for regional institutions					weak role for regional institutions
strong local/municipal role					weak local/municipal role
major responsibility on those at risk to protect themselves					minor responsibility on those at risk to protect themselves
strong culture of multi-stakeholder participation					no culture of multi-stakeholder participation
extensive public risk communication					very little public risk communication
multi-instrumental measures					single-instrumental measures
multi-institutional measures					single-institutional measures
multiple problem perception and multi-actor involvement					simple problem perception and no external actor involvement
combining formal and informal networks for problem discussion and finding solutions					formal networks with (normative) procedural solutions
PREVENTION FOCUS: Spatial Planning – Structural Measures – Disaster Control					
intense programs/procedures in civil protection					low importance of civil protection
intensive regulations/guidelines for technical preventive measures					low importance of technical preventive measures
specific measures in the spatial planning system					low importance of spatial planning for prevention

The blank governance profiles are used as a basis for the documentation of the discussion on the status quo of risk governance in every member state. By marking the magnitude for every parameter and linking them graphically, a unique profile for single natural hazards (floods,

⁴⁴ Professor at Lancaster Environment Centre, Lancaster University.

⁴⁵ Professor at Geography and Environment, Science Centre, Staffordshire University.

⁴⁶ *WALKER* and *TWEED*, 2015, p. 481f.

avalanches, torrents, rockfall, landslides) can be identified. With arrows to the left/right side ongoing discussions, efforts and shifts in governance can be added in the framework.

This framework will be used in a governance workshop and national evaluation of the risk governance status quo within national administrations. The documentation of the governance workshop and the analysis are included and commentated in the study.

On the whole, the study uses qualitative combined research with the overall aim to provide an initial mapping of Natural Hazard Risk Governance. The research process is managed and supervised by the contractor (III/5 Austrian Service for Torrent and Avalanche Control) and is flexible to the vote of the EUSALP AG8 members concerning the selection of good practice examples. The methodology is not designed for a stand-alone study but resembles a governance process itself and has the role to provide a basic stakeholder analysis, document the discussions in EUSALP AG8 and integrate the results into an objective and comparative compendium.

The study relies strongly on an intensive and ongoing exchange of knowledge and information among the members of EUSALP AG8 to achieve accuracy and relevance in the analysis. The Natural Hazards Platform (PLANALP) of the Alpine Convention has an important role as partner with regards to content of the study. EUSALP AG8 and PLANALP meetings are organised on a semi-annual basis on consecutive days to ensure cooperation and the creation of synergies. Both working groups agreed to foster this collaboration. Members of the PLANALP working group agreed to provide good practice examples for the evaluation of risk governance while EUSALP AG8 provides information for the preparation of the next Report on the State of the Alps (RSA). Actual input for the study is strongly linked to the EUSALP AG8 meetings, where workshops and discussions are conducted. For the clarification of information, bilateral coordination helps to develop a comprehensive view on risk governance.

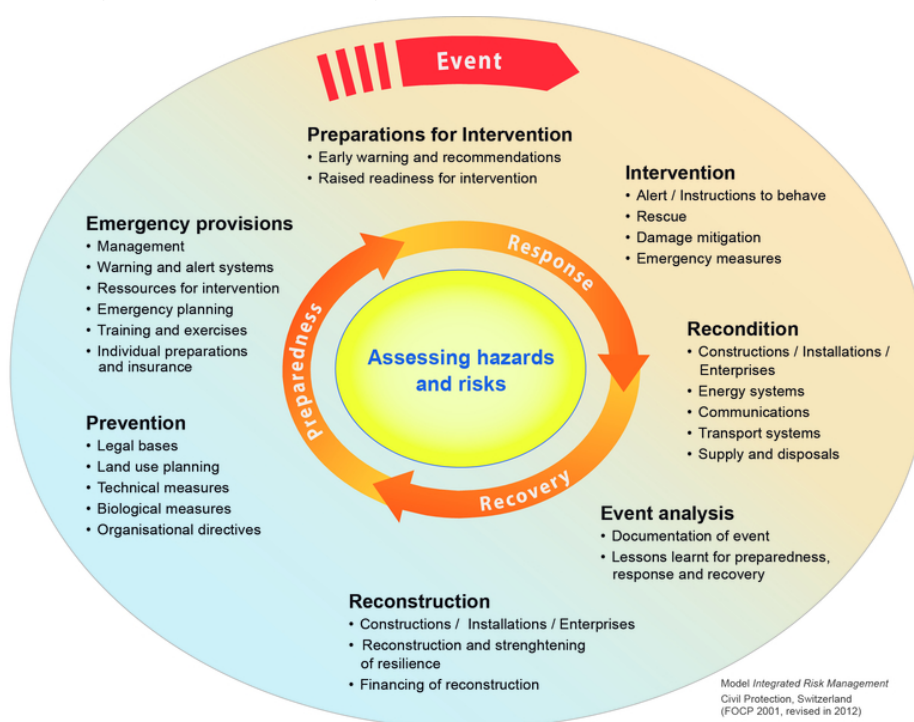
3 Responsibilities in Natural Hazard Management

The title of this chapter is on purpose using the term “management” in connection with natural hazards and institutional responsibilities. Governance is network and stakeholder orientated, while public management activities focus mainly on the efficiency within the public sector including in the first-place public institutions in their considerations. Looking at the responsibilities and the institutional framework in different nations include looking at the management aspects and legal and regulatory frameworks.

As already depicted the study takes only a selection of natural hazards into account. These hazards are: floods, avalanches, torrential hazards, rockfall and landslides. The study will leave especially earthquakes and anthropocentric hazards (nuclear, chemical threats) aside which are nevertheless relevant to a certain extent in the EUSALP region, but have differing regulatory mechanisms and would make a comparative analysis even more complex.

The well-known cycle of integrated hazard/risk management (see Figure 4) distinguishes between three main phases of action: immediate **response** after an event, **recovery** and **preparedness**. The study focuses on the preparedness phase including measures for prevention and preparation for possible events.

Figure 4: Cycle of Integrated Hazard/Risk Management



Source: PLANAT, 2017

Prevention against natural hazards can be achieved by a variety of measures. On the one hand by foresightful spatial planning or on the other hand reactively by the construction of structural prevention measures. The immediate preparation for handling events consists of a set of measures in the field of disaster control and management. The examination of responsibilities in the preparedness-phase distinguishes three sectors. Due to a distinction of public actors that can be made for the ones active mainly in planning, in the field of planning and implementing different structural/non-structural measures and the ones considered with rescue/relief preparation for actual events:

- 1) **Spatial Planning:** Different authorities from national, regional to local level implement preventive measures against the effects of natural hazards mainly by strategical planning instruments and actual land-use planning.
- 2) **Structural/Non-Structural Measures:** Authorities, that on the one hand plan, finance and construct physical measures to diminish the risk of settlement areas (and infrastructure) such as river-widenings, dams etc. and on the other hand implement non-structural measures such as awareness raising, risk communication, educational programmes etc.
- 3) **Disaster Control:** Authorities that manage rescue and disaster relief in case of hazard events; they prepare contingency plans and sustain the network of institutions and non-governmental organisations that are assigned certain tasks.

3.1 Spatial Planning

The core assignment of spatial planning is to shape the territorial and social development in a balanced manner. Fostering prosperity and economic growth, keeping people safe, enabling the access to education and treating finite resources with care, means a challenging and ongoing negotiation over future development. The planning of settlements and infrastructures – especially in alpine areas – has to take – as one aspect – natural hazards into account. By considering natural hazards, planners aim to reduce the exposure, lower damage potentials and focus further development in low risk areas. Common aims and measures in planning are:

- **keeping areas undeveloped** for flood drainage etc.;
- **adapt construction activities** to the degree of exposure to hazards;
- **re-zoning** of building plots, due to the location in hazard areas;
- **restrictive zoning policies** of building land in hazard areas;
- norming acceptable **land uses** in hazard areas with **low damage potentials**.

Generally, single authorities cannot implement such manifold measures including local, regional as well as national perspectives. Therefore, different authorities formulate and implement planning aims and measures concerning the threat natural hazards pose to society. The capacity of spatial planning lies in the specific field for prevention by regulating the future development. This means the formulation of (strict) principles for the development of settlements at a national/regional level as well as taking forward-looking decisions concerning the land-use allocation. At the same time this means, that planning decisions are highly dependent on hazard and risk plans to provide sufficient information. The regulatory planning frameworks in the EUSALP region member states are basically top-down orientated and normative and do not indicate governance qualities on a general basis.⁴⁷

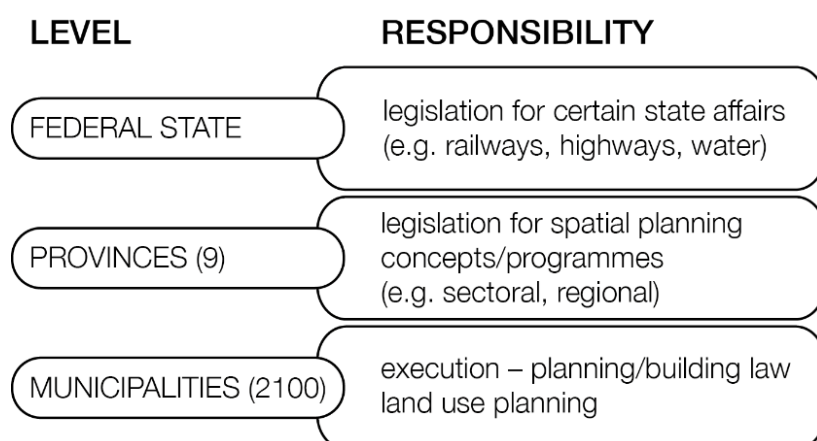
For a better understanding, the following comparison of member states will present in the first place the essential characteristics of the spatial planning systems complemented by an analysis of relevant aims, principles and measures related to the prevention of natural hazards in the EUSALP perimeter.

⁴⁷ FLEISCHHAUER, 2006, p. 9ff.

3.1.1 Austria

Austria has a strongly hierarchical and due to the federal state structure at the same time disperse spatial planning system. Evolving as a particular state assignment in the 1960/70s, it has a sophisticated network of relevant authorities with fragmented competences. The federal state has no overall planning responsibility and therefore no national planning act exists. Instead different sectoral laws on national level such as the *Federal Water Act*⁴⁸ or *Austrian Forest Act*⁴⁹ cover certain sectoral planning agendas. The actual planning legislation is settled at the level of the single provinces which determine the planning instruments on provincial and municipal level. The provinces have the possibility to pass sectoral and regional planning concepts and programmes, while the municipalities are in charge of land-use planning.⁵⁰ Figure 5 illustrates the structure of the spatial planning system in Austria in a simplistic manner. Crucial is the principle, that normative planning measures of the federal state need to be considered on lower levels, but conceptual developments don't.

Figure 5: Structure of the Austrian Spatial Planning System



Source: Schindelegger ©

The federal state has no possibility to address hazard prevention on a broad and integrative planning approach that would be binding to the provinces and municipalities. The only coordinating planning institutions on a national level is the Austrian Conference on Spatial Planning (ÖROK).⁵¹ The ÖROK can issue recommendations and serves as a communication and collaboration platform for the national government, the provincial governments and interest groups. The provinces are free to decide where sectoral or regional concepts and programmes are needed and normally focus on urgent topics that need regulation. Municipalities are responsible for the local spatial development using municipal development concepts, land use-plans and development plans as measures to regulate the development. They have to consider binding superordinate planning acts, but however have basically a planning monopoly on land-uses.

⁴⁸ Federal Water Act 1959, Official Law Gazette BGBl. Nr. 215/1959 as amended BGBl. Nr. 73/2018.

⁴⁹ Austrian Forest Act 1975, Official Law Gazette BGBl. Nr. 440/1975 as amended BGBl. Nr. 56/2016.

⁵⁰ LEITL, 2006, p. 106.

⁵¹ Österreichische Raumordnungskonferenz (ÖROK).

NATURAL HAZARDS AND SPATIAL PLANNING

On the national level the ÖROK supervises the negotiation and preparation of sectoral recommendations as well as the Austrian Spatial Development Concept (ÖREK)⁵² that is published every ten years and serves as a guideline for spatial development for the whole country. Natural Hazards appear in the latest concept ÖREK 2011 in different contexts. One important aspect is the updating process of hazard zone plans to have comprehensive documents for planning activities and decision making.⁵³ Specific national recommendations focus on risk management for gravitative hazards in spatial planning (Nr. 54)⁵⁴ and another one on general hazard prevention in spatial planning (Nr. 52).⁵⁵ The discussion of handling natural hazards in spatial planning is vivid on the conceptual national level, but the actual implementation of measures is left to the provinces and municipalities.

Every province has its own planning and building act accompanied by certain further decrees. The set of available instruments though is more or less the same in all provinces and it is possible everywhere to have informal or formally binding plans and programmes on the provincial level. The single provinces can address, as already stated, the prevention of natural hazards in sectoral or regional concepts and programmes. Some provinces have provincial development programmes/concepts, that relate to natural hazards.

At the moment there exist only two sectoral normative planning programmes directly addressing natural hazards: The Programme for Flood-Safe Development in Settlement Areas⁵⁶ existing since 2005 in the province of Styria. This programme actively aims to minimise the risk in case of flood events by anticipatory land use planning. It provides no solutions for settlement areas located within the flood run-off but sets strict rules for further development. Further information on the programme is provided in the chapter for good practice examples. In the western province of Vorarlberg the “Blue-Zone for the Rhine River” is another sectoral programme adopted in 2013.⁵⁷ The aim of this programme is to keep flood water run-off areas free from further development on a regional and strategical level.

On the municipal level authorities strongly rely in their planning decisions on appropriated hazard (and risk) maps, that provide a solid basis for an individual judgement for the zoning suitability of certain plots. If there is no information on hazards available individual expert advice on the hazard intensities is necessary. Municipalities have the option (or in some provinces the obligation) to prepare a **municipal development concept**, that has to address the topic of natural hazards (if relevant). Thereby, the further development areas for infrastructure and settlements can be defined and adjusted to the hazard situation. This instrument allows to establish a holistic perspective on further spatial development of communities by respecting limitations set by hazards. Then, the **land use plan** declares which areas are possible to be built on by zoning building land. The single planning acts regulate the suitability of areas for the zoning of building land. Hazard prone areas are basically not, or only to a minor degree, suitable depending on the probability and intensity of the particular hazard. **Development Plans** can be used to regulate the actual location of buildings on a plot of land

⁵² ÖROK, 2011.

⁵³ ÖROK, 2011, p. 68.

⁵⁴ Online: http://www.oerok.gv.at/fileadmin/Bilder/2.Reiter-Raum_u_Region/1.OEREK/OEREK_2011/PS_Risikom/OeROK_Empfehlung_NR._54_2015-12-03.pdf, 28.02.2018.

⁵⁵ Online: http://www.oerok.gv.at/fileadmin/Bilder/5.Reiter-Publikationen/OEROK-Empfehlungen/oerok_empfehlung_52.pdf, 28.02.2018.

⁵⁶ Province of Styria, 2005.

⁵⁷ Provincial Law Gazette Nr. 1/2014 (Verordnung der Landesregierung über die Festlegung von überörtlichen Flächen zum Schutz vor Hochwasser im Rheintal).

and prescribe certain technical features of buildings to lower their vulnerability. With such adjustments building in hazard prone areas could be made possible in a safe way. Due to the manifold natural hazards that limit the potential settlement area especially in mountainous areas these regulations are necessary in Austria.

On the whole, the prevention against natural hazards in spatial planning is strongly segmented among different authorities and dealt with in different spatial instruments. The planning system is strongly normative and formalised by legal regulations. Natural hazards are considered on all planning levels but the actual development of the built environment gets finally steered on the local level. This means that judgements on the zoning of building land are strongly related to individual plots and hazard levels. Regional perspectives on spatial development in coordination with hazard areas are still rare but evolving.⁵⁸

Identifying the actual institutions and responsibilities in spatial planning and their possibilities to contribute to natural hazard prevention delivers a complex picture as presented in Table 3.

Table 3: Institutions & Responsibilities in Spatial Planning, Austria

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
COORDINATIVE	Austrian Conference on Spatial Planning (ÖROK)	national recommendations on planning and natural hazards
		Austrian Spatial Development Concept
NATIONAL	none	none
PROVINCIAL	Provincial Government	regional/sectoral concepts (not binding)
		regional/sectoral programmes (binding)
LOCAL	Municipal Council	municipal development concept
		land-use planning
		development plans

Source: Schindelegger ©

3.1.2 France⁵⁹

The French spatial planning system used to be strongly centralised in its administration but has experienced reforms and decentralisation. The legislative monopoly is owned by the State which is represented by the prefectures (*préfectures*). The sub-state level splits up in 22 regions, 96 *départements* and over 36.000 municipalities. The French Constitution guarantees the principle of self-government as far as the administration is concerned but any kind of legislative action is excluded. Furthermore, there is no formal hierarchy between the three local levels (region/departement/municipality) which means, that the state is often the coordinating actor. The general physical planning is done at the municipal level that includes land use planning. The regional level is still weak not having any formal planning instruments due to the lack of a hierarchical planning systematic.⁶⁰

The most important planning instruments on national and regional level are:

⁵⁸ KANONIER, 2005. SCHINDELEGGGER, 2012.

⁵⁹ The information on the French planning system might be outdated to some extent; the used sources derive mainly from 2006.

⁶⁰ FLEISCHHAUER, 2006, p. 38.

- *Concept for public services: Schéma de services collectifs (SSC)*
- *Regional development concept: Schéma régional d'aménagement et de développement du territoire (SRADT)*
- *Directive territoriale d'aménagement et de développement durables (DTADD)*
- *Contrat de Plan Etat – Région (CPER)*

The first three are spatial development documents while the CPER is a formal instrument by the State. The SSC covers sectoral topics, while the SRADT are regional development plans that are drawn up by the regions in co-ordination with the *départements*. The DTADD defines the objectives of state planning policies in a regional dimension and is not bound to administrative borders. And finally, the CPER “national-regional planning contract” is a programmatic planning document for a 7-year period. It aims to coordinate national and regional actors by defining implementation and financial responsibilities.⁶¹

Land-use planning itself is regulated by the Law on Solidarity and Urban Renewal which secures compatibility of land-use planning instruments with planning documents on superior planning levels. The “strategic land-use-plan” (Schéma de cohérence territoriale, SCOT) is an inter-municipal plan to enable joint development among neighboring municipalities. The “local land-use-plan” (Plan local d'urbanisme, PLU) is a classic land-use-plan in the sense of zoning land uses for the municipal territory. It is an obligatory instrument for municipalities.⁶²

Figure 6: Structure of the French Spatial Planning System



Source: Schindelegger ©

NATURAL HAZARDS AND SPATIAL PLANNING

The connection between natural hazard management and spatial planning in France is strongly focused on the local level. Natural hazards need to be considered in the Strategic land-use-plan (SCOT) as well as the local land-use-plan (PLU) and existing risk prevention plans (PPR) need to be integrated. In fact, local authorities often oppose the PPR because of the effect on land value and the restriction of development options. PPRs are not directly binding for the zoning and therefore local authorities and the state are negotiating solutions.⁶³ The regional integration of natural hazards in planning instruments is so far missing or weak.

Looking at institutions and responsibilities in spatial planning in France provides a complex structure. Because legislation is fully owned by the state, regional planning is not normative and municipalities perform planning tasks within their right to self-government, there is a strong

⁶¹ FLEISCHHAUER, 2006, p. 40.

⁶² FLEISCHHAUER, 2006, p. 41f.

⁶³ FLEISCHHAUER, 2006, p. 50.

need and practice for co-ordination different planning activities. Especially the regional level is relying strongly on informal instruments (discussions, concepts, contracts etc.) which makes governance actually an integral aspect in the French spatial planning system.

Table 4: Institutions & Responsibilities in Spatial Planning, France

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Prefectures	sectoral development plans (<i>Schéma de services collectives, SCC</i>)
		national-regional planning contract (<i>Contrat de Plan Etat – Région, CPER</i>)
REGIONAL	Region	regional development plan (<i>Schéma régional d'aménagement et de développement du territoire, SRADT</i>)
		spatial development directive (<i>Directive territoriale d'aménagement et de développement durables, DTADD</i>)
		national-regional planning contract (<i>Contrat de Plan Etat – Région, CPER</i>)
LOCAL	Municipality	strategic land-use plan (<i>Schéma de cohérence territoriale, SCOT</i>)
		local land-use plan (<i>Plan local d'urbanisme, PLU</i>)

Source: Schindelegger ©

3.1.3 Germany

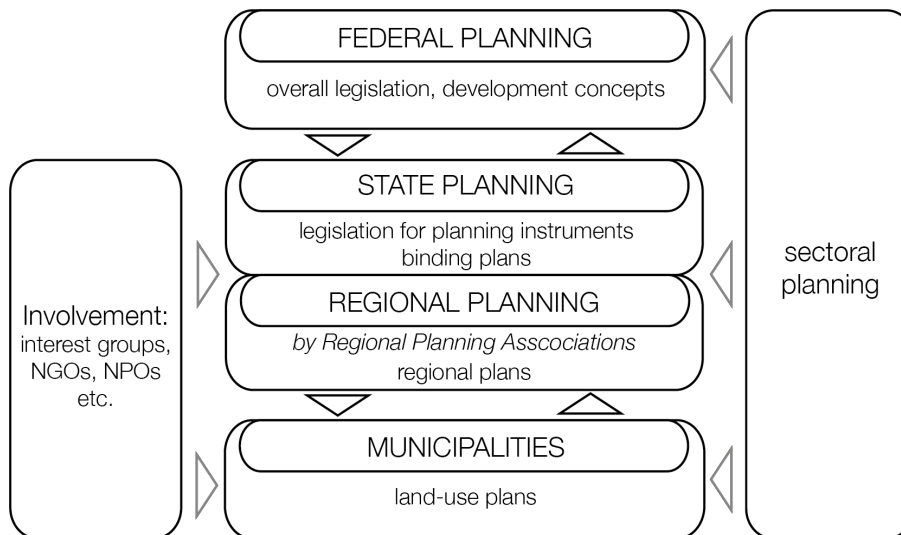
Germany is organised as a federal republic and grants the single states large autonomy in legislation and administration for many sectors. This characterises Germany as a strongly decentralised state that has three governmental levels: The Federation, the states and the municipalities as authorities of local self-government. Therefore, the German planning system is characterised by a distribution of responsibilities.

The Federation itself has only an overall competence in planning legislation and no legally binding planning instruments. But the framework for further legislation and basic principles in planning are defined here. The states have the essential legislative power and are obliged to manage land use policies by implementing the “Regional Plan for the Territory of the State” and “Regional Plans for parts of the States”. Land use planning itself is a responsibility of the municipalities distinguishing preparatory land-use plans (*Flächennutzungsplan*) and detailed land-use plans (*Bauleitplan, Bebauungsplan*).⁶⁴ Additionally most of the states have a complementary planning level for regional planning. Sectoral topics (water management, transport etc.) are regulated in specific federal laws and represent planning activities aside from actual land-use planning and shaping the development of settlement areas. Figure 7 shows roughly the organisation of the German planning system. The actual planning tasks get carried out on the three levels federation, state and municipality based on the principle of counter flow concerning content of concepts and plans. This means, that the system is not designed in a top-down logic but instead planning authorities have to take existing plans on lower levels into account. This guarantees the consideration of different intentions of different levels and is based on procedural consideration. Furthermore, sectoral plans are considered on all levels depending on their content. Relevant interest groups, NGOs, NPOs etc. can

⁶⁴ GREIVING, 2006, p. 50.

participate in the processes according to the procedural design set in the state planning acts. Bavaria for example has additionally established a strong normative planning level in regional planning with regional planning associations drafting binding regional plans. The planning system is strongly formalised by a set of legal acts. There do exist to some extent additional informal procedures for an early stage dialogue incorporating non-governmental actors as well.

Figure 7: Structure of the German Spatial Planning System



Source: https://www.arl-net.de/system/files/planungssystem_de.jpg, 28.02.2018. adapted by Schindelegger.

NATURAL HAZARDS AND SPATIAL PLANNING

Due to the size and topography of Germany the relevant natural hazards differ among the states. The EUSALP perimeter includes only two states: The Free State of Bavaria and Baden-Württemberg. Bavaria holds a share of the Alps in its south and Baden-Württemberg has with the Black Forest a low mountain range. Therefore, both states have to cope with alpine natural hazards and are especially prone to floods. The presentation of the relation of the spatial planning system to natural hazards focuses on Bavaria due to the information received from EUSALP AG8. Basically, the single states refer to relevant natural hazards in their regional plans for the state or parts of the territory. The Spatial Development Programme (LEP)⁶⁵ of Bavaria for example is a binding legal decree, which takes up the topic of natural hazards especially in the context of climate change. The LEP states, that risks and hazards need to be necessarily considered in planning for safeguarding the population, settlements and infrastructure. Bavaria is subdivided into 18 regions which have regional plans, that also refer to the natural hazards. Especially the overall development goals for settlements state, that areas that are threatened by avalanches, floods, landslides etc. need to be kept free of development.⁶⁶ The provision of suitable information and maps on hazard zones is not a responsibility of planning authorities but instead of sectoral authorities.

Construction activities for residential purposes in flood prone areas are basically prohibited according to the Federal Water Act (*Wasserhaushaltsgesetz WHG*) and the Bavarian Water Act (*BayWG*). This prohibition exists besides the limitations for zoning building law in spatial planning. Therefore, the flood areas defined by water legislation need to be incorporated in

⁶⁵ *Verordnung über das Landesentwicklungsprogramm Bayern (LEP)*, 22.08.2013.

⁶⁶ e.g. see Regionalplan Südostbayern, Online: http://www.region-suedostbayern.bayern.de/files/RP18_Text_PDF/RP18_Text_Gesamt.pdf, 28.02.2018.

spatial plans to pass the information and do not have a direct legal effect for planning decisions. For rockfall and landslides, the Bavarian Office for Environment (*Landesamt für Umwelt, LfU*) has from 2007 onwards been working on hazard maps. These maps show hazardous areas, but have no immediate consequence for land-use planning.⁶⁷

On the federal level, the Building Code (*Baugesetzbuch, BauGB*) defines healthy housing and working conditions as well as flood prevention to be important aspects in drafting (detailed) land-use plans. The Bavarian Building Code defines similar planning principles and goals.

Germany has a complex planning systematic with differing legal regulations on state level, many authorities involved and extensive co-ordination between different administrative levels. First of all, it is a holistic system covering the whole territory in the same regulatory depth. Table 5 gives a brief overview of the relevant planning authorities and their instruments.

Table 5: Institutions & Responsibilities in Spatial Planning, Germany

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Federal Government	Federal Planning Act (<i>Raumordnungsgesetz</i>)
STATE	State Government	state planning acts (<i>Raumordnungsgesetze</i>)
		regional plan for the territory of the state (<i>Landesentwicklungsplan</i>)
		regional development plan (<i>Regionalplan</i>)
LOCAL	Municipal Council	preparatory land-use plan (<i>Flächennutzungsplan</i>)
		detailed land-use plan (<i>Bauleitplan, Bebauungsplan</i>)

Source: Schindelegger ©

3.1.4 Italy

Italy is a territorial strongly subdivided state with 20 regions, 103 provinces and over 8000 municipalities but a centralised administrative structure. The legislative power belongs to the state and the regions with special regulations for autonomous regions/provinces. The state exercises concurrent legislative power with the region for certain state assignments (e.g. planning, civil protection). Regions have to enact their own laws referring to the principles introduced by the state. On the national level, there exist the Urban Planning Law 1942, n. 1150, that defines the planning activity, while the regional laws determine procedures and implementation modalities.⁶⁸ The actual physical planning takes place on the regional/provincial and the municipal level.⁶⁹ There are no national spatial plans, that supersede regional ones. Following the establishment of regions from 1972 onwards, the regions are now in charge of approving urban plans.

On the level of regions, there are different planning instruments to generally set development goals and steer spatial development on a bigger scale. Basically, there are general plans for the whole territory and more detailed sectoral plans. These plans are defined in detail in different regional planning acts but have the same principles in common. The provinces have to adopt a provincial co-ordination plan that links the regional development strategies and

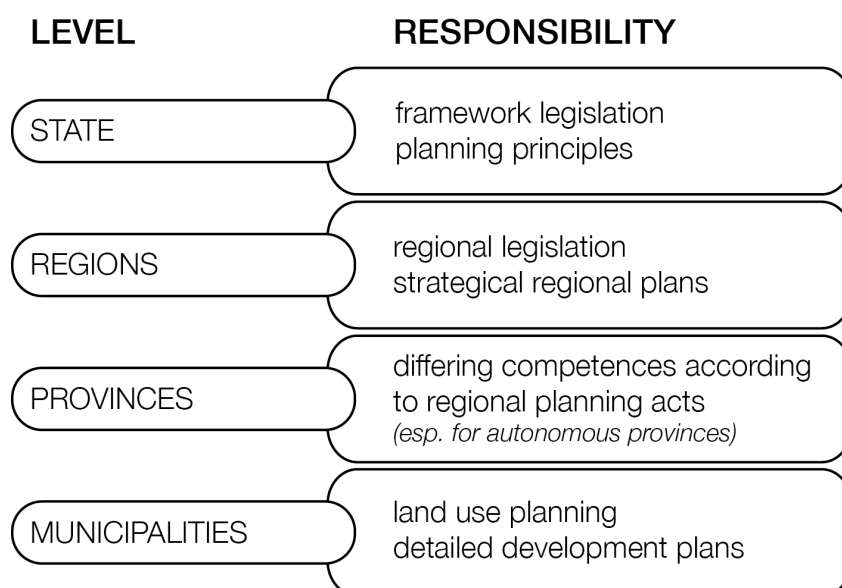
⁶⁷ LfU, 2017.

⁶⁸ CIRIANNI et al., 2013.

⁶⁹ GALDERISI, 2006, p. 97.

planning activities of the municipalities. In fact, the spatial distribution of land-uses was originally set in this regional plan. Provinces like South Tyrol have had reforms lately and passed land-use planning widely to the municipalities. Strategical spatial planning lies therefore predominantly within the competence of the provinces. Municipalities prepare different comprehensive and thematic plans of which the comprehensive land-use plan (*Piano Regolatore Generale*) is the most important one. It is drawn for the whole municipal territory and allocates land-uses. There also exist further detailed plans for industrial areas, areas for public housing or historic centres preservation. Figure 8 gives a basic overview of the Italian spatial planning system.

Figure 8: Structure of the Italian Spatial Planning System



Source: Schindelegger ©

NATURAL HAZARDS AND SPATIAL PLANNING

Italy is prone to different natural hazards with regional dimensions such as droughts or earthquakes. The northern alpine regions and provinces (Friuli-Venezia-Giulia, Trentino-Alto Adige, Lombardia, Piemonte, Valle d'Aosta) face rather alpine hazards such as avalanches, torrential floods or rockfall. The only actual sectoral tool on a regional dimension are **river basin plans**, that are designed for localizing and quantifying current and potential sources of hydrogeological risks in areas defined as basins or watersheds. The relevant river basins in the EUSALP region are the **Po** and **Easter Alps** river basins. Basin plans are legally binding for subordinate planning instruments. Natural hazards generally need to be considered for land-use planning, but legislation differs widely throughout Italy. The autonomous province of Trento has hazard maps to estimate and classify the areas subjected to natural hazards such as avalanches, river and torrential floods, rockfall and landslides, forest fires and earthquakes.⁷⁰ These singular hazard maps are the basis for the creation of the synthesis hazard map⁷¹, which is incorporated in the provincial urban plan to determine the requirements and constraints related to land-use planning. (Table 6)

Table 6: Institutions & Responsibilities in Spatial Planning, Italy

⁷⁰ Provincial Law n.9, 01.07.2011, Trento.

⁷¹ Art. 22 n.15, Provincial Law, 04.08.2015, Trento.

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Ministry of Environment, Land and Sea	sectoral competences; no spatial planning instruments
REGIONAL/PROVINCIAL	Regional Government	regional territorial plan (<i>Piano Territoriale Regionale</i>)
		provincial coordination plan (<i>Piano Territoriale di Coordinamento Provinciale</i>)
		provincial co-ordination plan
LOCAL	Municipal Council	land-use plan (<i>Piano Regolatore Generale</i>)
		detailed plan (industrial areas, public housing, historic centre preservation)

Source: Schindelegger ©

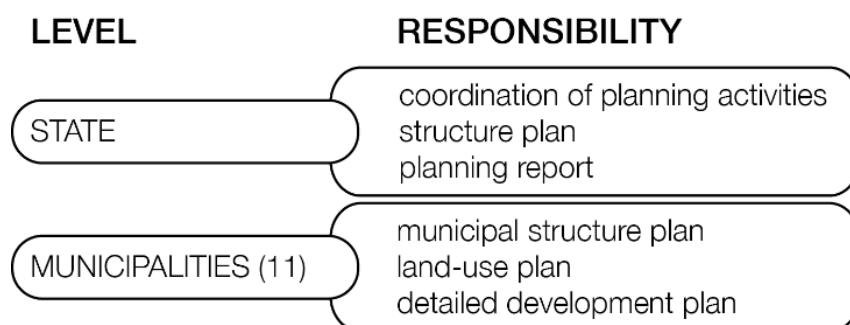
3.1.5 Liechtenstein

Liechtenstein has a unique situation concerning legal aspects of spatial planning and the organisation of land-use planning. The principality has so far no original national planning legislation. Instead the Building Act and other complementing decrees form the legal basis for planning activities. In section 2 of the Building Act⁷² planning instruments and principals are introduced and regulated. On the administrative side the Office for Construction and Infrastructure⁷³ is in charge of coordinating different planning activities at national level to ensure a sustainable spatial development. The overall aims and measures at national level are regulated in the national structure plan. The planning report serves additionally as an information and coordination tool. The single municipalities also draft a municipal structure plan and are responsible for enacting actual land-use plans as well as detailed development plans. The structure of the spatial planning system in Liechtenstein as shown in Figure 9, clearly depicts the importance of the municipal planning activities.

⁷² Baugesetz (BauG), 11.12.2008, 701.0, 44/2009.

⁷³ Amt für Bau und Infrastruktur (ABI), Online: <http://www.llv.li/#/1706/amt-fur-bau-und-infrastruktur>, 28.02.2018.

Figure 9: Structure of the Spatial Planning System in Liechtenstein



Source: Schindelegger ©

NATURAL HAZARDS AND SPATIAL PLANNING

The structure plan on state level is the most important strategical planning document. For hazard-prone zones passive and active measures as well as overall aims are proposed. Hazards should be avoided especially by measures in spatial planning and secondary by biological and technical measures. This means, that hazard areas need to be considered in planning activities and hazard zones should be kept free of constructive development for example via building bans.⁷⁴ The map of the structure plan also includes hazard zones.

The municipalities have to take hazard maps into account in their planning decisions. The municipal structure plan serves as a binding basis for the zoning decisions and further development of the built environment and also contains the hazard zone.

The relevant institutions for spatial planning are only a random few and the responsibilities for actual zoning and formulating the relevant framework is clearly assigned to the eleven municipalities and the Office for Construction and Infrastructure preparing the national structure plan. Table 7 gives an overview of the relevant institutions and responsibilities in spatial planning in Liechtenstein.

Table 7: Institutions & Responsibilities in Spatial Planning, Liechtenstein

LEVEL	AUTHORITY	RESPONSIBILITY
NATIONAL	Office for Construction and Infrastructure	national structure plan (binding) (<i>Richtplan</i>)
		planning report
LOCAL	Municipal Council	structure plan (<i>Richtplan</i>)
		land-use plan (<i>Zonenplan</i>)
		detailed development plan
		land consolidation

Source: Schindelegger ©

3.1.6 Slovenia

The Slovenian spatial planning system is based on the distribution of responsibilities executed by the Spatial Planning Act 2007.⁷⁵ Slovenia has only two administrative levels in planning,

⁷⁴ Government of Liechtenstein. 2011, p. 57.

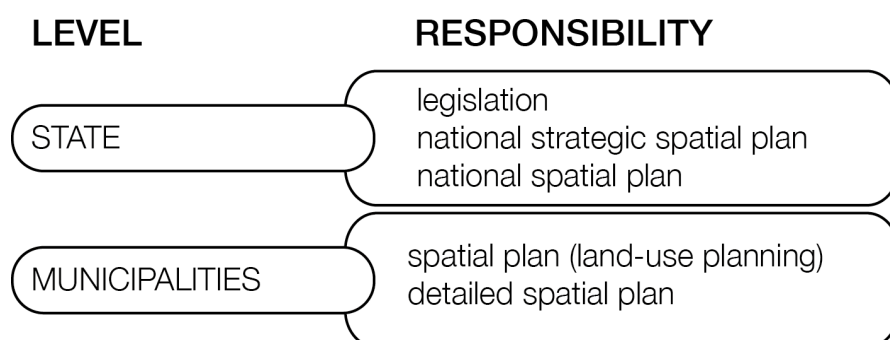
⁷⁵ Official Gazette of RS, no. 33/2007, Valid since 28/04/2007.

missing a regional subdivision in administration so far. The constitution enables the establishment of a regions/provinces, however no such administrative units have been implemented. Municipalities are based on a self-governing principle, act autonomously and independent in performing their tasks. National administration is in charge of supervising the municipal administration. The state itself is competent for spatial development of the state, determining references and guidelines for planning spatial arrangements at all levels and the supervision of planning activities performed by the municipalities. The municipalities can determine guidelines for their own development and carry out land-use planning.⁷⁶ Recently in October 2017 the Slovenian Government adopted the new Spatial Management Act⁷⁷ which supersedes the existing legislation and merges the existing regulatory framework in one single legal act. The new law aims to separate strategic and practical implementation documents/plans, but still keeping the existing planning instruments. Strategic planning at the regional level and maritime spatial planning have been introduced by the new act and will have to prove in practise.

Planning instruments are well structured in Slovenia with the strategic spatial plan (*Strategija prostorskega razvoja Slovenije*), the spatial plan on national level and a municipal spatial plan as well as a detailed spatial plan at municipal level. Inter-municipal plans are also possible. Plans on the lower administrative level may not be contrary to superordinate plans. In 2004 the Spatial Development Strategy for Slovenia⁷⁸ entered into force and regulates in detail development objectives and implementation measures.

In the formulation phase of spatial planning documents different institutional stakeholders are obliged to provide advice and response and approve the official draft. Public involvement takes place after clearance of the official draft. Citizens have the possibility to formulate statements. This process aims to collect the expression of interest from non-governmental stakeholders (citizens, professional associations, civil society groups etc.) and dis-/agreement regarding specific land-use proposals and future projects. This consultation process is a formalised procedure existing on all planning levels.

Figure 10: Structure of the Spatial Planning System in Slovenia



Source: Schindelegger ©

NATURAL HAZARDS AND SPATIAL PLANNING

The Spatial Planning Act of 2007 as well as the new one demand a management in areas with spatial limitations. Development has to be planned according to such existing limitations. Such areas are especially areas at risk in accordance with regulations governing water (flood areas,

⁷⁶ Art. 11, Spatial Planning Act 2007.

⁷⁷ Zakona o urejanju prostora, ZUP-2, Official Gazette of RS, no. 61/2017, Date of application: since 01/06/2018.

⁷⁸ MOP, 2004.

erosion areas, landslide areas, avalanche areas). Natural hazards are therefore not directly addressed in the Planning Act but linked via the Water Act 2002.⁷⁹ The mitigation of risk against natural and other disasters in the framework of spatial management shall be implemented with integrative activities outside areas with spatial limitation, appropriate management in areas at risk and monitoring activities of hazard processes.⁸⁰ In areas with spatial limitation, no additional settlement, infrastructure or activity which could lead to natural disasters or increase the risk is allowed.

The *Spatial Development Strategy* refers also to the risk natural hazards pose. Spatial development shall be for example adapted to the risk of potential natural disasters. Potential risks shall be reduced by preventive planning for example by locating activities outside dangerous areas at risk.⁸¹ The current problem is, that on the municipal level the information on areas with spatial limitations is not fully available. For now, the best information exists for flood prone areas. Development in such areas is restricted by a set of regulations that aim to prohibit an increase in flood risk. Hazard maps need to be incorporated in spatial plans on municipal levels. Some municipalities do so and add already diverse maps to their plans depending on the availability of data. Natural hazards are due to the partial hazard map coverage not addressed everywhere in Slovenia in spatial plans in the same way and level of detail. In the last ten years there have been significant improvements in the field of hazard/risk mapping but planning cannot use this information everywhere already.

Table 8: Institutions & Responsibilities in Spatial Planning, Slovenia

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Ministry of the Environment and Spatial Planning	national strategic plan
		national spatial plan
LOCAL	Municipalities	municipal spatial plan
		municipal detailed spatial plan

Source: Schindelegger ©

3.1.7 Switzerland

The Swiss planning system has many different formal institutions/stakeholders due to the federal organisation. The state has an overall planning competence defining the national objectives as well as planning principles and instruments. An important principle is the duty of all public authorities for extensive co-ordination. This means, that the state, the cantons and the municipalities have to take care of planning issues in a cooperative manner. Different state authorities draft sectoral programmes and plans that contain specifications of national importance and need to be bindingly considered in all other planning activities. For co-ordinating different sectoral plans, drafting a national planning strategy and to support the cantons the state has established the Federal Office for Spatial Planning (ARE).⁸² On the state level, there also exists a spatial development concept. The single cantons issue their own planning acts and are in charge of planning their territory by structure plans (*Richtpläne*). The actual land-use planning is in most cantons assigned to the municipalities, but in fact would be

⁷⁹ Official Gazette of RS, no. 67/2002, 12.07.2002.

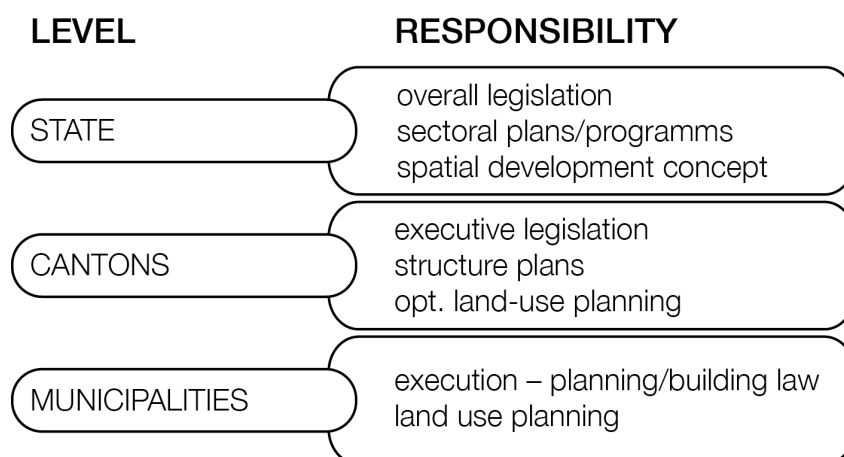
⁸⁰ Art. 22, Spatial Planning Act 2007, Official Gazette of RS, no. 61/2017, 24.10.2017.

⁸¹ MOP, 2004, p. 30f.

⁸² Bundesamt für Raumentwicklung, Online: <https://www.are.admin.ch/are/de/home.html>, 28.02.2018.

also possible for the cantons to perform it themselves. Normally the municipalities also have to draft a structure plan that serves as a strategical guideline for the future development and which serves as a basis for land-use planning. Figure 11 gives an overview of the responsibilities on different administrative and legislative levels.

Figure 11: Structure of the Spatial Planning System of Switzerland



Source: Schindelegger ©

NATURAL HAZARDS AND SPATIAL PLANNING

Due to the topography and exposure of large parts of Switzerland to natural hazards such as floods, avalanches or landslides the topic of disaster risk reduction is on the (political) agenda and there exists a distinctive discussion on hazard/risk mapping and appropriate measures for prevention. Spatial planning is in the focus of this discussion and planning documents generally relate to natural hazards and prevention measures.

The Federal Planning Act⁸³ states in Art. 6 that the cantons are responsible for generating information on areas that are threatened by natural hazards. This means, that the cantons have to prepare hazard maps and have to display and implement them in their plans and programmes. The spatial development concept also refers to natural hazards by stating that land-use has to be coordinated with hazard areas especially by designating retention and non-development areas.⁸⁴ The cantonal plans contain general hazard zones on a regional level and detailed hazard zones in land-use plans that enable judgements for single plots. The effects hazard zones have on zoning building land are defined by the cantonal planning laws. In general, red (high risk) zones exclude the zoning of additional building land while in blue (medium risk) and yellow (low risk) hazard zones development is possible under certain restrictions.

In 2005 the Federal Office for the Environment (BAFU) published jointly with ARE recommendations for spatial planning and natural hazards identifying important intersections and evaluation the existing regulatory framework.⁸⁵ Based on these findings the discussion moved on from hazard to risk based spatial planning. In 2014 a first report on two test planning cases in Switzerland was published.⁸⁶ It did show, that risk-based decision making is basically

⁸³ 700 Raumplanungsgesetz, RPG.

⁸⁴ ARE, 2012, p. 44.

⁸⁵ BAFU, 2005.

⁸⁶ CAMENZIND and LOAT, 2014.

possible but further challenges concerning the needed legal basis, the identification and evaluation of risks and asymmetric knowledge of hazards in different areas were identified.

As already stated, there are numerous authorities involved in the spatial planning system in Switzerland. Table 9 gives a brief overview of authorities, responsibilities and available instruments.

Table 9: Institutions & Responsibilities in Spatial Planning, Switzerland

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Federal Office for Spatial Development (ARE)	spatial development concept (<i>Raumkonzept Schweiz</i>)
	Ministries	sectoral plans (<i>Sachpläne des Bundes</i>)
CANTONAL	Cantonal Authorities	structure plan (<i>Richtplan</i>)
		optional land-use plan (<i>Nutzungsplan</i>)
LOCAL	Municipalities	structure plan (<i>Richtplan</i>)
		land-use plan (<i>Nutzungsplan</i>)

Source: Schindelegger ©

On the national level, the BAFU and ARE have regular meetings on an informal as well as formal level to harmonise their actions in prevention. This helps the cantons to implement the hazard maps into their land-use plans, with a current coverage of 75% on municipal level (1.1.2018). The level of implementation is not the same in every canton. The undergoing amendment of the Water Act⁸⁷ will enforce integrated risk management and strengthen planning measures compared to structural measures. The planners themselves can join trainings in the field of DRR to foster a risk-based planning approach.⁸⁸

3.2 Structural/Non-Structural Measures in Natural Hazard Management

Prevention of natural hazards is not only carried out by planning authorities through anticipatory development of land uses and infrastructure. Due to the simple fact, that many existing settlements and infrastructures are at risk already, diverse measures are undertaken by public authorities. Every member state in the EUSALP region has over the decades developed a specific and complex system of accountable authorities, legal regulations and harmonised financing schemes to raise the security level of the people in hazard prone areas. In fact, a large share of the today's existing building stock in hazard areas was built since the 1950s, partly relating to the fundamental trust in the technical possibilities to safeguard infrastructure and settlements. In the following chapter responsible public authorities on different administrative levels will be identified and the legal framework and financing schemes for structural as well as non-structural measures will be explained. While structural measures such as dams, embankments, river widenings etc. are widely associated with natural hazard management, soft measures such as awareness raising, risk communication and so on are fairly new instruments to foster the involvement of the general public and especially promote self-protection measures. Promoting governance mechanisms gives concerned people and

⁸⁷ 721.100, Bundesgesetz über den Wasserbau, 21.06.1991.

⁸⁸ SCHÄRPF, 2018.

other stakeholders the possibility to educate themselves and actively contribute to the development of local/regional prevention measures.

3.2.1 Austria

Austria holds a large share of the Alps and started developing an efficient planning and financing system for hazard prevention. The legal basis for the action of the relevant authorities is nowadays set in the Forest Act 1975 and Water Act 1959. Planning and supervising the financing of preventive measures is a shared assignment of the federal state who is accountable for the biggest share in financing measures, the single states and municipalities. From a financial point of view and concerning the resources, exclusive planning and implementation of structural measures by municipalities would be simply impossible. To achieve efficient local and regional solutions in prevention, different public authorities at the provincial and national level take care of the planning, financing and construction of measures as well as promoting different national initiatives.

In Austria there are three main public authorities that work in the field of hazard management and implement technical and biological measures against natural hazards on national level:

- *Austrian Service for Torrent and Avalanche Control (WLV), Federal Ministry of Sustainability and Tourism (BMNT)*
- *Flood Control Management (BWV), Federal Ministry of Sustainability and Tourism (BMNT)*
- *Federal Waterways, Ministry for Transport, Innovation and Technology (bmvit)*

The *Austrian Service for Torrent and Avalanche Control (WLV)* belongs to the forestry section within the ministry and takes care of avalanches, torrents, debris flows, rockfall and landslides. The WLV is first of all responsible to draft hazard zone maps that serve as basis for planning actual prevention measures. By this the WLV aims to raise the security of people and settlements. At the same time the WLV is not responsible for the protection of infrastructure or the protection of so far undeveloped potential settlement areas. The actual implemented prevention measures are manifold due to the different hazards WLV is coping with. Basically, a distinction between biological measures, technical measures and non-structural measures is possible. Developing technical measures is based on internal guidelines, while non-structural measures are implemented by different activities like the annual *Risk Dialogue*. A broad consultation of concerned people or the public is not formally established so far in the technical guidelines while in the drafting process of hazard zone plans, interested people have the possibility to submit statements.

The *Flood Control Management (BWV)* is organised in a slightly different way, even though it is also part of BMNT. The BWV holds only an overall administrative responsibility, while the actual planning and administration of prevention is passed on to provincial authorities.⁸⁹ The BWV prepares hazard zone plans for rivers to have a basis for planning prevention measures against floods.

The division for *Federal Waterways* in the transport section of the *bmvit* is responsible for rivers and section of rivers that are official waterways. This is in the first place the Danube river and

⁸⁹ BGBl. Nr. 280/1969.

the March at the boarder to Slovakia. The actual planning activities are also passed on to the provincial authorities by legal decree.⁹⁰

All three listed public authorities become only active if the municipalities apply for preventive measures. This is a simple necessity because local people, municipalities as well as the provinces have to contribute financially to a certain extent to every measure. Table 10 gives an overview on public authorities and their responsibilities for structural and non-structural prevention measures in Austria.

Table 10: Public authorities and responsibilities for structural and non-structural measures in natural hazard management, Austria

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Austrian Service for Torrent and Avalanche Control (WLV, BMNT)	planning and supervising biological and technical measures for avalanches, torrents, rockfall; non-structural measures
	Flood Control Management (BWV, BMNT)	supervising projects for flood prevention; non-structural measures
	Federal Water Ways (bmvit)	supervising projects for flood prevention along waterways; non-structural measures
PROVINCIAL	Flood Control Management	planning and supervising structural measures for flood prevention
LOCAL	Municipalities	applying for prevention measures; financial contribution to cost of construction/maintenance

Source: Schindelegger ©

3.2.2 France

Hazard Management in France experienced many adaptations over the past years based on the overall aim to establish a more integrative system. Disaster control and other prevention measures are closely linked and prepared together. The role of the state level represented on the regional levels by the prefectures is essential and coordination of measures happens in the first place at state level. The relevant ministries for hazard management on state level are:

- *Ministry of Interior: Responsible for Civil Security and Crisis Management Directorate*
- *Ministry of Economic Affairs and Finance: Treasury and Budget Directorate*
- *Ministry for the Ecology and Inclusive Transition:⁹¹ Risk Prevention Directorate*

Theses ministries coordinate their action via the inter-ministerial commission, an informal coordination board. France is threatened by a set of natural hazards and developed a national strategy for dealing with risk based on seven principles:⁹²

(1) Understanding and assessing risk

⁹⁰ ÜV-HWS, BGBl. II Nr. 351/2006.

⁹¹ Before May 2017 the ministry was called "Ministry of Ecology, Sustainable Development and Energy".

⁹² Ministry of Ecology, Sustainable Development and Energy, 2015.

- (2) Forecast and early warning
- (3) Promote education and risk awareness
- (4) Take into account risks into sustainable planning development
- (5) Reducing vulnerability
- (6) Prepare and manage crisis
- (7) Feedback

Structural measures are in the first place included in (5) *Reducing vulnerability* which are planned and implemented within the **Ministry for the Ecology and Inclusive Transition** represented in the regions by the *préfectures*. The responsible department within the ministry is the **Directorate-General for Risk Prevention**. Non-structural measures are especially included in (3) *Promote education and risk awareness* to promote integrative measures to risk reduction.

3.2.3 Germany

Due to the federal principle legislation and administrative organisation between the single states differs considerably in Germany. Therefore, the following presentation of regulations focuses on the Bavarian system for hazard prevention because the representatives of Bavaria in EUSALP AG8 did directly provide relevant information and Bavaria has to deal with all kind of alpine natural hazards due to its topography.

First of all, the Federal Water Act⁹³ of Germany includes a general duty to take care of threats natural hazards pose for citizens. They must not deteriorate the situation of flood water run-off and should undertake preventive measures themselves.⁹⁴ This applies especially for individual adaptations of properties. Large scale structural measures are reserved to responsible public authorities.

Legislation for hazard mapping, risk assessment as a well as structural measures for hazard prevention are adopted on state level. The legal basis in Bavaria is set by the Bavarian Water Act.⁹⁵ Water courses are basically distinguished in three categories already by the federal state. For the first two categories the free State of Bavaria is responsible while for the third category municipalities are in charge. If minor watercourses (third category) are officially classified as torrents the free state of Bavaria is responsible. Water management is not executed by one single authority but distributed regionally and thematically. The supreme authority is the Bavarian State Ministry of the Environment and Consumer Protection (*Bayrisches Staatsministerium für Umwelt und Verbraucherschutz*) with the Bavarian Environment Agency (*Landesamt für Umwelt, LfU*) as sub-ordinate consultative authority for water management. The seven governmental districts (*Regierungsbezirke*) also hold responsibilities in the sectoral topic of water management and take care of the coordination of measures. Furthermore, there are 17 local offices for water management that are responsible for the planning and maintenance of structural measures against floods and torrential hazards. They also act as consulters for municipalities to help them fulfill their assigned responsibilities. Avalanches are as well handled by the listed authorities. Geological risks (landslides, rockfall) are also a responsibility of the Bavarian Environment Agency. Besides, the obligation of the road owners to ensure road safety, includes also the responsibility to regard natural hazards.

⁹³ Wasserhaushaltsgesetz (WHG) 2009. National Law Gazette BGBl. I 2585/2009 as amended BGBl. I 2771/2017.

⁹⁴ Art. 5 WHG 2009.

⁹⁵ Bayrisches Wassergesetz (BayWG) 2010.

For watercourses in the category 1 or 2 the State of Bavaria is to the bigger part in charge of financing measures, but those who take advantage have to contribute as well. The share can reach up to 50% and is normally taken over by the municipalities themselves. Maintenance of structural measures lies within the duty of the State of Bavaria. Watercourses in the 3rd category are regulated differently and the municipalities are in charge of planning and financing protection measures. Generally, the state supports the municipalities with voluntary contributions (45% to 75%), but the maintenance remains with the municipalities. The federal state takes over a certain responsibility as well in financing protection measures especially for all important measures of directly after large flood events. The amount and share differ according to the frame conditions. The decision on the measure itself is to be taken by the states of municipalities.

The case of Bavaria shows impressively the number of administrative units that need to coordinate their actions among each other, with municipalities and other stakeholders. This is especially for floods due to the regional dimension a challenging task and that is why the coordinative instrument *Flood-Dialog (Hochwasserdilog Bayern)* was introduced and applied in selected cases. The legal situation also makes close cooperation of the state administration and municipalities necessary. Awareness raising and an active information policy is therefore strongly relying on different actors involved in the risk management process, with the state administration and municipalities taking a leading role. The Flood Risk Management Plan (FRMP) helped in Bavaria to develop the NHM system further, and for the first-time events larger than design events are taken into account. That helps especially municipalities to understand the concept of risk in hazard management.

Table 11 gives an overview of the administrative organization of natural hazard management in Bavaria and the institutional embedment in the federal context.

Table 11: Public authorities and responsibilities for structural and non-structural measures in natural hazard management, Germany/Bavaria

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
FEDERAL STATE	Federal Government	legislation (Water Act), waterways
STATE (Bavaria)	Bavarian State Ministry of the Environment and Consumer Protection	waters in category 1, 2; torrents
	Bavarian Environment Agency 7 governmental districts 17 local offices for water management	structural measures, river widenings, etc.
LOCAL	Municipalities	Waters in category 3

Source: Schindelegger ©

3.2.4 Italy

The Italian regulatory system for structural and non-structural measures for natural hazard prevention is strongly relying on the provincial/regional level. The current distribution of different responsibilities to national, regional, provincial and local governments was established by the **National Decree no. 112 in 1998**. Generally, Italy is prone to natural hazards of many kinds (landslides, mudflows, avalanches, earthquakes, volcanic eruptions,

floods, storms, tsunamis) which demand specific prevention measures.⁹⁶ Governing hazard risks is therefore to an eminent degree disaster driven. In the aftermath of the 1966 flood in northern Italy an interministerial commission was established to design principles of modern flood risk management. It took almost two decades to reach a political consensus, so in **1989** the **law 183/1989** was introduced providing key principles of effective water and flood risk management. In the first place, the **river basins** were adopted as a planning and management unit. River basins crossing administrative borders of national, inter-regional and regional importance were designated. Within river basins the flood and landslide management plans (*piano di assetto idrogeologico*, PAI) identify hazard prone areas and assign different intensity classes (R1-R4). The development of the river basin plans proved to be demanding and the law 398/1993 made it possible to develop such plans in a piecemeal way. An amendment to the situation by the law 180/1998 and 267/1998 demanded, that the identification of the infrastructure and buildings in areas prone to risk is necessary.⁹⁷

Today the state coordinates measures and activities on the topic and defines the amount of resources for planed actions. The regions are responsible for planning and implementing protection measures and care about the maintenance. Especially for autonomous provinces these tasks were transferred to the provinces. The competencies of authorities at national, regional or local administrate level are differentiated in detail by topic but generally there is always a set of institutions of different disciplines involved in the management of hydrogeological risks.⁹⁸

On national level, different ministries and institutions are engaged in hazard and risk management:

- Ministry of Environment, Land and Sea (*IMELS*): collaborates with the Council of Ministers, the Ministry of Interiors; determines policies of soil protection; allocates financial resources; sets up policy guidelines
- National Institute ISPRA (*Istituto Superiore per la Ricerca Amientale*): provides technical support to IMELS
- Presidency of the Council of Ministers directly with the Department of Civil Protection and Conference of the Regions

The **River Basin Districts** are defined on national level and are responsible for drafting the **River Basin Management Plans** and the FRMPs. The districts are coordinated by an institutional committee consisting of five state ministers, the presidents of the regions and autonomous provinces.

The autonomous province of South Tyrol has legislative and executive powers to deal with natural hazards in its territory. There exist different legal acts that altogether build the regulatory framework for implementing physical measures against natural hazards. After gaining autonomy in 1972 the avalanche and torrent control was legally organised by law in 1975.⁹⁹ Ever since the established authority *Sonderbetrieb für Bodenschutz, Wildbach- und Lawinenverbauung* in the Division for Hydraulic Engineering (since 2015 within the Agency for Civil Protection) works on hazard prevention for floods, avalanches, torrents and debris flow. This provincial office takes care of planning, constructing and maintaining structural measures

⁹⁶ MYSIAK et al., 2013.

⁹⁷ MYSIAK et al., 2013.

⁹⁸ BIANCHINI and STAZI, 2016.

⁹⁹ Regelung des Sonderbetriebes für Bodenschutz, Wildbach- und Lawinenverbauung, Nr. 35/1975.

for prevention as well as measures for awareness raising and organising the organisational prevention measures.

Mass movements, rockfall and landslides are set in the competence of the provincial geological office. Planning, building and maintaining structural measures are managed with external experts and municipalities.

The autonomous province of Trento has like South Tyrol direct legislative responsibilities in the field of hazard and risk management. The legal cornerstone for hazard management is the Provincial Law 2011 n. 9 (Rules of civil protection activities in the province of Trento) which does not only address organisational but instead the whole risk cycle in the fields of preparation, prevention, protection and emergency management. The province for example drafts hazard and risk maps as a basis for planning prevention and protection measures. The prioritisation of provincial investment is based on the results of the risk assessment process. There exists a general plan of disaster prevention works, covering the whole province and gets updated at least every three years. The municipalities are incorporated widely by Art. 8 of the Provincial Law 2011 n.9. In particular, the municipalities collaborate in the definition of hazard areas, the preparation and management of civil protection plans, the definition of the general plan of disaster prevention works with respect to the location of the works, reconstruction and repair of assets, the protection activities defined by the civil protection plans and in supporting the voluntary bodies.

The autonomous provinces in Italy have strong self-determination concerning the planning of protection measures and the obligation to establish a sufficient legal basis.

Table 12: Public authorities and responsibilities for structural and non-structural measures in NHM, Italy

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Government	Definition of River Basin Districts
REGIONAL	River Basin Committees	River Basin Plans
	Regional government	Flood Risk Management Plans
PROVINCIAL	Provincial government	Flood Risk Management Plans (autonomous regions/provinces)
	Civil protection departments	Hazard Management (planning measures)
LOCAL	Municipalities	mapping, planning activities, contribution to financing

Source: Schindelegger ©

3.2.5 Liechtenstein

The principality of Lichtenstein has well-arranged systematic of implementing natural hazard prevention. The Department for Civil Protection (DCP) merges organisational issues of prevention addressed in disaster control and physical prevention measures. No matter what natural hazard, the DCP is in charge of capturing and monitoring the hazardous processes and in a next step planning appropriate counter-measures. This includes also structural measures that are complemented by restrictions for further constructive development and spatial planning. Awareness raising is implemented as well via the DCP, especially by using a Web-GIS platform for providing information to the public.

Planning and financing of measures is fully carried out by the state. Measures get developed on a certain cooperation with municipalities, but are formally not engaged in establishing protection measures.

Table 13: Public authorities and responsibilities for structural and non-structural measures in natural hazard management, Lichtenstein

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Department for Civil Protection (DCP)	planning/implementation of measures
LOCAL	Municipalities	no formal responsibilities

Source: Schindelegger ©

3.2.6 Slovenia

Slovenia has only two administrative levels missing so far a regional one. Therefore, policies, regulations and responsibilities for the implementation of structural/non-structural prevention measures against natural disasters are defined legally on the national level.

On this level, the **Ministry of the Environment and Spatial Planning** is in charge of natural hazard agendas. Sub-divisions like the **Water and Investments Directorate** and the 2016 introduced **Slovenian Water Agency** are assigned with actual planning and implementation activities. Due to the fact, that spatial planning policies and administration is also part of the ministry, prevention measures can be coordinated already within the ministry. Regular field inspection and maintenance works on watercourses are continuously implemented through competent private concessionaires, supervised by the Water Agency. In many cases, local communities participate not only in planning but also in co-financing of structural water management works. The implementation of the Flood Directive and drafting the FRMP for Slovenia strengthened this administrative integrative approach. General legal basis for protection against natural hazards is the *Act on Protection Against Natural and other Disasters*¹⁰⁰ which defines basic principles for hazard management. It especially involves besides the state and local communities also citizens in the provision of protection measures.¹⁰¹ The actual management of the local system of protection against natural hazards is performed independently by the municipalities. This means, that prevention measures are actually a responsibility of the municipalities themselves but they receive support by state authorities to carry out the planning and implementation. Nevertheless, the legal responsibility for water management is set on state level. Flood hazard management is with the establishment of the FRMP extensively regulated and coordinative and planning assignments are performed at state level. Landslides are meanwhile as well addressed by a series of legal acts to especially be able and provide the financial resources for financing structural measures. The financial responsibility is basically shared between affected municipalities and the state. Prevention concerning rockfall has not been strategical so far and due to the unregularly appearance of avalanche threats, this hazard is not addressed in detail in the legal framework. However, local hazard assessment, planning, design, financing and implementation of the structural protection measures against rockfall, landslides and snow avalanches, which threaten state road's and railway's infrastructure, are regularly performed by state administrations responsible for management and maintenance of these infrastructure.

¹⁰⁰ Official Gazette of the RS 64/1994.

¹⁰¹ Art. 5 Act on Protection against Natural and other Disasters, 1994.

Awareness raising for natural hazard risk in civil society is an important measure as well in Slovenia and is carried out on a cooperative basis mostly by state institutions.¹⁰²

Table 14: Public authorities and responsibilities for structural and non-structural measures in natural hazard management, Slovenia

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Ministry of the Environment and Spatial Planning	support municipalities in planning/implementing measures
LOCAL	Municipalities	planning/implementing prevention measures

Source: Schindelegger ©

3.2.7 Switzerland

Natural hazard management is implemented in Switzerland as a joint task based on a close cooperation of responsible authorities (federal, cantonal, municipal) and involving public initiatives and an active information policy (risk dialogue). The protection against natural hazards is a common task of the state and the single cantons. The legal basis is set in the Water and Forest Act that define responsibilities and financial involvement of the state in the implementation of concrete protection measures. The cantons have the obligation to implement actual prevention measures and need to consider risk in spatial strategies, plans and developments. The cantons have also the possibility to involve municipalities, infrastructure operators, forest owners, concerned people etc. by its legislation for implementing measures. The financing of measures is secured by a 4-years lasting agreement between involved state and cantonal authorities.¹⁰³

At the federal level the coordinative authority is the **Federal Office for the Environment** (BAFU). This means that structural and non-structural measures as well as spatial planning for hazard prevention are located within the same federal department. This clearly promotes coordination and knowledge exchange on national level. The cantons have organised their administration in different ways. The largest canton in Switzerland Canton of Grison has for example an Office for Forest and Natural Hazards¹⁰⁴ that holds the responsibility for hazard and risk mapping, taking care of the cadastre of events and plan and implement actual measures. Other relevant authorities for hazard protection in the Canton of Grison are the Office for Spatial Development and the Office for the Army and Civil Protection.

For the financing of planning and implementing prevention measures the federal state provides co-financing. Hazard fundamentals such as hazard maps receive 50% subsidies from the federal level. The basic federal share for any measures is 35% but can be bigger depending on certain aspects. If a participative process is carried out, the case of overload or ecological requirements are considered, the federal contribution increases. On the whole, the federal share must be less than 80% of the total project costs.¹⁰⁵ In principle, the share for the costs of prevention measures should be 1/3 at the federal, the cantonal and municipal or private

¹⁰² SLOKAR and PAPEŽ, 2018.

¹⁰³ BAFU, 2017.

¹⁰⁴ Amt für Wald und Naturgefahren.

¹⁰⁵ BAFU, 2015a, 123ff.

level. Since there are 26 cantons, there exist 26 different regulations of how to handle the financing in detail.¹⁰⁶

The decisions, which prevention measures will be implemented is taken by the canton, municipalities and if involved, third parties. For the request of federal subsidies, a cost-benefit ratio calculation needs to be done.¹⁰⁷ Each measure has to fulfil certain minimum standards. Big cantons tend to pay for a larger share of prevention measures, while in medium sized cantons the municipalities have a more important role in financing measures. In small cantons, often the private sector bears the costs due to a lack of public financial resources for certain measures.¹⁰⁸

Awareness raising is a comprehensive task for all involved public stakeholders. The federal level takes over a certain responsibility, but cantons, as well as municipalities, insurances, interest groups etc. undertake information campaigns, trainings and so on. Practise shows, that cantons undertake the majority of awareness raising activities, while esp. municipalities do it in connection with actual measures.¹⁰⁹

Table 15: Public authorities and responsibilities for structural and non-structural measures in NHM, Switzerland

LEVEL	AUTHORITY	RESPONSIBILITY - INSTRUMENTS
NATIONAL	Federal Office for the Environment	develop/evaluate instruments/strategies national initiatives/coordination in hazard management awareness raising; providing information/studies
CANTONAL	Cantonal Offices	planning/implementing preventive measures
LOCAL	Municipalities	implementing preventive measures

Source: Schindelegger ©

¹⁰⁶ Schärpf, 2018.

¹⁰⁷ The EconMe(4.0) tool helps to evaluate the economic effects of planned measures; Online: https://economie.ch/eco_work/index.php?PHPSESSID=f6ptsqhosh0fg25s888p2btsr5, 03.03.2018.

¹⁰⁸ Schärpf, 2018.

¹⁰⁹ Schärpf, 2018.

3.3 Disaster Control and Management

The handling of hazardous effects of disasters is an essential state task. Concerning the EUSALP region both natural events and disasters that result of human activities are relevant and get addressed by national authorities and regulatory frameworks. The majority of disasters though, is directly linked to climate and weather extremes. Referring to the focus of this study, especially alpine natural hazards such as avalanches, floods, landslides e.g. are of interest. To minimize the potential damage of disasters and to prevent the loss of life member states have established effective institutional frameworks for disaster control and management. The aspect of “control” is here relating to the actual operational measures to handle events, while “management” means in a bigger scope the efforts to plan and prepare for organisational measures. In case of disasters, authorities have to react fast and need a decent supply with well-trained personnel and resources. Therefore, most nations have a disperse organisational structure involving NGOs and volunteers’ actual intervention. This makes formal/informal procedures especially interesting for an analysis of governance characteristics and capacities.

3.3.1 Austria

As a federal republic Austria generally has a complex structure of competencies and responsibilities. Disaster Control is set on different legislative and administrative levels and has its legal foundation in several legal acts. The overall responsibility for civil protection as well as crisis and disaster protection management is assigned to the Ministry of Interior (MOI) complemented by regional responsibilities. The national system of *National Crisis and Disaster Protection Management* was reorganized based on a declaration by the council of Ministers in 2004. The essential innovation was the instalment of a committee on national level for overall coordination conducted by the director-general for public safety. Furthermore, in January 2006 the *Federal Alarm Centre* (FAC) which serves as a contact point for the provinces, neighbouring countries, the European Union and other international organizations was established. Besides, the regional level represents the backbone of an operational disaster control. While nuclear safety and crisis and threats of international dimension are governed by the MOI directly, at regional level competence is principally incumbent on the federal provinces. They have adopted relevant laws as a basis for organizing disaster control and created widely independent and differing organisational structures. Nevertheless, the federal authorities support the provinces in disaster relief operations. The essential actors in the field are the Austrian Federal Armed Forces as well as the voluntarily organized Austrian Red Cross and Austrian Fire Brigade.

The organizational structure (Figure 12) shows, that the eventual coordination and communication is set at the national level. The coordination committee serves as an integrative platform between different levels and stakeholders. The actual readiness and leadership are distributed for most hazards on provincial, district and municipal level.

Figure 12: Organization chart – National Crisis and Disaster Management in Austria



Source: MOI, 2017. own adaptation.

Planning ahead is the essential role of the state led *National Crisis and Disaster Management*. Different measures to achieve an efficient management have been undertaken. A set of certain measures is relevant for natural hazards too:

- *Disaster Management Plans*
- *Command and control structures to support the head of operations*
- *Setting up/Maintaining facilities for alerting the general public; provincial alarm centres, federal alarm centre*
- *Training of disaster management personnel*
- *Series of guidebooks on Civil Protection by the MOI¹¹⁰*

A new initiative of the Ministry of Interior within the *National Crisis and Disaster Management* is a national risk analysis. Severe hazards in the last few years and the policy framework towards risk lead decision making processes a national risk analysis should be conducted. The focus will be in the first place on critical infrastructure and work is underway and a first risk-matrix already drafted.

Disaster Control in Austria strongly risk driven and combines many governance components. In the first place, many different public authorities are involved, but at the same time rescue organizations and civilians play a vital role. Due to the legal and institutional set up, governance mechanisms are highly relevant within the Austrian disaster management.

3.3.2 France

With a population of nearly 67 million France is one of the most populous countries in Europe and organised as a democratic republic with a centralised administrative structure. Disaster management in context of alpine hazards is relevant predominantly in the south and eastern parts of the country but regulated in a common way for all possible disasters. Disaster

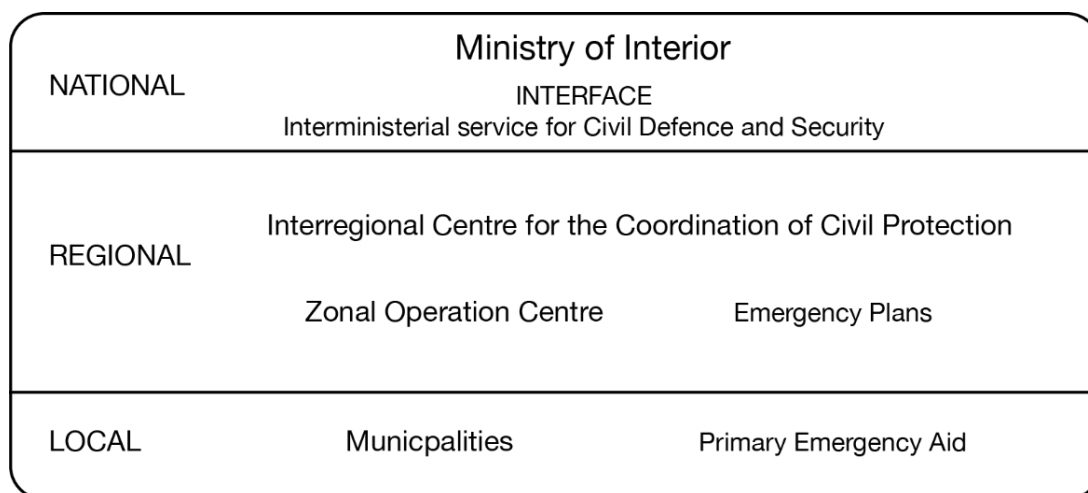
¹¹⁰ Guidebooks online: <http://www.bmi.gv.at/204/Download/start.aspx>, 03.03.2018.

Management in France is a state assignment involving public bodies on different levels. The legal basis is set on national level by an ordinance and 1a decree relating to civil defence.

In the administrative organisation of disaster management and control different levels were established in France to be able to cope with disasters according to their extent. At the national level, the Ministry of Interior¹¹¹ has the overall responsibility, followed by a zonal coordination and the departments and a rather local level. On the national level disaster management is a holistic assignment by dealing with all kind of different risks and possible disasters and is performed by the Directorate of Cooperation of Civil Defence and Security (DSC).¹¹² The DSC is part of the Ministry of Interior and has a national operational centre. Zonal operational centres for public safety exist in Marseilles, Lyon, Rennes, Bordeaux, Meth and Paris. At the department level the operation centres of the fire and emergency services are at the disposal of the prefect. Generally, disaster management is a shared competency between local authorities and the state. The mayors of each municipality and the department prefects are responsible for disaster risk prevention, preparation and the distribution of aid and rescue in case of an event.

In case of an event and the relief organisation assumes a particular scope or nature, an emergency plan (ORESEC plan) is launched by the *Département*. These plans take inventory of all public and private means that can be mobilised according to the type of event. If the event exceeds the scale of the *Département* the zonal operation centre (COZ) gives further supplies and coordinates action. This means that the principle of subsidiarity is also in place concerning disaster control in France. Figure 13 shows the organisational structure in a simplistic manner.

Figure 13: Organization chart – National Crisis and Disaster Management in France



Source: initial draft by Schindelegger

Since 2004 there exists a security plan (*Plan communal de sauvegarde, PCS*) on municipal level for the preparation of rescue and relief actions in case of hazard events. The plans are based on an evaluation of vulnerabilities and risks and guarantee a sufficient flow of information and appropriate warning of people in case of events. These plans incorporate different stakeholders on municipal level and facilitate regional harmonisation among municipalities. The involvement of different stakeholders of the public as well as private sector

¹¹¹ Ministère de l'Intérieur: <https://www.interieur.gouv.fr/>, 03.03.2018.

¹¹² Direction de la coopération de sécurité et défense.

in the organisation of disaster management fosters the establishment of governance schemes. At the same time efforts, such as the PCS, are undertaken to institutionalise such cooperation.

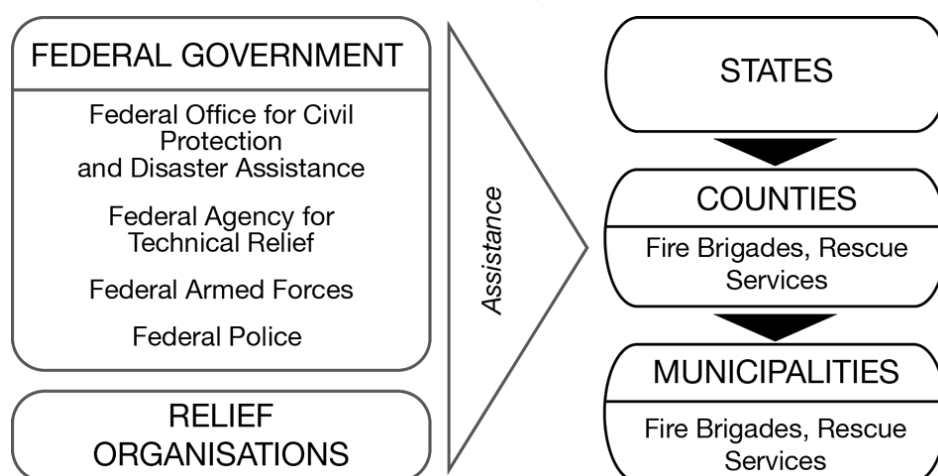
3.3.3 Germany

Concerning disaster control/management Germany as a federal republic has also a system of shared competencies between the federal state, the states and municipalities in disaster management. During peacetime disasters, the rural district, county or municipal authorities are in charge of handling the situation. Depending on the situation a staff composed of officials from the administration, representatives of other authorities as well as other organisations involved in disaster management form together an ad-hoc management group to deal with the situation. If a disaster strikes several districts or exceeds the capabilities of the local government, the next highest hierarchical authority ensures the coordination. The federal government supports if necessary regional and local authorities with their own operational forces, when asked for assistance. Using this subsidiary system, an efficient response to disasters on the appropriate scope can be assured.

The legal basis for disaster management differentiate in Germany the case of peacetime and wartime. In the second case the competences are concentrated on federal state level, while at peacetime, the 16 constituent states are in charge of disaster management. The competences and tasks at federal level have been revised in 2009 and laid down in the German Civil Protection and Disaster Assistance Act.¹¹³ The single states have adopted state laws and therefore the actual organisation of Disaster Management is different in every single state. Responsibilities of municipalities are also set in this state legislation. The private sector, NGOs and volunteers are also involved in Disaster Management according to the specific legislation.

Concerning the different administrative levels and involved stakeholders, a basic distinction between operational organisations and managing civil protection authorities is possible. During events and operations, the competent authorities receive support by fire-fighters, NGOs etc. Figure 14 depicts the system of different authorities.

Figure 14: Structure of Civil Protection in Germany



Source EC, 2018. Own revision and adaptation.

¹¹³ Gesetz über den Zivilschutz und die Katastrophenhilfe des Bundes – Zivilschutz- und Katastrophenhilfegesetz – ZSKG 2009.

The overall competence for Disaster Management is assigned to the Federal Ministry of Interior¹¹⁴ which get assistance by The Federal Office of Civil Protection and Disaster Assistance¹¹⁵ as well as The Federal Agency for Technical Relief¹¹⁶. The single states have the actual competence for Disaster Management and command the counties and the municipalities.

To achieve a national coordination in Disaster Management all civil protection authorities contribute in form of planning, administration and material resources to the prevention, actual management and recovery of all kind of disasters. Therefore, an inter-ministerial coordination group can be set up within The Federal Ministry of the Interior when a catastrophe exceeds the ability of the affected state.

STAKEHOLDERS – GERMANY¹¹⁷

The coordination and cooperation of all branches of the public administration from municipalities to national level as well as the private sector is crucial for the Civil Protection in Germany.

PUBLIC ADMINISTRATION: Municipalities, districts, regional commissioner/intermediate authority, state ministry, federal ministry; *PRIVATE SECTOR:* infrastructure providers (electricity, rail traffic, water supply etc.) – National Strategy for Critical Infrastructure Protection¹¹⁸; cooperation with IT-infrastructure providers; *VOLUNTEERS:* Workers' Samaritan, German Red Cross, Johanniter-Unfall-Hilfe, Malteser, Deutsche Lebens-Rettungs-Gesellschaft; *NGOs:* Deutsches Komitee Katastrophen Vorsorge, Ständige Konferenz für Katastrophenvorsorge und Bevölkerungsschutz

3.3.4 Italy

Disaster Control/Disaster Management in Italy is like other state assignments difficult to portray in a simple way because besides the regular administrative organisation there exist five autonomous regions, of which three are situated in the EUSALP perimeter. These are Friuli-Venezia Giulia, Trentino-Alto Adige (Province of Bolzano, Province of Trento) and Valle d'Aosta. The constitution guarantees them home rule in legislation, administration and finance.

The overall aim, to protect lives, goods, properties and environment from damage or threats caused by natural and technological disasters and other calamities serves as a basis for the organisation of Civil Protection and Disaster Management in Italy. As the national legal basis **Act no 225** was established in **1992**. By definition the "National Service of Civil Protection" is constituted by state administration, the provinces, the municipalities, the national public and local institutions and all other institutions or organisations (public and private) that are present on the national territory. The legislative **decree 112/98** redefined the task of each component retaining the mixed competence approach. Recently a reorganisation of the legislative provisions concerning the national civil protection system was adopted (March 2017).

The coordination of the national service and the promotion of civil protection activities are undertaken by the **Department of Civil Protection (DPC)**¹¹⁹ under the office of the president

¹¹⁴ Bundesministerium des Inneren.

¹¹⁵ Bundesamt für Bevölkerungsschutz und Katastrophenhilfe.

¹¹⁶ Bundesanstalt Technisches Hilfswerk.

¹¹⁷ Federal Office of Civil Protection and Disaster Assistance, 2012.

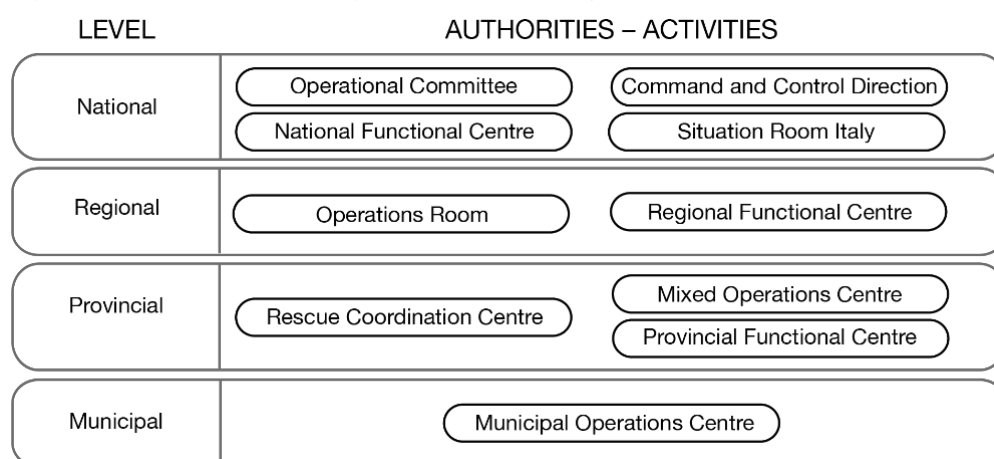
¹¹⁸ National Strategy for Critical Infrastructure Protection. Online:

http://www.bmi.bund.de/cae/servlet/contentblob/598732/publicationFile/34413/kritis_englisch.pdf, 03.03.2018.

¹¹⁹ Dipartimento della Protezione Civile (DPC). Online: <http://www.protezionecivile.gov.it/jcms/it/home.wp>, 03.03.2018.

of the Council of Ministers. The Department of Civil Protection is thus the operative arm of the president of the council, when it comes to coping with the protection of the country's people and goods. The DPC is divided into six offices and 34 services carrying out specific tasks. In case of disastrous events, the DPC assesses the disaster and whether local resources are sufficient to cope with them. If necessary, support to provinces, regions and municipalities will be provided. The DPC takes herein an overall coordination of operations, while regional/local authorities perform their specific roles. The organisational chart in Figure 15 shows the operational organisation, hierarchy and coordination of different institutions involved in Disaster Management.

Figure 15: Disaster Control – Organisational Chart, Italy



Source: EC, 2018. Own adaptations.

The Italian civil protection (and therein the disaster management) system is basically centralised with the state holding the overall competency and hierarchically organised. Recently efforts were undertaken to foster regional and local institutions competences and responsibilities, while safeguarding the state's role of overall guidance and coordination. Many regions have an independent civil protection organisation and structure, capable of dealing with local/regional disasters and strongly adapted to specific territorial characteristics. Nevertheless, the responsibility for implementing civil protection measures falls with the lowest-possible administrative level. The mayor is the primary civil protection authority while a subsidiary principle is in place to deal with events on the corresponding spatial and administrative level. The risk forecast and provision of prevention programmes is an assignment of the regions with the provinces and municipalities implementing the regional/local emergency plans and coordinating relief operations on their territories.

In the autonomous province of Trento, the organisational measures for the disaster control and management are provided by the Provincial Law 2011 n. 9 which in particular regulates: the organization of structures within the provincial administration and external structures (volunteer fire brigades, research dog school, Italian Red Cross, alpine rescue, psychologists, technical experts), the definition of the Civil Protection Plans and the Emergency Plans, the meteorological forecasting and monitoring of the territory, the early warning system, the Emergency Central Unit (112) , the operational rooms and the Helicopters Centre. An important role has the mobile column which is the mobile structure used for emergency interventions out of the province territory. The Italian regions and the autonomous provinces have adopted a coordination instrument called the **Civil Protection Special Commission** which, in peacetime, plays a supporting role in the National Civil Protection, while in case of

an emergency is activated the National Operational Committee to manage the regional resources available and to activate the mobile columns.

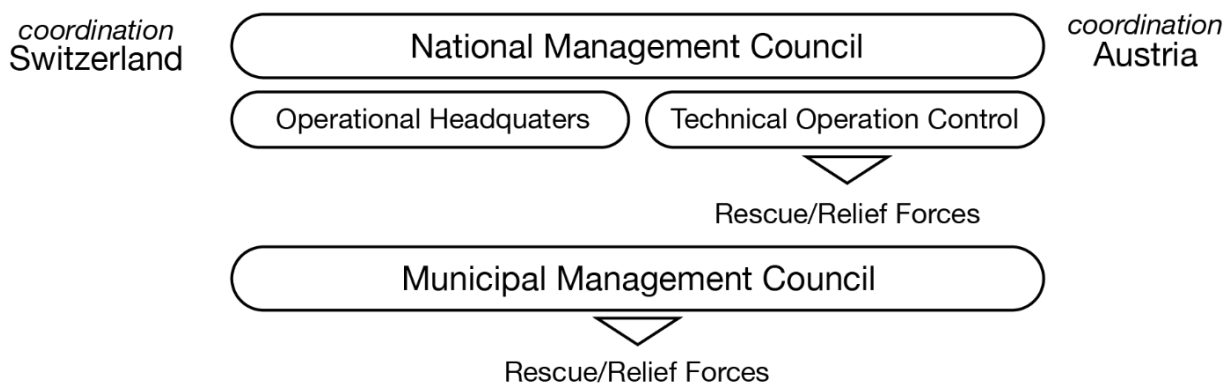
STAKEHOLDERS – ITALY

PUBLIC ADMINISTRATION: Department of Civil Protection (state), regional/provincial offices/agencies, national fire-fighters corps, police, armed forces, state forest-corps, national health service, national alpine rescue-corps; **PRIVATE SECTOR:** technical-scientific experts; **NGOs/VOLUNTEERS:** Italian Red Cross and other national and local organisations and groups (municipal civil protection groups, voluntary fire brigades)

3.3.5 Liechtenstein

The principality of Liechtenstein is a special case concerning the international comparison in Disaster Management/Control. The state consists of only eleven municipalities and has therefore no regional level/perspective in the public administration. Due to the small administration body communication and coordination among authorities is comparatively easy. This can be seen especially by the fact, that the Department of Civil Protection (DCP)¹²⁰ is responsible for the organisation of Disaster Management and also accountable for structural measures in hazard prevention. The political responsibility lies at the Ministry for Home Affairs, Education and Environment that also takes care of the inter-ministerial coordination. The organisational chart in Figure 16 is due to the size of Liechtenstein comparatively simple and holds only two administrative levels.

Figure 16: Disaster Control – Organisational Chart, Liechtenstein



Source: EC, 2018. Own adaptation.

In case of an event, the DCP is responsible for the whole operation, determines the required rescue/relief capacities and coordinates the active units. The municipal management councils provide local infrastructure and knowledge.¹²¹ The disaster control system of Liechtenstein has due to spatial characteristics a rather unique approach, of the state authority managing all relevant events by consulting and involving the effected municipalities. An essential aspect in Liechtenstein is the coordination with the neighbouring countries Switzerland and Austria.

¹²⁰ Amt für Bevölkerungsschutz. Online: <http://www.llv.li/#/12140/amt-fur-bevolkerungsschutz?scrollto=true>, 03.03.2018.

¹²¹ DCP, 1993.

STAKEHOLDERS – LIECHTENSTEIN

PUBLIC ADMINISTRATION: Department of Civil Protection (operational headquarters, technical operation control); *NGOs/VOLUNTEERS:* voluntary rescue and relief organisations (fire brigade, rescue dogs, water rescue unit, mountain rescue unit etc.), civil society

3.3.6 Slovenia

Slovenia has only two administrative levels (national/local). Besides the state, there are 212 municipalities which are governed by the elected municipal council and mayor. The disaster management system is based on the shared responsibility of the state and the municipalities to prevent and reduce disaster risk and to provide disaster response. Additionally, it is incorporating companies working in the private sectors as well as citizens in taking care of their safety and safeguarding property. During disaster events, the system is activated according to the principle of a step-by-step and bottom-up approach. At the national level the **Administration of the Republic for Civil Protection and Disaster Relief (ACPDR)**¹²² is the competent authority for disaster management, organisationally a constituent body of the Ministry of Defence.

The ACPDR organizes, develops and implements administrative and professional matters related to the national disaster management system. In general, the organisation, preparation and implementation of organisational prevention measures is set on national level and coordinated by the ACPDR. Tasks of the ACPDR are amongst others the preparation of the National Programme of Protection Against Natural and Other Disasters, organisation of monitoring, notification and warning systems, coordination of risk assessments, preparation of national emergency response plans, training of protection and rescue units as well as for the population, maintaining the national reserves of material assets for protection, rescue and relief purposes.

In the response phase ACPDR is responsible for coordinating response to major disasters, assisting local communities, providing support to the Civil Protection Commander of the Republic of Slovenia, providing basic help in a disaster area. In the phase of recovery, the ACPDR assesses the damage caused by the event. ACPDR is also responsible for international cooperation and for the coordinating international assistance in case of a major disaster abroad or in Slovenia. The Administration has 13 regional offices covering designated geographical parts of Slovenia. In every regional office there is a regional notification centre (112 emergency call centre) collecting and dispatching emergency calls to all rescue services (firefighters, medical and other rescue services).

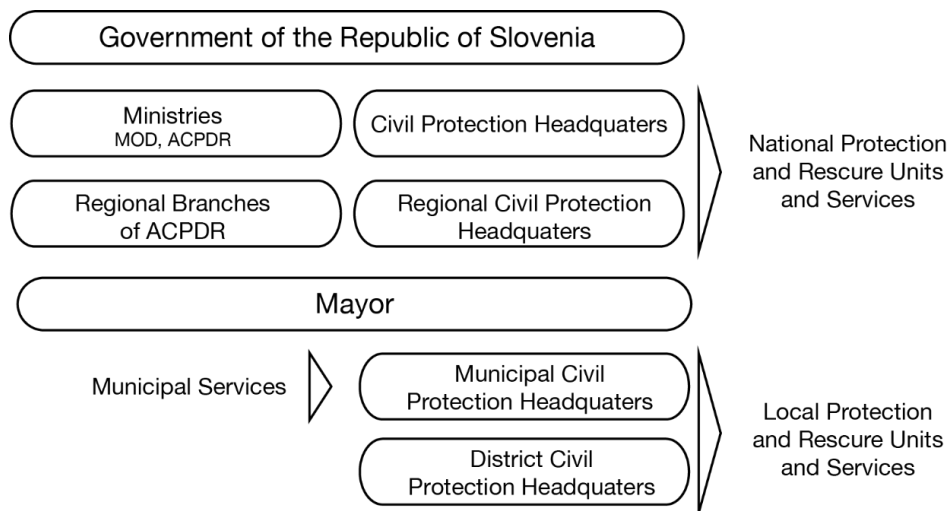
Operational command and coordination is carried out on different levels. In cases of minor events, commanders of individual protection and rescue units command the response (incident commander). The management of the response in major accidents or disasters is in the hands of civil protection commanders and their staff at municipal or regional level. In case of major disasters, the civil protection commander of the Republic of Slovenia manages the response and is directly accountable to the government. He is assisted by the Civil Protection Headquarters, which is formed by the members of various respective ministries, experts from different fields and heads of different protection and rescue units.

¹²² Online:

http://www.mo.gov.si/en/about_the_ministry/organization/administration_of_the_republic_of_slovenia_for_civil_protection_and_disaster_relief/, 03.03.2018.

Figure 17 shows the organisational and command structure for disaster management/civil protection in Slovenia.

Figure 17: Disaster Control – Organisational Chart, Slovenia



Source: Online: http://ec.europa.eu/echo/files/civil_protection/vademecum/si/2-si-1.html#orga, 03.03.2018. Own adaptation.

The structure of the disaster management system is set by the Act on Protection Against Natural and Other Disasters.¹²³ It regulates the roles and responsibilities for administrative units, the private sector (commercial companies, institutions, other organisations) and volunteers. Volunteers/NGOs play in handling disasters like everywhere else an important role.¹²⁴ The system of protection against natural and other disasters is non-military but the armed forces can support rescue and relief tasks especially when civilian resources are not sufficient. The Government shall decide on the participation of the Slovenian Armed Forces in protection and rescue activities, while the Minister decides on its participation in the event of emergency on the proposal of the Civil Protection Commander or the Chief of General Staff when authorised by the Minister (Article 37, Official Gazette of the RS, No. 03/04). Slovenia has a 100% coverage with contingency plans.

STAKEHOLDERS – SLOVENIA

PUBLIC ADMINISTRATION: The Slovenian professional fire fighters' association, emergency medical services, public veterinary services, public social care services, forensic unit, national rapid response unit, NBC Protection and Decontamination Units, technical rescue unit, urban search and rescue unit, explosive ordnance disposal unit, support services; **PRIVATE SECTOR:** Within the scope of their activities, commercial companies, institutions and other organisations are responsible for implementing emergency measures relating to the protection and rescue of people and property; **NGOs/VOLUNTEERS:** firefighting association, mountain rescue service, cave rescue service, federation of divers, Slovenian Red Cross, Caritas of Slovenia, Scout Association etc.

¹²³ Official Gazette for the RS 64/1994.

¹²⁴ Act on Slovenian Red Cross, Official Gazette for the RS 7/1993, The Societies Act, Official Gazette for the RS 61/2006.

3.3.7 Switzerland

In Switzerland Disaster Management is as a part of civil protection handled by the **Federal Office for Civil Protection (BABS)**¹²⁵ which is part of the Department of Defence, Civil Protection and Sport¹²⁶ and represents the same governmental unit as a ministry in other countries. The BABS has six different business units, among them civil protection policy, training, resources and infrastructure. There also exists a national emergency operations centre¹²⁷ in Zürich. The legal basis for Disaster Management in Switzerland is complex and the BABS holds only an overall competence. Like in many other areas in the Swiss administration, there exists a federal law, the **Federal Act on Civil Protection and Civil Defence**¹²⁸ accompanied by other regulations on different administrative levels. Civil protection is basically performed by the 26 cantons and they have their own regulatory and organisational frameworks. Especially natural hazards have to be dealt in the first place on the cantonal level. If a certain event exceeds the capabilities of the canton support by the federal state (esp. armed forces) is possible.

The Swiss system of civil protection is based on five pillars: the police, the fire brigade, the medical services, infrastructure providers and civil defence.¹²⁹ They are coordinated by a common management on different levels. The responsible administrative unit has to establish a management that provides sufficient information on threats, performs the warning and coordinates the organisations. The cantons are also accountable for training programmes and inter-cantonal cooperation.

Within Switzerland relevant hazards have been identified and divided into three groups: natural hazards, technical hazards and societal hazards. For all of them a comprehensive analysis of the actual hazard and risk serves as basis for the development of coping strategies in civil protection. There is an ongoing discussion in Switzerland on the further development of civil protection in general and a **Strategy for Civil Protection and Civil Defence 2015+**¹³⁰ is in place.

In case of events there are cooperative units that are responsible for dealing with the situation. In the national level, there exist a staff unit: The **Federal Crisis Management Board (FCMB)**. The FCMB is in general in charge when it comes to incidents or events with national implications. The experts assess the overall situation, possible developments and directs the federal management measures. The responsibilities of the board comprise leading the personal in the administrations as well as further agencies that are integrated on the basis of operational experience or situation demands. The National Emergency Operations Centre is one core element of the FCMB notification/coordinating its members.¹³¹ The single cantons have their own legislation for civil protection and a similar crisis management system to the federal state and organise civil protection in cooperation with the municipalities. The cantons have crisis management boards themselves and also at local as well sometimes on regional level crisis management boards are established. All of them prepare emergency/contingency

¹²⁵ Bundesamt für Bevölkerungsschutz. Online: <http://www.babs.admin.ch/en/home.html>, 03.03.2018.

¹²⁶ Eidgenössisches Department für Verteidigung, Bevölkerung und Sport. Online: <http://www.vbs.admin.ch/en/home.html>, 03.03.2018.

¹²⁷ Online: <https://www.naz.ch/index.html>, 03.03.2018.

¹²⁸ Bundesgesetz über den Bevölkerungsschutz und den Zivilschutz (BZG), 2002.

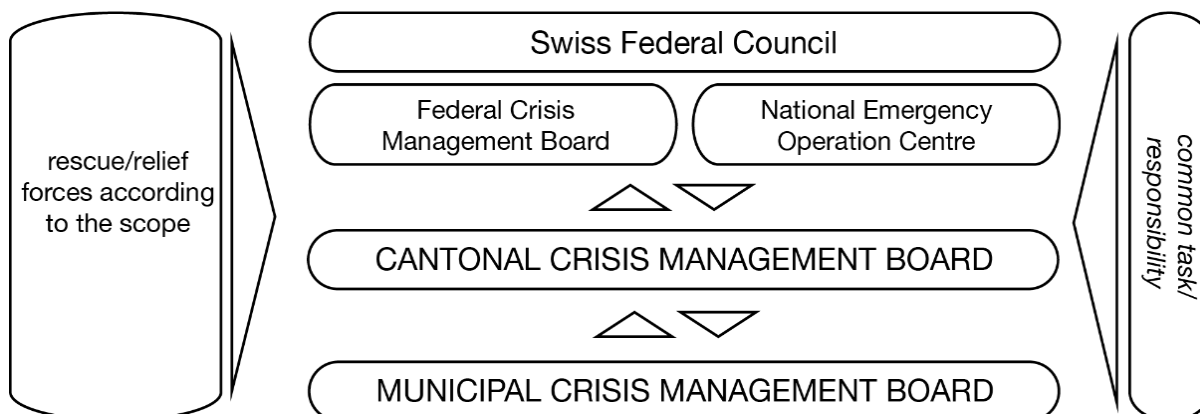
¹²⁹ Art. 3 BZG 2002.

¹³⁰ VBS, 2016.

¹³¹ VBS, 2012.

plans.¹³² Figure 18 gives a basic overview of the organisation of civil protection which holds also the agendas of natural hazard management.

Figure 18: Civil protection (focus on natural hazards) – Organisational Chart, Switzerland



Source: Schindelegger ©

Warning and alert systems concerning natural hazards events are very valuable to set up appropriate measures in time. That is why, the federal state introduced OWARNA.¹³³ This project aims to improve the warning and alarming systems concerning natural hazards and contribute thereby to risk reduction. Local capacity building is an important aspect in this project that is clearly governance related. Generally, the Swiss civil protection system is very well organised including all administrative levels, institutions from the private sector as well as NGOs (local fire brigades etc.). Running civil protection is a common task and is based on a large extent on voluntary participation. The coordination of various actors is therefore a crucial aspect and was improved in 2005 by establishing LAINAT, a coordinative board. On the local level, experts are trained and available in most municipalities. The fire brigades are, except in few cities, voluntary non-professionals, that receive specific training.

STAKEHOLDERS – SWITZERLAND

PUBLIC ADMINISTRATION/INSTITUTIONS: Federal Office for civil protection, BAFU (for forecasting and warning), Federal Office for Meteorology and Climatology MeteoSwiss, Swiss Federal Institute for Forest, Snow and Landscape, Police forces, fire brigades, armed forces, health care system; **PRIVATE SECTOR:** technical companies (esp. for infrastructure provision), insurances (mainly building insurances), Swiss Society of Engineers and Architects (SIA); **NGOs/VOLUNTEERS:** fire brigades, rescue organisations.

¹³² Kanton Bern, 2017.

¹³³ Online: <https://www.bafu.admin.ch/bafu/de/home/themen/naturgefahren/dossiers/projekt-owarna-zeitige-warnungen.html>, 03.03.2018.

4 Mapping Risks

The mapping of hazard areas for single natural hazards has experienced a rapid development over the last decades. Firstly, the facilities for exact calculations and predictions by the use of information technologies lead to new possibilities and accuracy. Secondly, the legal requirements for state interventions have been clarified by judicature and a comprehensive foundation in political decision-making processes is inevitable.

For the first hazard maps, state authorities tried to demarcate concerned areas by using simple methods such as observations of events. By using calculation methods based on the probability and magnitude of events a practical demarcation of hazard areas became possible. Such hazard maps served and still serve primarily for the planning of technical protection measures and have over the years been developed towards a general basis for planning and supporting all kinds of preventive measures. The sheer delineation of hazard areas includes normally no statement on the actual damage potential. But different natural hazards have specific characteristics leading to different strategies and measures. Avalanches might occur only on a local level but hold a high probability of killing people. The same accounts for rockfall events. Slow landslides or floods might not be a direct threat to the life of people but mean a major threat to property and infrastructure. Taking damage potential of natural hazards into account leads to a judgement on risk and can also be displayed in maps.

Mapping hazards and risks is a national obligation and is in some nations existing nationwide for different hazards with differing level of detail in the member states. The European Union has established a systematic flood hazard mapping approach by the **Floods Directive**. The overall aim of the directive is to "...establish a framework for the assessment and management of flood risks..."¹³⁴ and mapping the risks is an essential part of the assessment. The procedure should start with a preliminary flood risk assessment identifying the river sections with potential significant flood risks. As a second step flood hazard maps and flood risk maps for the relevant sections have to be prepared. As third step, an integrative flood risk management plan has to be developed that lists actual measures for flood areas and presents a national working programme. The systematic of the Floods Directive had to be transformed into national law in the member states. Meanwhile the flood risk management plans exist in EUSALP region member states.

The European Commission was also working on **Risk Assessment and Mapping Guidelines for Disaster Management** and published a working paper in 2010.¹³⁵ The experience of efficient national disaster management practices should be shared and the drafted guidelines build an experience in the practical implementations of national risk assessments and mapping.¹³⁶ In this sense coherence and consistency among the national systematics should be improved. The risk Assessment process itself gets split up in an actor analysis, public consultation and communication and data collection to calculate and map risks. With additional information and publications, the European Commission serves as knowledge platform for hazard/risk assessment and mapping and supports initiatives such as the **Disaster Risk Management Knowledge Centre (DRMKC)**.¹³⁷

¹³⁴ Art 1 Directive 2007/60/EC.

¹³⁵ EC, 2010.

¹³⁶ EC, 2010, p. 5.

¹³⁷ EC, 2017b.

The national regulatory frameworks and obligations for having hazard and/or risk maps are strongly differing and set within the independent specific national and regional legislative frameworks. On the whole, all EUSALP member states have already established hazard (and partly risk) mapping within their specific need framed by the hazard exposure and vulnerability. Therefore, a direct comparison of existing maps and coverage would provide only limited value for the discussion. Scales, calculation/simulation methods and actuality differ widely. When it comes to the presentation of risk maps, that have experienced a promotion by the Flood Directive, many aspects still need further discussion. Risk is a dynamic concept changing on a daily basis and is difficult to use for planning determinations. Risk maps are therefore still under way and exist largely only exemplary or on a preliminary scale.

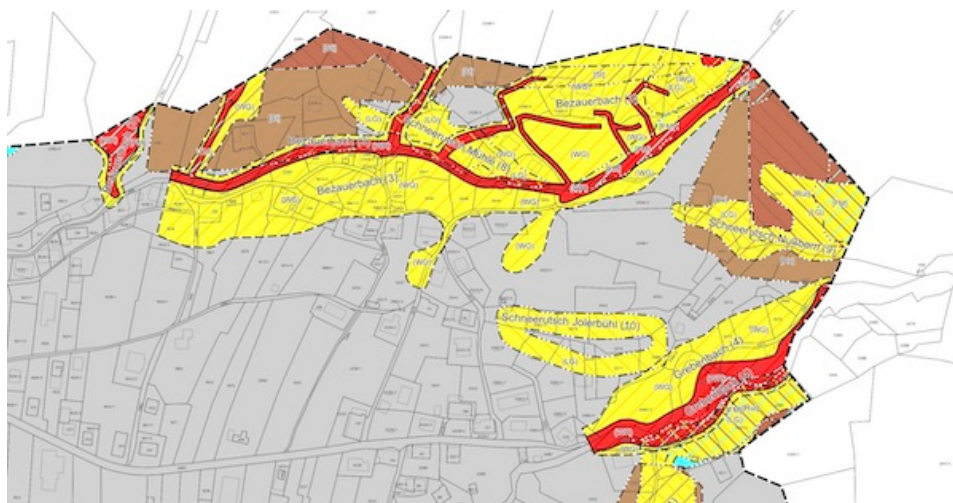
4.1.1 Austria

In Austria, there are many different kinds of hazard maps and recently more evolving risk maps for different hazards. Maps are basically drafted on a municipal scale and sometimes on a regional one (e.g. along lakes, rivers). The provision of hazard maps is basically an assignment of the federal state and set in the Forest Act 1975 as well as the Water Act 1959.

Generally, in Austria there exist two public authorities (BWV, WLV) that are responsible for hazard mapping of floods, avalanches, torrents, rockfall and landslides. The **Austrian Service of Torrent and Avalanche Control** (WLV) set at the Austrian Ministry for Sustainability and Tourism, has according to the provisions of the Austrian Forest Act 1975 the obligation to present catchment areas of torrents and avalanches as well as endangered areas in hazard zone maps. The first maps were drafted in the 1970s and step by step extended all over Austria. Basis for the differentiation of hazard zones is an event that might occur with a probability of 1 in 150 years. The determination of the zones is based on the cadastre on a 1:1.2000 scale and therefore very detailed. Every hazard zone map has to undergo a comprehensive control and approval procedure. Everybody who can demonstrate a justified interest has in this procedure the possibility to inspect the draft and express one's opinion but with no direct formal effect.¹³⁸ The hazard zone maps of the WLV distinguish two main zonal categories for avalanches and torrents (see Figure 19). The red hazard zone means, that a permanent use by settlements and infrastructure is not possible and a protection not cost efficient. The yellow hazard zone means, that different land uses are basically possible but affected by threat and need precaution measures. The hazard zone maps include also areas of potential threats by rockfall and landslides, but don't distinguish the intensity of the threat in a zonal distinction.

¹³⁸ WLV, 2007.

Figure 19: Hazard Zone Map – WLV (extract)

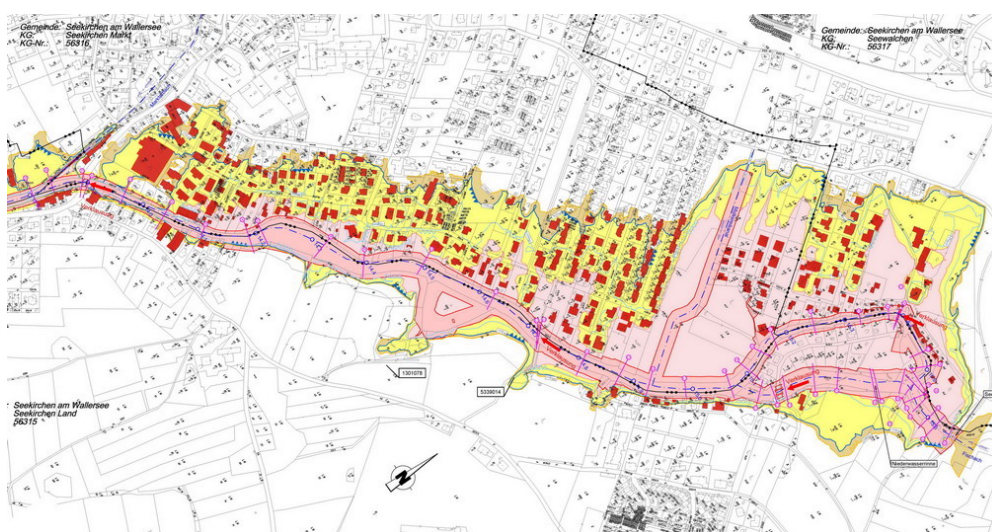


Source:

http://vogis.cnv.at/output_ims/WLV/GZP%20Bezau%20Revision%202014/2_KARTOGRAPHISCHER%20TEIL/E_Gefahrenzonenplan_Ubersicht%20Blattschnitte_1.pdf, 02.03.2018.

The division for **Flood Control Management (BWV)** at the Ministry Sustainability and Tourism has the overall responsibility for hazard zone maps for rivers in Austria.¹³⁹ They distinguish more different zones due to the differing legal basis but basically show Red Zones where there is a ban for construction activity, Red-Yellow Zones for areas that are needed for flood water runoff and Yellow Zones where further development is basically possible but needs specific countermeasures.¹⁴⁰ The procedure of adoption for these hazard zone plans is widely identical to the ones of the WLV. Because some rivers are used as waterways (esp. the Danube river) the Ministry for Transport, Innovation and Technology (bmvit) holds, as already presented, also certain responsibilities for mapping hazards. There, the same methodology and differentiation of hazard zones of the BWV is used for mapping.

Figure 20: Hazard Zone Map – BWV (extract)



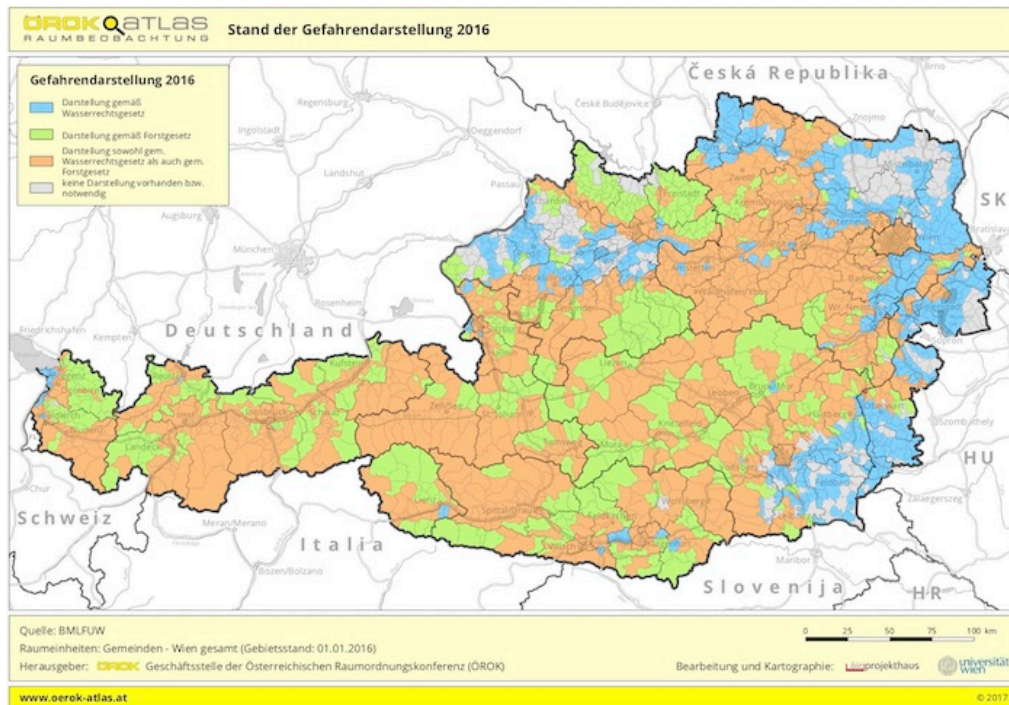
Source: <http://www.dlp.at/projektarten/ Gefahrenzonenplanung/>, 02.03.2018.

¹³⁹ Hazard Zone Plans are based on § 2 Z 3 WBFG 1985.

¹⁴⁰ BWV, 2006.

The harmonization and provision of data and information has been a focus of efforts in the past few years. The platform for Natural Hazard Overview & Risk Assessment Austria (HORA)¹⁴¹ brings together different hazard maps and hazard information and is generally accessible.

Figure 21: Hazard Mapping, Coverage in Austria, 2016



Source: ÖROK, 2016

On the whole, the existing hazard maps in Austria were in the first place introduced as a basis to plan technical and biological measures for hazard prevention. Meanwhile, spatial planning regulations are referring to hazard zone maps which have to be displayed in land use plans and hazard intensities have to be taken into account in planning decisions. As seen in Figure 21 there is a high degree of coverage with specific hazard zone plans. Especially for avalanches, torrents and floods hazard zones are very well known and also documented. Still in its infancy is the identification and evaluation of rockfall and landslide areas.

Another important aspect is the fact, that the focus so far has been on the identification and demarcation of hazard zones based on the probability of occurring events. Hazard risks have been taken into account for the first time for the implementation of the Floods Directive and by drafting the flood risk maps.

Generally, the information level on hazard prone areas in Austria is so far very good and hazard and risk maps easily accessible for the general public.

¹⁴¹ Online: <http://www.hora.gv.at>, 02.03.2018.

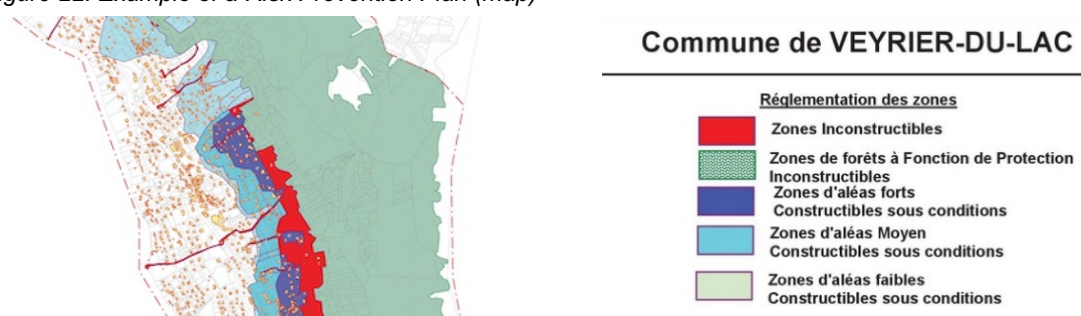
4.1.2 France

Risk and hazard mapping have a long tradition in France, providing risk information plans at the *département* level and the risk prevention plans at the local level.¹⁴² The Ministry of Ecology, Sustainable Development, Transport and Housing (MEDDTL) is the national authority in charge of natural risk prevention relevant in the EUSALP region. The MEDDTL fosters the knowledge on risk, passes information to the public and takes care of hazard mapping, especially with the Risk Prevention Plans (PPR).¹⁴³ The Risk Prevention Plan was introduced in 1995 and has become an essential instrument for planning state action to reduce vulnerability. The legal basis is set in the environmental code¹⁴⁴ and assigns the PPR responsibility to the state. The PPRN includes different kinds of risk including floods, earthquakes, land movements, forest fires, avalanches etc. and up-to-date information can easily be accessed via the web-platform “GeoRisques”.¹⁴⁵ The General Directorate for Prevention of Risks (DGPR) part of the MEDDTL leads the implementation of the risk prevention policy.

For mapping natural hazards there are different public authorities in charge and the scales of hazard maps are differing widely. Landslides for example are mapped very roughly (1:100.000) while floods go down to a scale of 1:10.000. Hazard maps in France are used for communication to the public, as basis for land use planning, emergency response plans and targeted allocation of resources for prevention.¹⁴⁶ Risk Prevention Plans are only available for spatially displayable hazards and have following objectives:¹⁴⁷

- Delimit so called “danger zones” (red zones) where any kind of construction, development etc. is forbidden
- Delimit “precautionary zones” (blue zones) that are not directly exposed to risks, but where constructions or other activities might increase existing risk or create new risks
- Define measures of prevention and protection
- Define in red and blue zones measures for existing land-uses

Figure 22: Example of a Risk Prevention Plan (map)



Source: © ONF-French National Forests Office – Restoration of Mountain Territories Department

The dossier on every Risk Prevention Plan contains a set of maps. A map of historic events, a map of existing hazards defining zones that are affected, a map of objects to define the

¹⁴² FLEISCHHAUER, 2006, p. 43.

¹⁴³ http://www.risknat.org/adaptalp/who-does-what/stakeholders_france.html#MEDDTL, 03.03.2018.

¹⁴⁴ Article L515, Code de l'environnement.

¹⁴⁵ Online: <http://www.georisques.gouv.fr>, 03.03.2018.

¹⁴⁶ Online: http://ec.europa.eu/echo/files/civil_protection/civil/prote/hazard_mapping/mss_eea_cc/france/hazard_mapping.pdf, 03.03.2018.

¹⁴⁷ FLEISCHHAUER, 2006, p. 46.

vulnerability of a site and finally the zoning map which is a result of the previous maps merged under expert advice.

With the Natural Risk Prevention Plan France has a holistic and systematic hazard and risk mapping tool. The essential limit for such plans is the time span it takes to draft such plans.

4.1.3 Germany

In Germany hazard and risk mapping is a task regulated and carried out by the federal states. The two states within the EUSALP region, Baden-Württemberg and Bavaria, have differing hazard mapping approaches for most of the natural hazards. Floods are handled equally because of the legal basis on federal state level. Floods get addressed in the Water Management Act¹⁴⁸ at federal level. The implementation of the Floods directive was enacted in §§ 73-75 WHG to fulfill the requirements of the European Union. In § 76 WHG general flood areas are defined as areas that are statistically affected by floods every 100 years. The federal states governments have to legally declare these general flood areas. In such areas zoning in additional building land is prohibited.

In Bavaria, there does not exist an area-wide hazard mapping yet. They do have hazard and risk maps for APSFR sections as well as the general flood and retention areas according to the Water Management Act. For other hazards such as rockfall there exist preliminary hazard maps that in case of a development need additional analysis and expert advice. Past events get officially recorded and documented as information for future planning activities. The coverage with hazard maps for floods is for APSFR sections finished, for other natural hazards there exist no up-to-date information. Drafting and financing of hazard maps is fully covered by the State of Bavaria. Involvement of local population is so far rather low. The procedure is more a technical task and the results are checked for plausibility with locals before the plans enter into force. They can be easily accessed online via the Bavarian geoportal.¹⁴⁹

In Baden Württemberg avalanches and rockfall are due to the topography not relevant. Floods, torrential hazards and landslides though occur. For floods the national legislative framework requests the definition of general flood areas as well as areas for flood retention and the preparation of an FRMP. Other hazard or risk maps for landslides or torrential hazards don't exist in Baden Württemberg.

¹⁴⁸ Wasserhaushaltsgesetz (WHG), 2009.

¹⁴⁹ Online: www.iug.bayern.de, 03.03.2018.

[illegible]

4.1.4 Italy

Hazard mapping in Italy is done to a certain extent by the state represented by the River Basin Authorities (RBA) that were legally established in 1989 and prepare the River Basin Plan (RBP). It is the institutional instrument to coordinate different sectoral policies for the water cycle, soil conservation, water pollution etc. All other plans are settled at a lower institutional ranking and depend strongly on the general guidelines set in RBPs. There exist different plans, such as the Water Infrastructure Plan, the Regional Water Plan and for natural hazards relevant risk management plans (*Piano stralico per l'assetto idrogeologico del territorio*, PAI).¹⁵⁰ These plans provide coordination in management of geohydrological risks and only local authorities and the state itself are required to conform the PAI. The first PAI was prepared for the Po-basin. Other basins followed providing such preliminary hazard maps at the scale of 1:25.000 to 1:10.000 displaying also the most vulnerable zones. Here risk classes (low, moderate, high, very high) are distinguished.¹⁵¹ River basin hazard maps are provided also online and Figure 24 shows an example of such a map. There exist different maps for flood hazards, avalanches and geologic risks. Due to the establishment of mapping principles in the RBAs the coverage with preliminary hazard maps for different natural hazards is very good. Detailed hazard and risk plans are regulated differently especially in autonomous regions.

A map of the area around Remanzacco and Moimacco, showing the Tevere river and various colored zones (green, yellow, orange, red) indicating different levels of risk or land use. The map includes labels for 'REMANZACCO' and 'MOIMACCO'.

¹⁵⁰ MASSARUTTO et al., 2003, 19.

¹⁵¹ RISKNAT, 2017. Online: <http://risknat.org/?lang=en>, 03.03.2018.

The PAI is basically a top-down instrument and does not show extensive public participation and public involvement. Provincial/regional laws demand lately the provision of the plans via online platforms to at least pass on information.

The need to implement the Flood Directive meant new aspects that had to be considered concerning flood hazard management in Italy. The Areas with Potential Significant Flood Risk (APSFR) in Italy are still not available via the European Commission.¹⁵² The implementation and drafting of Flood Risk Management Plans though is underway and finished for some areas. The legal basis for the Flood Directive on state level is the decree 49/2010. For the drafting of the FRMP the regions/autonomous provinces together with the national authority of civil protection (*Dipartimento della Protezione Civile*). The autonomous province of Bozen-South Tyrol has for example finished its FRMP in 2016.¹⁵³

The autonomous province of Bozen-South Tyrol has not only the river basin-based hazard/risk maps and the FRMP but instead detailed hazard maps having their legal basis in the Planning Act (13/1997). Such hazard maps are drafted on municipal level for water hazards, avalanches, landslides and rockfall. The Agency for Civil Protection aims to have a full coverage for the province by 2021.¹⁵⁴ Preliminary hazard maps, an event cadaster as well as detailed hazard maps are accessible online.¹⁵⁵

The autonomous province of Trento has established hazard maps associated to natural hazards such as avalanches, river and torrential floods, rockfalls and landslides, forest fires and earthquakes. The maps are available online either by theme or in a multilayer version. The hazard maps form the basis of reference for the realization of the Synthesis Map of Hazards adopted in the territorial planning and for the realization of the General Risk Map, mainly used for the definition of prevention and protection intervention plans. Hydrogeological risk areas, including areas that are deriving from flooding, landslide or avalanche phenomena, are identified by the General Plan for the use of public waters which represents the instrument for governing water resources in the autonomous province of Trento. The adoption of the district flood risk management plan is responsibility of the national basin authorities that act within the hydrographic district of the eastern alps and the Po river basins. However, taking the special statute of autonomy and the exclusive expertise in the field of civil protection, prevention and first aid for disasters, public, urban planning and landscape protection into account, the Province has adopted the decision to draw up its own flood risk management plan that is integrated with the plans that the various national basin authorities have prepared for each river basin district.

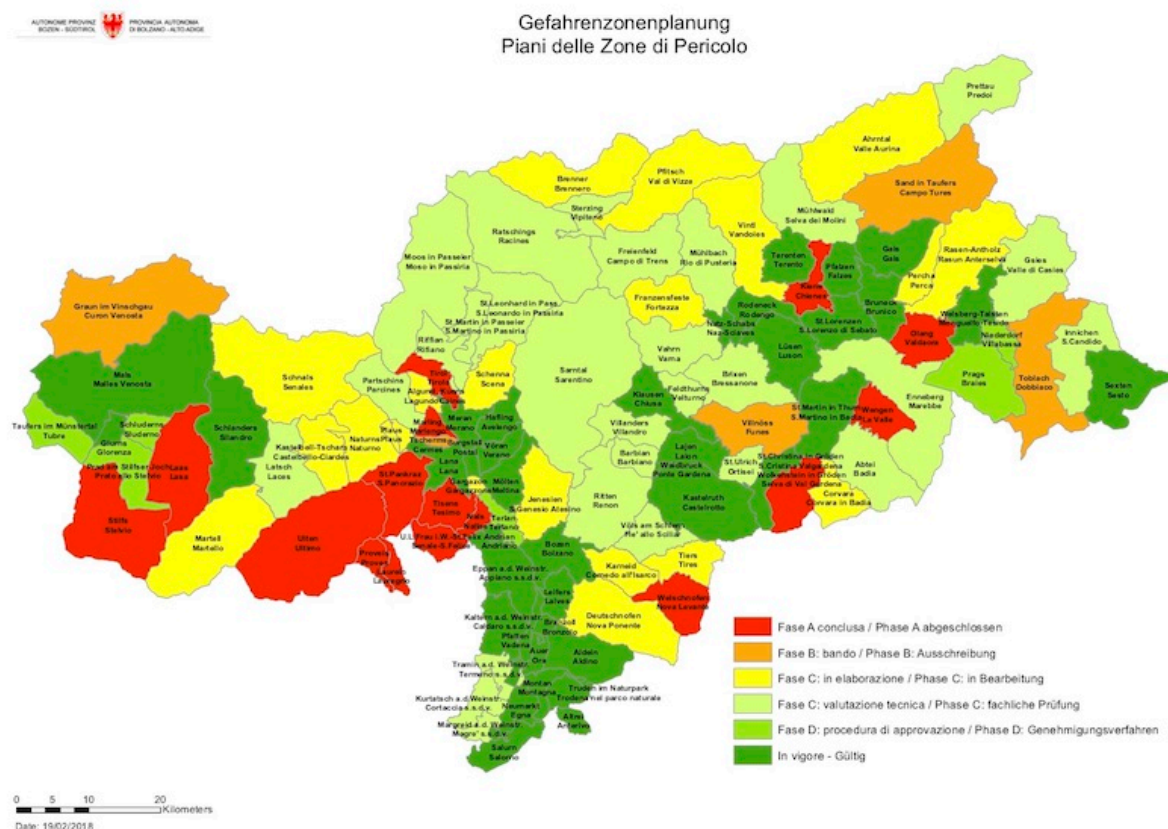
¹⁵² See Online: <http://www.eea.europa.eu/themes/water/interactive/floods-directive-pfra-apsfr>, 03.03.2018.

¹⁵³ Agentur für Bevölkerungsschutz, 2016.

¹⁵⁴ Agentur für Bevölkerungsschutz, 2016.

¹⁵⁵ Online: http://gis2.provinz.bz.it/geobrowser/?project=geobrowser_pro&view=hazardbrowser_atlas-b&locale=de, 03.03.2018.

Figure 25: Coverage with hazard maps in South Tyrol



Source: http://www.provinz.bz.it/natur-raum/images/GZP_Karte_Status_20180219.pdf, 03.03.2018.

4.1.5 Liechtenstein

The systematic for hazard mapping in Liechtenstein was mainly adopted from the Swiss neighbors and hazard mapping in the principality is basically completed.¹⁵⁶ The maps contain color-coded hazard zones that make the intensity and the natural hazard visible. The hazard map is included in land use planning as hazard zone map showing affected settlement areas (see Figure 266). The intensity of the hazards for settlement areas is displayed by the decreasing scale: red, blue with stripes, blue, yellow, yellow with stripes. Red zones exclude building activities completely while the other zones only mean certain restrictions. For agricultural land and forests, there is also a color-coded scale for hazard intensities distinguishing basically purple (generally great intensity) and green (moderate intensity) zones.

The legal basis for the hazard map was established by the Forest Act in 1991.¹⁵⁷ The accompanying directive did specify the instrument further.¹⁵⁸ The systematic was individually developed for the needs of Liechtenstein together with the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) and was implemented under lead management of the Office for Forest, Nature and Landscape.¹⁵⁹ Due to the administrative reorganization in 2013, hazard maps are now a responsibility of the Department for Civil Protection (DPC).

¹⁵⁶ Government of Liechtenstein, 2011, p. 11.

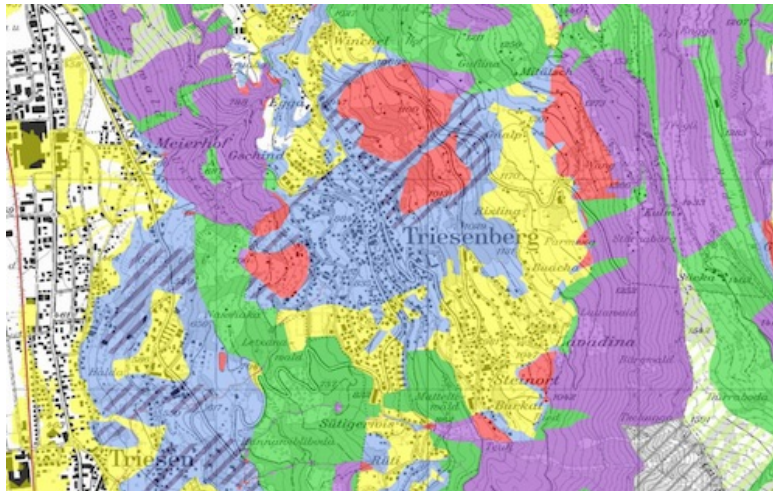
¹⁵⁷ Art. 25 Waldgesetz (WaldG) 1991 (921.0).

¹⁵⁸ Waldverordnung (WaldV) 1995 (921.012).

¹⁵⁹ AWWL, 2006.

There is no broad participation process included in drafting hazard maps. Locals are consulted on an individual basis for information on past events and process dynamics. The finished hazard map is discussed within the municipality for a plausibility check. The mapping process gets fully paid by the state.

Figure 26: Example of a Hazard Zone Map (extract)



Source: State Administration Liechtenstein, 2017.

Hazard maps in Liechtenstein show no information on the damage potential of the actual hazard within the zonal determination. Therefore, risk maps were introduced in Liechtenstein in 2004. They are not online accessible because they were calculated on differing information and are not fully consistent and comparable. They are not dynamic and don't get updated on a regular basis, which could lead to a misinterpretation if used for actual planning activities. The risk maps are therefore rather preliminary risk maps to get a basic idea where a closer look and additional expert advice is necessary.

On the whole Liechtenstein has easily accessible hazard maps with a nearly 100% coverage of the principality. The available online access to the maps ensures high transparency and especially spatial planning can take not only the hazard zones but also the actual hazard risk into account.

4.1.6 Slovenia

The republic of Slovenia has a 2-step hazard map approach providing preliminary maps on national/regional level and maps on local level for detailed assessment on hazard processes. On the national/regional level there exist preliminary hazard maps (*Opozorilna karta*) for different natural hazards on scales from 1:10.000 up to 1:400.000. Such maps cannot be used in actual local planning activities. Such preliminary maps exist for example for flood hazards, erosion landslides or avalanche hazards.¹⁶⁰ These maps are integrated in the River Basin Management Plans prepared for the Danube and the Adriatic Sea catchments established in 2009 (for period 2009-2015) and 2016 (for period 2016-2021).¹⁶¹ There also exist large scale maps (susceptibility maps) for landslides, debris-flow and rockfall events, earthquakes etc. Hazard assessments are done by the combination of statistical/stochastic models and the detailed knowledge of the actual hazard processes. The final result of the assessment

¹⁶⁰ MIKOŠ, 2013. Online: http://www.mop.gov.si/si/delovna_podrocja/voda/nacrtn_upravljanja_voda/.

¹⁶¹ European Commission, Online: http://ec.europa.eu/environment/water/participation/map_mc/countries/slovenia_en.htm, 03.03.2018.

procedure are local hazard maps at scales reaching from 1:500 to 1:5.000. Such maps show the investigated areas and define hazard classes based on a calculation of probability and expected hazard intensity. The three classes are color coded and give an information on the actual threat: high (red), moderate (orange) and low (yellow).¹⁶² Such local hazard maps serve especially as a basis for planning prevention measures. The first legal decree regulating spatial development linked to the hazard map information was prepared after a debris flow event in 2000 in the village of Log pod Mangartom. The reconstruction of damaged/destroyed building was based on the assessed risk and regulations for further development of the village established. Hazard mapping activities are planned and financed by the Ministry of Environment and Spatial Planning and are basically a state responsibility. There is no current data on the actual coverage rate with hazard maps. Especially the mapping of flood hazard/risk has been a focus in recent years. Hazard maps are basically accessible online. Flood hazard maps are legally binding for planning activities by decree, while for other maps the legal basis differs.

The Flood Directive introduced new kind of maps in Slovenia concerning the assessment of flood hazards. 61 areas of potentially significant flood risk (APSFRs) were identified in the first place. The actual coverage with flood hazard/risk maps on APSFR areas (areas with ca. 50% of damage potential in Slovenia) is 100% and are included in first state's Flood Risk Management Plan (for the period 2017-2021). Currently, on the one hand, efforts are directed towards the adoption of additional state official rules for the production of hazard/risk maps for torrential floods (debris flows), landslides, snow avalanches and rockfall on the other hand, state, municipalities and infrastructure management administration foster hazard assessments and production of legally binding flood hazard/risk maps¹⁶³ for municipalities or critical areas with spatial limitation by competent external expert institutions. In this context, the fact that Slovenia has provided the whole of Slovenia LIDAR data for free has a great positive effect. Both, nationally and locally, the public availability and accuracy of all available data on restricted zones is constantly improving. For example, all flood hazard maps are online available¹⁶⁴ and proved to be a useful basic starting point in public discussion and flood risk awareness activities, useful support in the participatory process, indispensable input in spatial planning and the basic platform for integral flood risk management. Published flood hazard and other (mostly "warning") maps help residents and users to understand the hazard/risk.¹⁶⁵

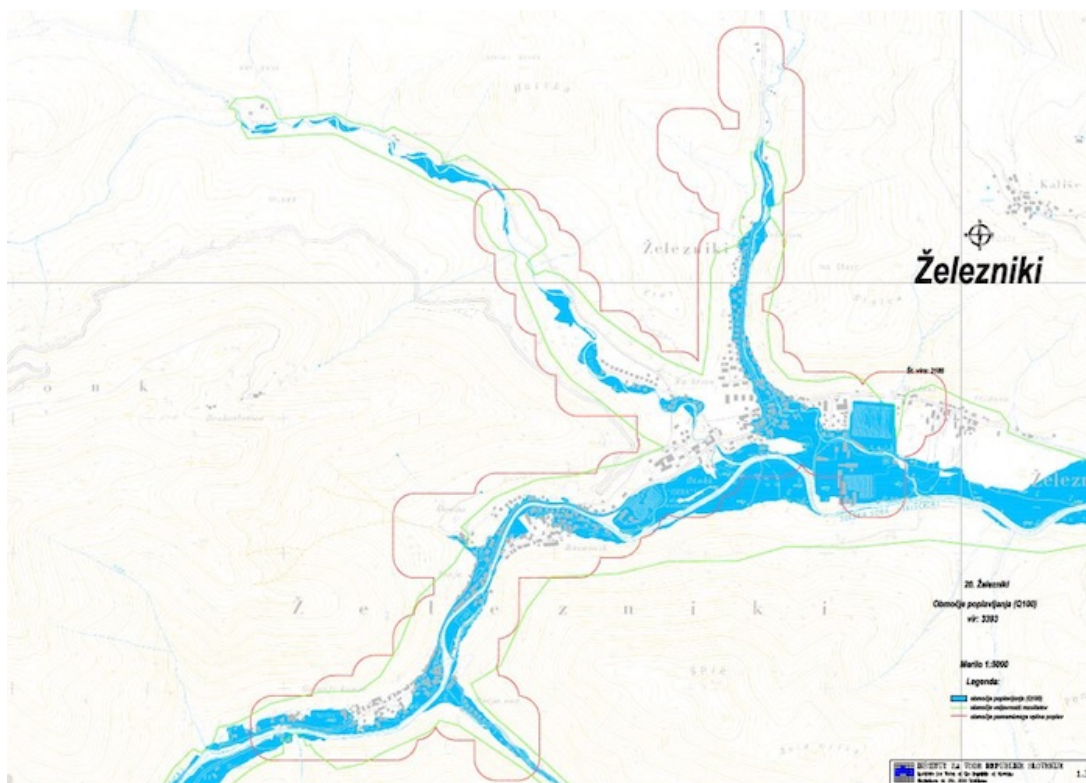
¹⁶² MIKOŠ, 2013, 9.

¹⁶³ Official Gazette for the RS 60/2007 and Official Gazette for the RS 89/2008.

¹⁶⁴ Online: http://gis.arso.gov.si/evode/profile.aspx?id=atlas_voda@Arso.

¹⁶⁵ SLOKAR and PAPEŽ, 2018.

Figure 27: Example of a flood hazard map (100-year flood) – Železniki, Slovenia



Source: Ministry of the Environment and Spatial Planning, 2017.

4.1.7 Switzerland

Hazard mapping in Switzerland on a consistent general basis started rather late in the 1990s. Nevertheless, meanwhile the coverage with hazard maps is almost up to 100% of the residential area and the information is easily accessible online.¹⁶⁶ Hazard maps are used as a basis for spatial planning, planning of risk reduction measures, as instruments in emergency planning and for raising awareness. The legal obligation for identifying areas that are at risk is in fact a cantonal assignment and there is a distinction between preliminary hazard maps at the scale between 1:10.000 to 1:50.000 and actual hazard maps that allow a judgement on property scale. The legal basis for the assignment of the responsibility to the cantons is set in the Swiss Federal Water Act¹⁶⁷ and the Swiss Forest Act¹⁶⁸ while the federal state supports the cantons financially in carrying out preventive measures and provides a framework for drafting hazard maps. **Fehler! Verweisquelle konnte nicht gefunden werden.**²⁹ illustrates that hazard maps use generally the same colour coding for different hazards (floods, avalanches, landslides, rockfall).¹⁶⁹ *Red Zones* mean an absolute building ban while in *Blue Zones* development with certain adaptations is still possible. In *Yellow Zones*, certain minor damages to buildings and infrastructure can occur. *Yellow Brindled Zones* show residual risk areas and *White Zones* have no significant hazard risk. The calculation of the zones is based on an evaluation of the expected probability and intensity (see Figure 28). Hazard maps with

¹⁶⁶ General web-application for geographic information: <https://map.geo.admin.ch>, see 'Natural Hazards'. Information on the status quo in hazard mapping:

<https://www.bafu.admin.ch/bafu/de/home/themen/naturgefahren/fachinformationen/naturgefahrensituation-und-raumnutzung/gefahrengrundlagen/gefahrenkarten--intensitaetskarten-und-gefahrenhinweiskarten.html>, 03.03.2018.

¹⁶⁷ Art. 2, 721.100 Bundesgesetz über den Wasserbau, 1991.

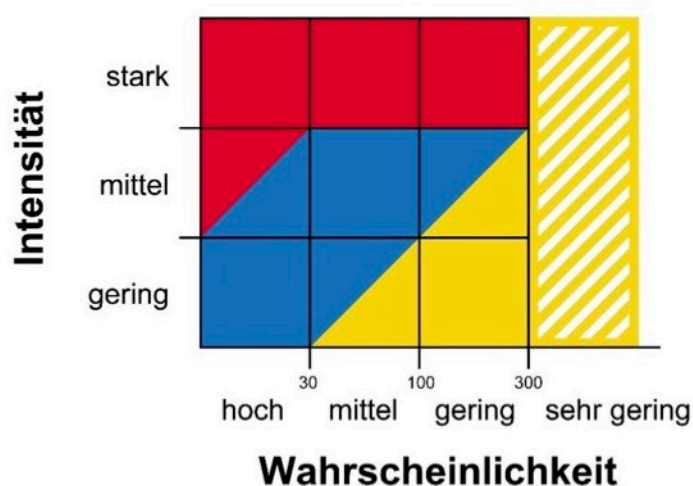
¹⁶⁸ Art. 19, 921.0 Bundesgesetz über den Wald, 1991.

¹⁶⁹ BAFU, 2015b.

this zoning distinction exist for floods, avalanches, landslides and rockfall and use a harmonised data structure to provide information on a national basis. The coverage with hazard maps in Switzerland is comparatively good. 88% to 99% of relevant hazard processes are already mapped.¹⁷⁰ The financing for the mapping work is brought up by the canton and the federal state in an equal share.

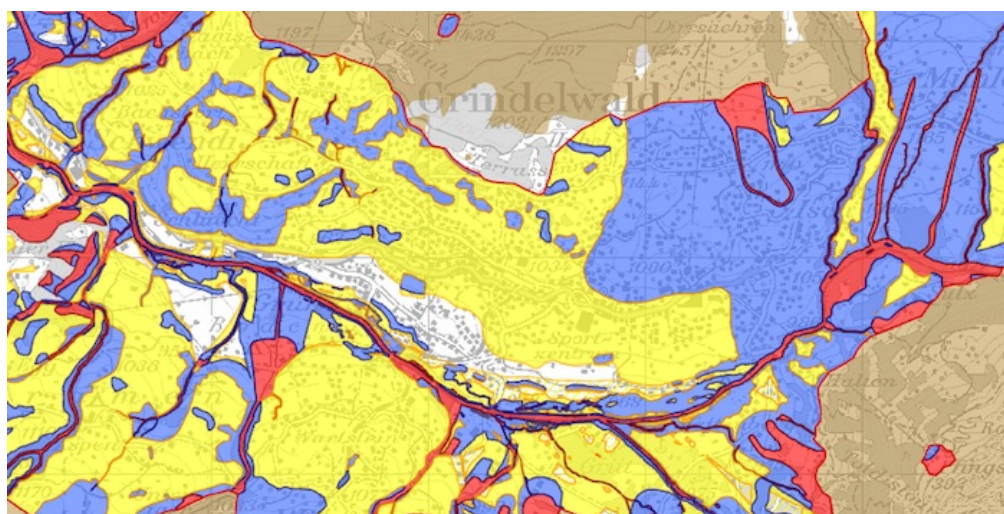
Switzerland did not have to implement the Flood Directive of the European Union and has therefore not Flood Risk Management Plan. Furthermore, there do not exist risk maps on a general basis so far and hazard information is at the moment strongly relying on the twofold hazard maps incorporated in land-use and cantonal structure plans. As soon as hazard maps are incorporated in land-use plans, they become legally binding. Municipalities can, to some extent, decided on exceptions.

Figure 28: Hazard categories in Switzerland



Source: BAFU, 2001. Online: <https://www.bafu.admin.ch/bafu/en/home/topics/natural-hazards/publications-studies/publications/flood-control-at-rivers-and-streams.html>, 03.03.2018.

Figure 29: Example of a Hazard Map, Switzerland (extract)



Source: Geoportal Canton Bern, Online: <https://www.geo.apps.be.ch/de/>, 03.03.2018.

¹⁷⁰ Online: <https://www.bafu.admin.ch/bafu/de/home/themen/naturgefahren/fachinformationen/naturgefahrensituation-und-raumnutzung/gefarengrundlagen/gefahrenkarten--intensitaetskarten-und-gefahrenhinweiskarten.html>, 03.03.2018.



Risk maps exist in Switzerland only very limited. Some cantons have started developing risk maps, but there does not exist a federal guideline so far. Vulnerability is therefore also not taken into account. As hazard maps for flood, avalanches, landslides etc. are nearly finished in full coverage, the next step will be the development of hazard maps for surface runoff.

Concerning governance and participation of the local population, there is no formal involvement. Sometimes certain local people contribute in the hazard analysis, but the general population gets informed, when the hazard map is drafted.¹⁷¹

¹⁷¹ SCHÄRPF, 2018.

5 Risk Governance in the Natural Hazard Management System

Assessing the status quo of risk governance within the natural hazard management systems of the EUSALP member states in a comparative manner is a difficult undertaking. Different forms of government, a diverse distribution of responsibilities among public authorities and the fact, that governance mechanisms are difficult to identify on an abstract national or supra-national level, pose certain difficulties to drafting a framework for a profound analysis and comparison. That is why, the study is based on a mix of governance mapping approaches. At first, a basic evaluation of governance characteristics and capacities within spatial planning, natural hazard management and disaster control and management systems of the EUSALP member states was carried out by expert judgement on existing reports, guidelines, articles etc. Secondly the expertise of the EUSALP AG8 members and their specific networks was utilised to receive a broad assessment of the actual status quo of risk governance for different natural hazards from a national perspective. The initial findings were discussed within the group. Outcomes are general statements on the individual status quo as well as recommendations that identify challenges and potentials to foster risk governance.

5.1 Sectoral Risk Governance Evaluation

The analysis of relevant stakeholders working in the field of natural hazard prevention shows a complex framework of legal regulations, formal and informal procedures and participatory approaches to include non-governmental stakeholders. The following consideration on the status quo of risk governance is based on the analysis and comparison of the national regulations, expert judgement deriving from discussion within EUSALP AG8 and feedback from member states officials to inquiries of the editors of the study.

5.1.1 Spatial Planning

The main idea of spatial planning is to negotiate and balance different societal, economic and environmental demands to allow prosperity and development and prevent conflicts in land-use. Different natural hazards pose especially in the Alps a severe threat to existing human activities and represent spatial limitations for development. All member states in the EUSALP perimeter have developed a normative spatial planning system with different administrative procedures to ensure that planning decisions are made according to constitutional principles and existing legal regulations. The involvement of the general public in planning acts is generally higher for conceptual and visionary plans and lower in administrative procedures. That means, that for many planning assignments, there are strict legally defined procedures that leave little space for informal governance processes.

Concerning the incorporation of hazards in planning decisions, the so far most important level was the municipal level. Land-use planning is nearly in all states a monopoly or prevailing assignment of municipalities. For defining land-use categories, regulating the building stock and – if necessary – specifying restrictions comprehensive information on relevant hazards is needed. The two main sources for information on natural hazards for municipalities are:

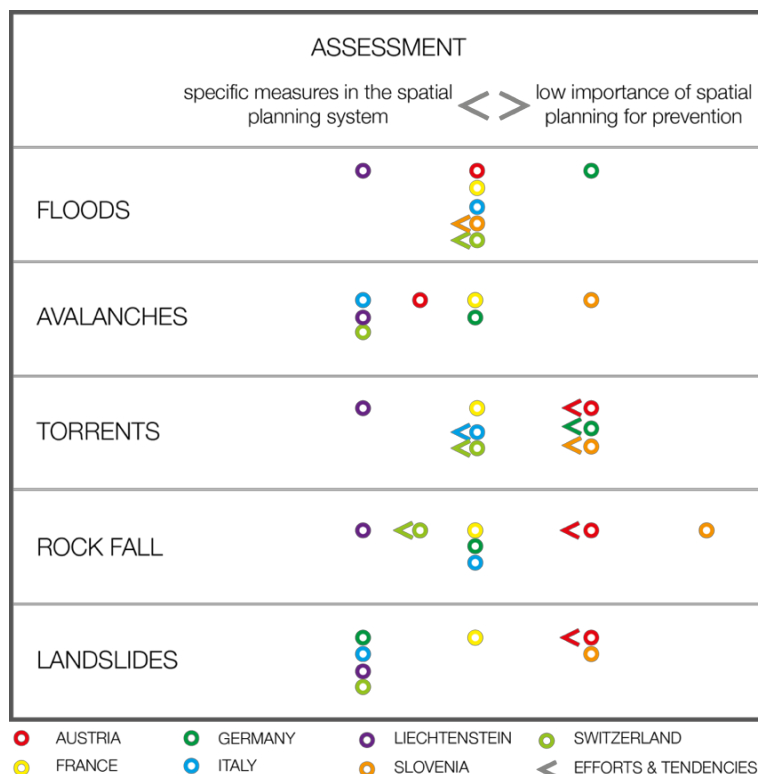
- **preliminary hazard plans; hazard zone plans; risk plans** etc. provided by superior authorities and
- **expert opinions** for single locations/areas.

Expert opinions are cost intensive for municipalities and have the disadvantage of missing a bigger perspective. They are normally focused on only one or a few plots and can be challenged by other, differing expert opinions. This leads to the conclusion, that land-use planning is strongly depended in its decision making on actual and precise information provided by hazard (or risk) maps. Only with such information an equal consideration of hazards in planning all over the territory is ensured. All assessed countries have established a certain hazard zone category that states, that infrastructure or settlement development is not permissible. Besides, local land-use planning has to consider hazard zones which mean certain restriction for future development. Municipalities have to decide which land-uses regarding the constraints should be still possible in such zones and for already zoned building land, what further development is arguable. Especially alpine municipalities have typically very limited land resources for development and experience high pressure by land owners and developers to zone in building land in adaptive hazard zones. This practice leads to an increasing building stock in hazard zones and therefore an overall risk increase.

On a national level, most planning acts are not legally binding and have a strategic orientation. They define overall – mostly sectoral – planning goals and define roughly accompanying measures. On a regional level there exist manifold strategic planning policies as well as binding development programmes. Natural hazards or risk reduction are rarely core issues in such planning policies or programmes, but instead an aspect within policies for settlement development. The **Programme for Floods-Safe Development in Settlement** in the provinces of Styria, Austria is for example a legally binding programme that is based on a consensual process of different stakeholders and defines now basic principles for further development in flood areas. (see chapter 6.1.1)

The carried-out assessment in a EUSALP AG8 workshop on the importance and existence of specific spatial planning measures and regulations related to natural hazards shows a differentiated picture for different natural hazards. Figure 30 shows the results of the workshop in a generalised manner. **Floods** and **avalanches** are well addressed by planning instruments and measures, while **torrents** and **rockfall** are not everywhere linked to spatial planning extensively. **Landslides** are well addressed by planning in some member states, while others still have to implement regulations related to this hazard in the planning system. Generally spatial planning is gaining attention and importance which can be seen by national efforts and tendencies in place.

Figure 30: Evaluation, Spatial Planning and different Natural Hazards



Source: Own adaptation.

The involvement of the general public as well as NGOs/NPOs in planning decisions is diverse because the allocation of land-uses is based on procedures carried out by the public administration. Regarding natural hazards, the spatial planning system is adapting slowly. For example, planning has difficulties to establish risk as a decision basis¹⁷² as well as to open normative processes to public consultation. Understanding governance processes as the negotiation of relevant stakeholders to find a solution to a certain problem, the above-mentioned link of spatial planning instruments to natural hazards miss a clear statement on the involvement of stakeholders in preparation, decision making and long-term implementation.

Spatial planning decisions, especially at local level, are due to constitutional principles suited to follow strict procedures and allow only limited and strongly formalised involvement of the public so far. Strategical planning instruments/measures are here more open to broad discussions and extensive participation. The potential to establish governance processes within the legal framework and execution of formal procedures in spatial planning is generally limited to strategical/visionary aspects. Spatial planning itself needs to be recognised as an integrative aspect and stakeholder in governance processes for finding solutions in natural hazard prevention. Therefore, the exclusive focus should not be a transformation of planning procedures to governance processes. Planning measures should be selected wisely in combination with other instruments in prevention to achieve a long-term hazard risk reduction. Essential contributions by spatial planning can be:

¹⁷² CAMENZIND and LOAT, 2014.

- **long-term prohibition of hazard prone areas** as well as **retention areas** from development;
- holistic **consideration of hazards (and risk)** in the allocation of **land-uses**;
- locating **vulnerable land-uses** outside any hazard prone areas;
- achieve balanced developments in an **inter-municipal/regional framework**, that takes risk into account.

Especially the long-term protection of hazard prone areas and retention areas on local and regional level does not only need legal titles, but the willingness of land owners and decision makers to cooperate and find long-lasting solutions. At the same time, inter-municipal allocation of development needs collaboration of politicians and local people to achieve development solutions that do not increase the risk posed by natural hazards. The adaption of spatial planning for intensified and better natural hazard risk governance does generally not only need to improve legal regulations but link individual planning processes to regional/national and other sectoral perspectives and stakeholders. Table 16 gives an overview on governance characteristics, qualities and capacities of spatial planning and natural hazard prevention on basis of the EUSALP AG8 expert discussions.

Table 16: Governance Characteristics, Qualities and Capacities of Spatial Planning and Natural Hazards

GOVERNANCE CHARACTERISTICS	
Level	<i>regional, local</i>
Organisation	<i>cooperation of local/regional planning authorities is not very strong; even for flood-risks</i>
Actors	<i>planning authorities on regional/local level; local people, other authorities in the field of hazard management</i>
Problem Perception and goal	<i>avoiding increasing hazard risks; securing retention areas</i>
Strategies	<i>long-term strategic approach vs. individual judgement on zoning of building land</i>
Instruments	<i>multi-instrumental (informal boards, land-use plans, development plans etc.)</i>
Resource and organisation of implementation	<i>no additional financing; voluntary cooperation of planning authorities; formal/informal results</i>
GOVERNANCE QUALITIES/CAPACITIES	
Extent	<i>strongly within authorities; involving local people to some extent; mostly single level</i>
Coherence	<i>domination of a simplistic problem perception; single actor responsibilities in implementation</i>
Efficiency	<i>depending on individual measures</i>
Effectiveness	<i>depending on individual measures</i>
Equity	<i>high transparency/equity</i>
Legitimacy	<i>mainly institutionalised cooperation/coordination; according to legal acts</i>

Source: Own adaptation.

Analysing the role and relation of spatial planning to risk governance for natural hazards within the EUSALP region, following aspects concerning existing gaps and recommended improvements can be highlighted:

- **Introduce risk as a planning principle:** Risk is so far not well established as a basis for decision making in spatial planning. First, the term “risk” needs to be introduced to planning legislation and defined. Second, regulations need to state how to consider risk in planning decisions and how to achieve risk reduction.
- **Risk reduction as a planning goal:** Risk reduction needs to be acknowledged as a consensual overall development goal and included in planning legislation.
- **Strengthen regional perspectives:** Allocating land-uses is strongly performed by local authorities and at risk to miss regional relations. Especially flood hazards need regional cooperation and collaboration involving the concerned people, land owners as well as other concerned stakeholders. Regional compensation mechanisms play an important role to achieve overall risk reduction and resilient development.
- **Integration of planning in a holistic disaster risk reduction framework:** Spatial planning legislations provides different instruments and measures to effectively address natural hazards that unfold their full capabilities in close coordination with other prevention measures. Therefore, a coordinating board for the integration of planning in a holistic DRR framework could help developing innovative and effective measures for prevention.
- **Provide information on planning regulations and natural hazards:** Maps and plans that show on the one hand planning regulations and on the other hand hazard (and risk) areas should be available to the general public. This would encourage awareness raising and allow additional initiatives to help people understand the complex relations.

5.1.2 Structural and Non-Structural Measures

Apart from spatial planning and organisational measures, especially structural measures (technical, nature-based solutions etc.) and non-structural measures (educational programmes, provision of information etc.) are important aspects in hazard management. The study summarises these measures as structural and non-structural measures although a far more detailed distinction would be possible. In fact, most of the public authorities that plan and implement technical preventive measures (dams, levees etc.) are also responsible for mapping hazards, “soft” measures and deciding on the actual combination of prevention measures. This makes such public authorities the key-stakeholders in risk governance processes, because they are needed for financing and implementing prevention measures.

The analysis of responsibilities and institutions shows, that the planning of structural as well as alternative or additional non-structural measures is strongly institutionalised and has a clear and strict formal legal background with technical prevention measures still prevailing. Protection of settlements and infrastructure against natural hazards is a cost-intensive task but crucial state assignment and therefore all EUSALP member states have appropriate administrative structures. The economic efficiency and effectiveness of measures play a very important role and cost-benefit analysis are generally established. The choice measures or combinations has to be taken individually, based on the actual situation. Especially settlements can very often only be secured by technical or nature-based measures. For any implemented measure the maintenance plays a crucial role to have long-lasting positive effects on risk reduction. For constructive prevention measures that might mean the restoration every few

years, while for protection forests ensuring the protection characteristics is an ongoing management process. In case of events structural measures need often correct handling and in the aftermath activities to make them operational again.

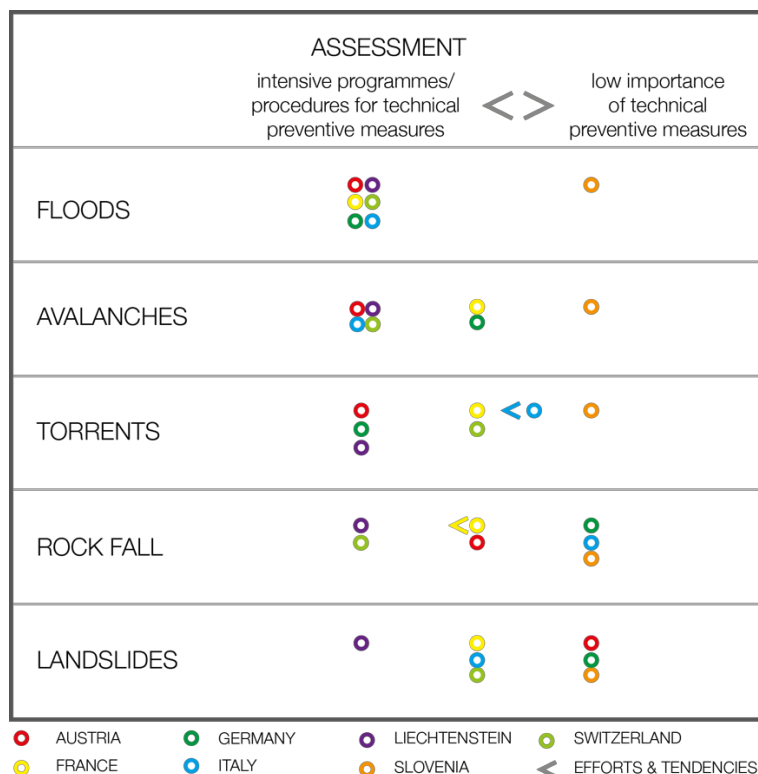
Essential aspects and findings from the analysis of the legal and institutional framework for the planning and implementation of structural and non-structural measures are:

- **Strong legal framework for technical structural measures:** Planning and implementing of structural preventive measures is in all EUSALP member states legally regulated strongly and responsibilities are clearly assigned. The only exception is so far to a certain extent the Republic of Slovenia, but just lately in 2017¹⁷³ a new legal act has been established.
- **Strong institutional framework:** Due to the clear administrative procedures and assignment of responsibilities on national, regional and local level, the institutional set up for planning and implementing structural prevention measures is comprehensive. The more actors involved in planning, constructing and running structures, the weaker the institutional rules are.
- **Nature-based measures play an essential role:** The discussion within EUSALP AG8 did address explicitly nature-based prevention measures and the responsibilities for them. In fact, protection forests are in the whole EUSALP perimeter the largest protection structure for settlements and infrastructures and need continuing attention and care. Here, especially land owners need to be integrated in the management to sustain the protective function.
- **Awareness raising, active information policy as an additional measure:** The discussion as well as the analysis of national publications showed, that “soft prevention measures” such as awareness raising, active information policy via webpages and WebGIS tools or education programmes are generally perceived as important aspects in integrative prevention strategies, but lack continuing financing and personnel resources.
- **Technical preventive measures are still in the focus:** of the discussion amongst the experts within EUSALP AG8, because for these measures already a comprehensive regulatory framework exists and weaknesses can be identified therein, while risk governance demands a shift in personal perceptions and turned out to be an ongoing process even amongst experts.

The carried-out assessment in an EUSALP AG8 workshop on the intensity of regulations related to technical preventive measures shows – similar to the planning questionnaire – a differentiated picture for different natural hazards. Figure 311 shows the results of the workshop in a generalised manner. Slovenia stated generally, that the technical preventive measures don't have a very high importance for none of the listed natural hazards. All other member states did say that for **floods** management intensive programmes and procedures for technical preventive measures exist. For **avalanches**, **torrents** and **rockfall** the picture is similar amongst the member states, stating that preventive measures are fairly well addressed by programmes and procedures for technical preventive measures. The exception are **landslides** that have not been incorporated in the single legal and regulatory frameworks to the same extent.

¹⁷³ Spatial Management Act 2017, Official Law Gazette of the RS, no. 61/2017, 24.10.2017.

Figure 31: Evaluation, Technical Preventive Measures



Source: Own adaptation.

Regarding the two aspects/concepts of **risk** and **governance**, the research for this chapter showed ambivalent results.

- **Risk** as a basis for planning and designing actual technical prevention measures is so far not a generally established concept. This due to the legal requirements of using design events to establish a certain accepted security level and the challenge, that risk would be a dynamic and constantly changing basis for planning. Concerning non-structural measures risk is far more established. For ordinary people the concept of design events based on probabilities might be even more difficult to understand, than with a certain probability actual damage on private property can occur and certain (individual) measures can help to reduce such damages in case of an event.
- **Governance** is especially for personnel working with guidelines, formal procedures and a comprehensive legal basis still a difficult concept to grasp. Thinking out of the box of everyday experiences and taking complexity, uncertainties and ambiguities into account is a major shift in working processes. Especially because guidelines, regulations and procedures define a very clear and precise path on how to develop, design and evaluate prevention measures. This is also one reason, why the scientific discussion has been led sectoral and focusing on structural prevention. Governance mechanisms are especially important when it comes to the maintenance and long-time effectivity of measures. Short-term, project-based financing of measures, such as information campaigns, interventions in schools or investments in protection forest need long-term financial support and local responsibilities.

The evaluation of risk governance characteristics, qualities and capacities for the sector of structural as well as non-structural measures has to have a very broad set of parameters. A

wide variety from exclusive planning and implementing measures within certain state authorities to open participatory processes on different spatial levels in negotiating solutions to a common risk are possible. As shown in Table 17 the overall assessment on the status quo revealed that multi-stakeholder and multi-institutional processes/procedures are in place on different levels but still tend to focus on single instrumental solutions. Good practice examples brought up in the AG8 discussion were mainly informal initiatives, that have so far largely no general legal basis. Furthermore, the discussion showed, that qualities of governance-based approaches are especially promoted in cases, where innovative and cross-cutting solutions are needed. For many other cases, conservative planning procedures work according to the discussion effectively. This highlights clearly, that risk governance is not a general solution to manage hazard risk in an effective and widely accepted way.

Table 17: Governance Characteristics, Qualities and Capacities of structural and non-structural in natural hazard management

GOVERNANCE CHARACTERISTICS	
Level	<i>regional, local</i>
Organisation	<i>Informal involvement in formal procedures</i>
Actors	<i>Planning authorities on regional/national level; local people; NGOs; other authorities (e.g. environment)</i>
Problem Perception and goal	<i>accepted/stable solution for structural measure design/maintenance; long-term risk reduction</i>
Strategies	<i>long-term regional/local effects</i>
Instruments	<i>mainly single instrumental</i>
Resource and organisation of implementation	<i>no additional financing; voluntary coordination and collaboration of local people and authorities</i>
GOVERNANCE QUALITIES/CAPACITIES	
Extent	<i>cross cutting private actors and authorities; multi-actor; involving local people/NGOs</i>
Coherence	<i>domination of a simplistic problem perception; single actor responsibilities in implementation but multiple actor responsibilities for maintenance</i>
Efficiency	<i>depending on individual processes</i>
Effectiveness	<i>depending on individual processes</i>
Equity	<i>essential aim of such processes to raise equity</i>
Legitimacy	<i>largely informal cooperation/coordination</i>

Source: Own adaptation.

Analysing structural and non-structural measures and their risk governance status quo within the EUSALP perimeter, following aspects can be highlighted and certain recommendations formulated:

- **Structural measures as only one component of natural hazard management:** Hazard management did focus so far strongly on improving the cooperation and coordination of public authorities involved in the planning and construction of structural measures. Fostering inter-sectoral cooperation and promoting risk governance makes

the involvement of non-governmental stakeholders as well as concerned local people in the negotiation of risk reduction measures possible. Structural measures are thereby only one instrument in the toolkit. Platforms for developing integrative solutions are therefore to be pursued.

- **Strengthening regional perspectives:** Shifting the planning perspective from individual structural measures to holistic regional concepts, including different actors and perspectives in a conceptual process for risk reduction; Such an approach can consider cascading and cumulative effects and helps for those at risk to understand the complexity of preventing hazard events.
- **Local and regional responsibilities:** Local communities and concerned parties should be integrated in the maintenance and financing of measures to strengthen commitment and local awareness for natural hazard risks.
- **Financing and resources for non-structural measures:** Providing information via the web, establishing educational programmes, install specific subsidy programmes need long term funding and resources within the state administration to take over a coordinative and supporting role.

Generally, all structural measures need a certain preparation of local authorities, stakeholders and people to be long-term effective risk reduction measures. They are designed for certain events and can suffer damage, destruction or events bigger than the design event. However certain residual risk persists.¹⁷⁴ Furthermore, the responsibilities for maintenance and handling structures in case of events need to be clarified to ensure effective prevention. Therefore, different non-structural measures (training, education, information etc.) are essential to guarantee effective prevention and have to rely on people taking over responsibility for their own risk situation or for their community.

5.1.3 Disaster Control and Management

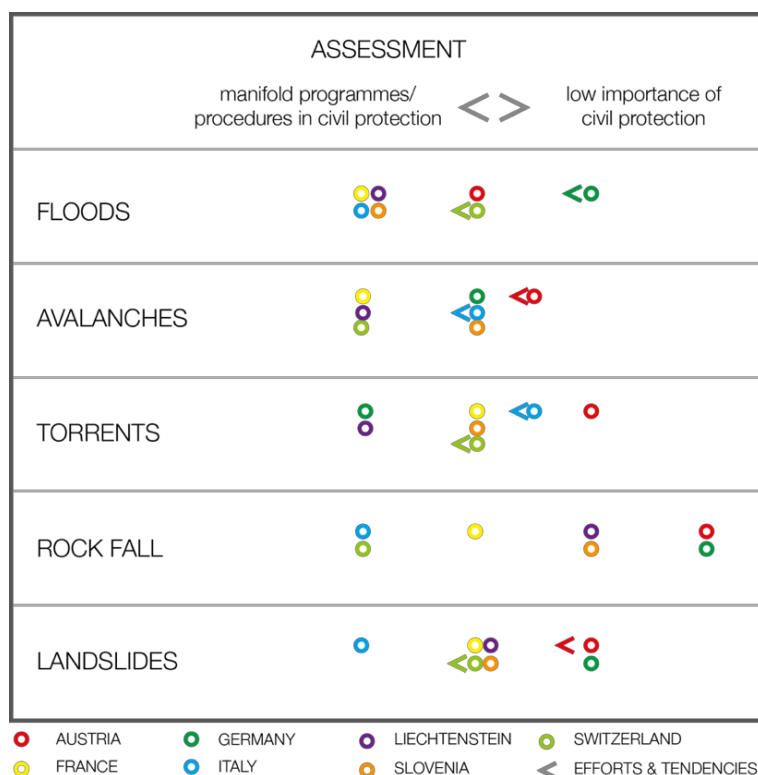
One essential task in the preparatory phase of the risk management cycle are organisational measures. All EUSALP member states have established sophisticated systems for civil protection which also addresses natural hazards. Within the state assignment of disaster control and management natural hazards represent only one aspect and the existing alerting, response, rescue intervention and institutional structures are in place to handle other threats as well. The scope of natural hazards can differ widely. They can affect only a specific location, have a regional extent or even effect whole nations. This is especially the case for weather extremes (heat waves, storms etc.). Therefore, the established framework of handling such events needs to provide sufficient resources according to the scope of the event. This requirement makes disaster control and management an aspect in natural hazard management that incorporates governance aspects widely.

Legislation for/ implementation of disaster control and management throughout the EUSALP region is a shared competence of municipalities, regional authorities and the (federal) state administration incorporating in addition a multitude of other organisations/institutions. Especially rescue and relief forces are not exclusively trained state personnel but instead working with other (voluntary) organisations. Therefore, there exist publicly financed organisations especially for special tasks and voluntary/private organisations embedded in the national disaster management framework on local to national (partly international) level.

¹⁷⁴ SCHNEIDERBAUER et al. 2017.

Within a workshop of the AG8 the importance of the single national civil protection system on a whole (with disaster control and management as one part) for different natural hazards was discussed. This comparative discussion and analysis aimed to point out, where the mechanisms of organisational measures are well in place to handle actual events. As presented in Figure 322 floods, avalanches and torrential hazards are generally well addressed by organisational measures. This due to the comprehensive prediction as well as the effectiveness of measures by rescue and relief forces. Rockfall events are difficult to predict and simulate and therefore considered in different ways by the member states. A similar tendency exists for landslides. Landslides differ mainly concerning speed and depth and the relevant rapid landslides, that pose a severe threat to built-up areas, are rare. Generally, different hazards are addressed in different ways by organisational prevention measures and this seems to correlate with the single hazard processes.

Figure 32: Evaluation, Disaster Control



Source: Own adaptation.

An essential principle of organisational measures is subsidiarity concerning the scope of events and the level it is handled at. Small scale events need only a local response, while regional floods might need far more resources and maybe event assistance by the national armed forces. Such a system is fairly impossible to finance with professional forces only. Depending on the probability of events every EUSALP member state has a unique combination of publicly financed professional rescue and relief forces as well as other – mostly voluntary – stakeholders. All civil protection systems have similar national guidelines and define rules concerning when and how to incorporate different forces in case of emergency.¹⁷⁵ In the first place, the negotiation of this structure as well as actual tasks and responsibilities, is already strongly governance based. It aims to establish formal structures beyond public administration

¹⁷⁵ For a description of all national Civil Protection systems in Europe see: EC, 2018.

considering different stakeholders. Another governance related aspect is the definition of actual functions and assigning responsibilities on local to regional level to different involved stakeholders and formalise these structures especially through contingency plans. Table 18 gives an overview on governance characteristics, qualities and capacities within disaster control and Management and therefore shows already widely established and existing governance mechanisms.

Table 18: Governance Characteristics, Qualities and Capacities of Disaster Control and Management

GOVERNANCE CHARACTERISTICS	
Level	<i>international, national, regional, local</i>
Organisation	<i>institutional establishment, informal cooperation</i>
Actors	<i>International organisations, national governments/administration, federal states/regions, municipalities, NGOs, NPOs, local people</i>
Problem Perception and goal	<i>preventive planning for emergency operations, risk management</i>
Strategies	<i>long-term preparation for events, immanent status of preparedness</i>
Instruments	<i>single-instrumental</i>
Resource and organisation of implementation	<i>voluntary cooperation with formal (consensual) procedures, largely state financed</i>
GOVERNANCE QUALITIES/CAPACITIES	
Extent	<i>multi-level, multi-actor, involving all kind of actors</i>
Coherence	<i>perception and capacities of multiple stakeholders, multiple actor responsibility in implementation</i>
Efficiency	<i>depending on individual processes</i>
Effectiveness	<i>depending on individual processes</i>
Equity	<i>compensation schemes for individual expenditure/preparedness</i>
Legitimacy	<i>Institutionalised and formal cooperation</i>

Source: Own adaptation.

Disaster control and management is in its basic structural design strongly governance orientated and the current level service would be impossible relying only on public authorities and professional publicly employed staff. For handling events, sufficient forces are needed within a short response time. Such forces need appropriate resources, training and formal involvement to act effectively. Preparation for events, operational activities and following analysis for improvements are a continuing process with a multitude of actors. Public as well as non-governmental actors cooperate for the common good and even civil society is/can be integrated in organisational measures. Therefore, the analysis and discussion for organisational measures concerning risk governance pointed out recommendations focusing on the incorporation of risk rather on fostering governance mechanisms, because many of them are well in place.

- **Promote risk in disaster control and management:** Introduce/Promote risk as essential information for preparing contingency plans to primarily protect vulnerable land-uses and areas with high damage potential.

- **Raise transparency:** Make information on contingency plans accessible to the public for awareness raising and to be able to integrate local people in operations.
- **Include local people:** in the preparation processes of contingency plans and assign them if reasonable responsibilities to help prepare for events and undertake effective measures to protect themselves and their property. This means especially raising the individual responsibility in prevention.
- **Consider residual risk:** Take residual risk in contingency and preparation into account.¹⁷⁶

5.2 Risk Governance for different Natural Hazards

Making the establishment of governance mechanisms visible in a comparative way for different member states of the EUSALP, is a difficult assignment. This can be explained due to the lack of a common understanding of terminology, differing individual experiences and complex national/regional regulatory frameworks. These premises lower the value of expert interviews because a following quantitative analysis would need to make sure, that the concept of risk governance is transparent and distinct or a qualitative analysis would have to problem of missing comparable categories.¹⁷⁷ The evaluation of the status quo for natural hazard risk governance in this report is therefore based on a workshop, where member state representatives negotiated an assessment for different governance aspects and natural hazards. The resulting initial governance profiles were discussed and harmonised on the ministerial level in the member states. The final results don't represent a fully comparative governance status quo for member states but instead show tendencies, weak spots and relations. It is not possible to identify any member state to have a better or worse governance system concerning the relevant natural hazards in place.¹⁷⁸

The workshop results and harmonised risk profiles show on the whole that the governance mechanisms are well in place especially for managing floods risks. Regional effects and multiple affected actors as well as the European Flood Directive were the main explanations raised in the discussions within EUSALP AG8, that promoted on the one hand risk as a basis for evaluation and planning prevention measures and on the other hand a cross-sectoral planning approach.

For the discussion and analysis of the *Risk Governance* status quo of different natural hazards specific as well as overall conclusions can be drawn.

- All EUSALP member states identified in the discussions, workshops as well as consultations within their professional field, aspects in the **natural hazard management system** that need **changes to foster a risk-based perspective** and **establishment of governance mechanisms**. Due to the specific expositions of member states, the importance of certain natural hazards differs widely and thereby the institutional and legal framework.
- A direct **comparison of a risk governance** status quo in member states for different natural hazards has therefore **only limited validity** and has to rely far more on a qualitative understanding of existing governance mechanisms within their unique institutional setting.

¹⁷⁶ SCHNEIDERBAUER et al., 2017.

¹⁷⁷ SCHNEIDERBAUER et al., 2017.

¹⁷⁸ See for the used methodology: Chapter 2.

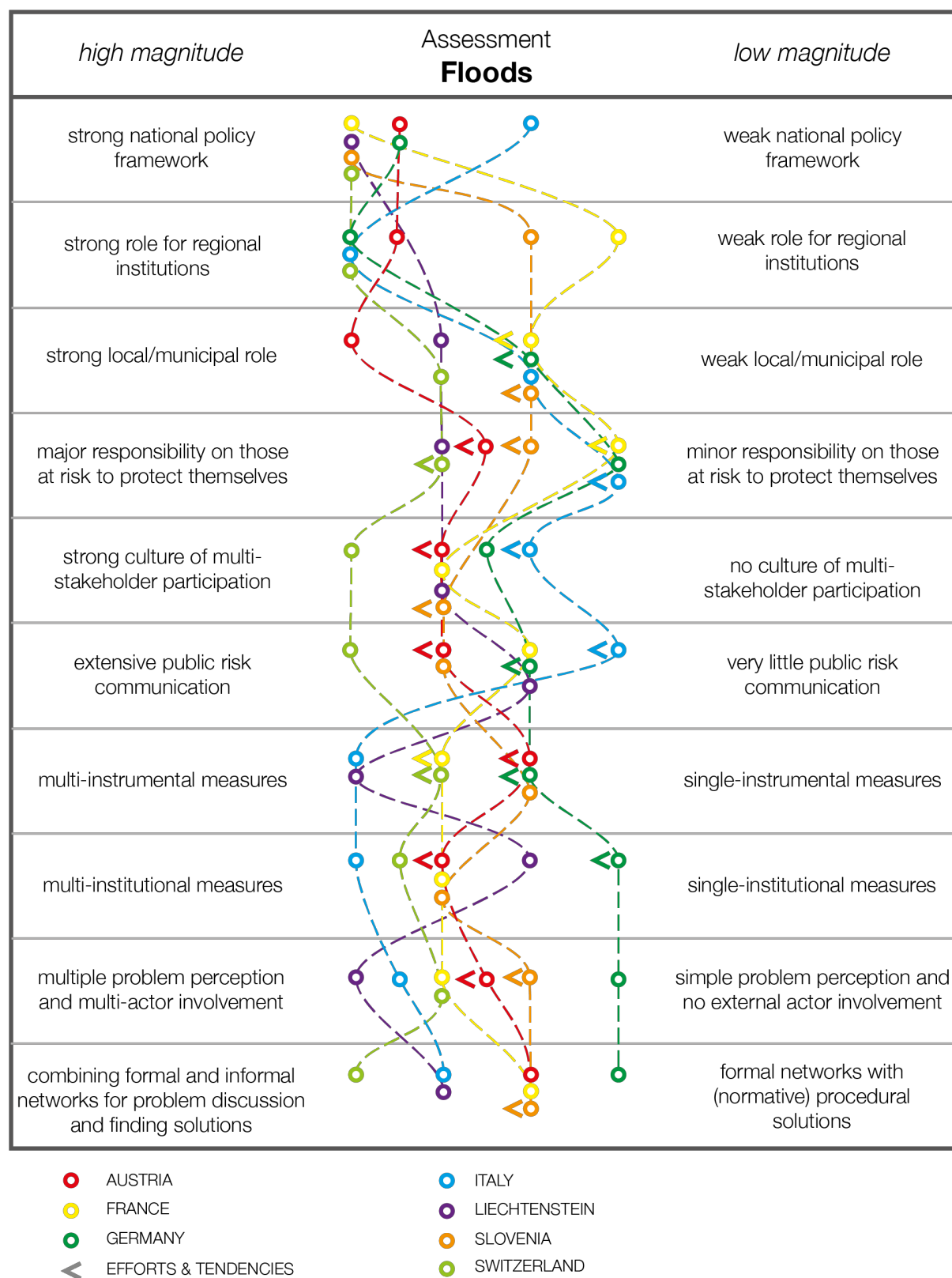
- Within the national natural hazard management frameworks, **risk governance mechanisms** are already **implemented to a certain extent**, especially for fostering holistic perspectives involving non-governmental stakeholders. Some fields in the hazard management framework still miss the incorporation of concerned and local people etc. to negotiate common problems and find solutions. Such antagonisms are omnipresent but are difficult to be linked causally on a general basis and would need detailed further investigation.
- Flood hazards hold a special role within hazard management systems. In connection to European initiatives/regulations, such as the Flood Directive, as well as the regional solutions that are needed for effective risk reduction lead to intensified **implementation** of both **risk and governance mechanisms in flood prevention** throughout the EUSALP area.
- There does not exist a risk governance raw model or stereotype governance structure that works on different levels and in different context. Therefore, it is necessary to evaluate in the first place characteristics, qualities and capacities of involvement, transparency etc.

The analysis below presents the governance profiles drafted within EUSALP AG8 commented by a rough qualitative analysis of the results and tendencies.

5.2.1 Floods

As seen in Figure 33, there exist nearly in all EUSALP member states a **strong national framework** with important roles for regional institutions for flood hazard management. The regional component is missing in Liechtenstein and Slovenia and is weaker in France, due to the more centralised administrative structure. The **role of municipalities differs widely** and is closely connected to the competencies and responsibilities set by the legal framework. Measures for **self-protection receive** obviously at the moment large **attention** and initiatives and efforts are underway. At the same time member states stated that there are still minor responsibilities on those at risk to undertake appropriate measures. Concerning flood management there exists already a certain culture for multi-stakeholder participation, which is linked to the risk communication which receives also major attention and should be improved further. Concerning the development of prevention measures, **multi-instrumental** and **multi-institutional approaches** are **widely established** or further initiatives underway. The problem perception shows a more differentiated picture but is strongly related to the particular institutional framework. The combination of different formal and informal networks takes obviously place to a certain extent. Generally, flood management tends to need **regional perspectives, involve a variety of stakeholders and concerned people** and has beyond doubt potential for fostering risk governance approaches in developing solutions on different spatial scales. Especially the Flood Directive supports a holistic understanding of flood management and includes risks into evaluation of measures. The process of developing solutions though is not explicitly governance orientated. Nevertheless, the good practice examples show that many initiatives are underway and the regional perspective as well as multi-instrumental solutions gain importance.

Figure 33: Risk Profiles, Floods



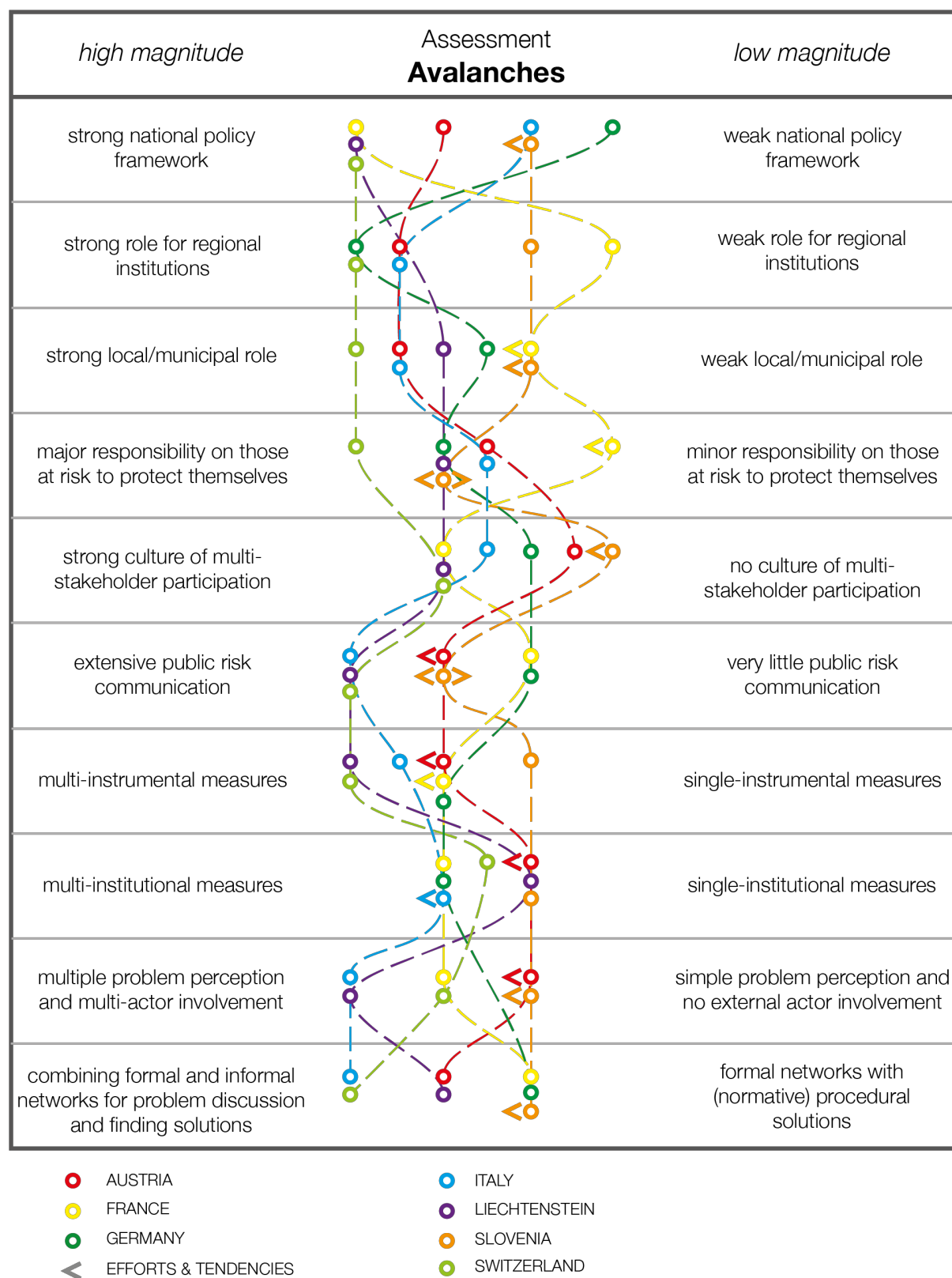
Source: AG8 Workshop 15/16.03.2017, Zugspitze. Drawing by Schindelegger ©.

5.2.2 Avalanches

Avalanches are relevant only in specific areas of the EUSALP region as a threat to settlements. In fact, linear infrastructures such as roads have a far higher exposure to avalanches but can be more easily managed facing an actual avalanche threat. The evacuation of settlements is difficult, time consuming and costly so the vulnerability of the built environment should be as low as possible and risk reduced whenever possible. Therefore, especially the **member states with a generally high exposure** to avalanches have established already at **national level a sufficient framework**. This is certainly different for Slovenia, Italy and Germany which have to deal with avalanches only in limited areas. Therefore, the regional level for regulating avalanche prevention is more important in Germany and Italy than the national level. Municipalities hold throughout the EUSALP region differing responsibilities concerning prevention of avalanches and on the whole, there **does not exist an overall tendency** in the **distribution of responsibilities**. **Self-protection** against avalanches is **implemented widely** but only Switzerland did state that there is already a major responsibility on the people at risk to protect themselves. Interestingly the aspect of multi-stakeholder participation shows a general shift to a lower magnitude. This might be related to the nature of avalanches rather distinct hazard zones on a local level. Nevertheless, large scale avalanche events in combination with rockfall events or other cascading effects are possible and can lead to devastations on a regional scale. The **public risk communication** is basically in place **depending** obviously on the **quality and spatial coverage of hazard/risk information**. Multi-instrumental measures as a combination of technical, nature-based, organisational etc. measures are widely implemented and by trend handled only by a few public institutions. This again correlates to the multi-stakeholder participation aspect and rather clear assignment of the management of avalanches to a few institutions. The aspects of problem perceptions and the combination of formal and informal networks support the ambivalent evaluations throughout the EUSALP area.

On the whole, avalanches are obviously not of the same importance for every EUSALP member state and **participatory processes** for the development of prevention measures are **not generally established**. Governance aspects are especially important for the evaluation of the actual danger by local/regional avalanche committees, because there, local stakeholders and citizens get closely involved.

Figure 34: Risk Profiles, Avalanches

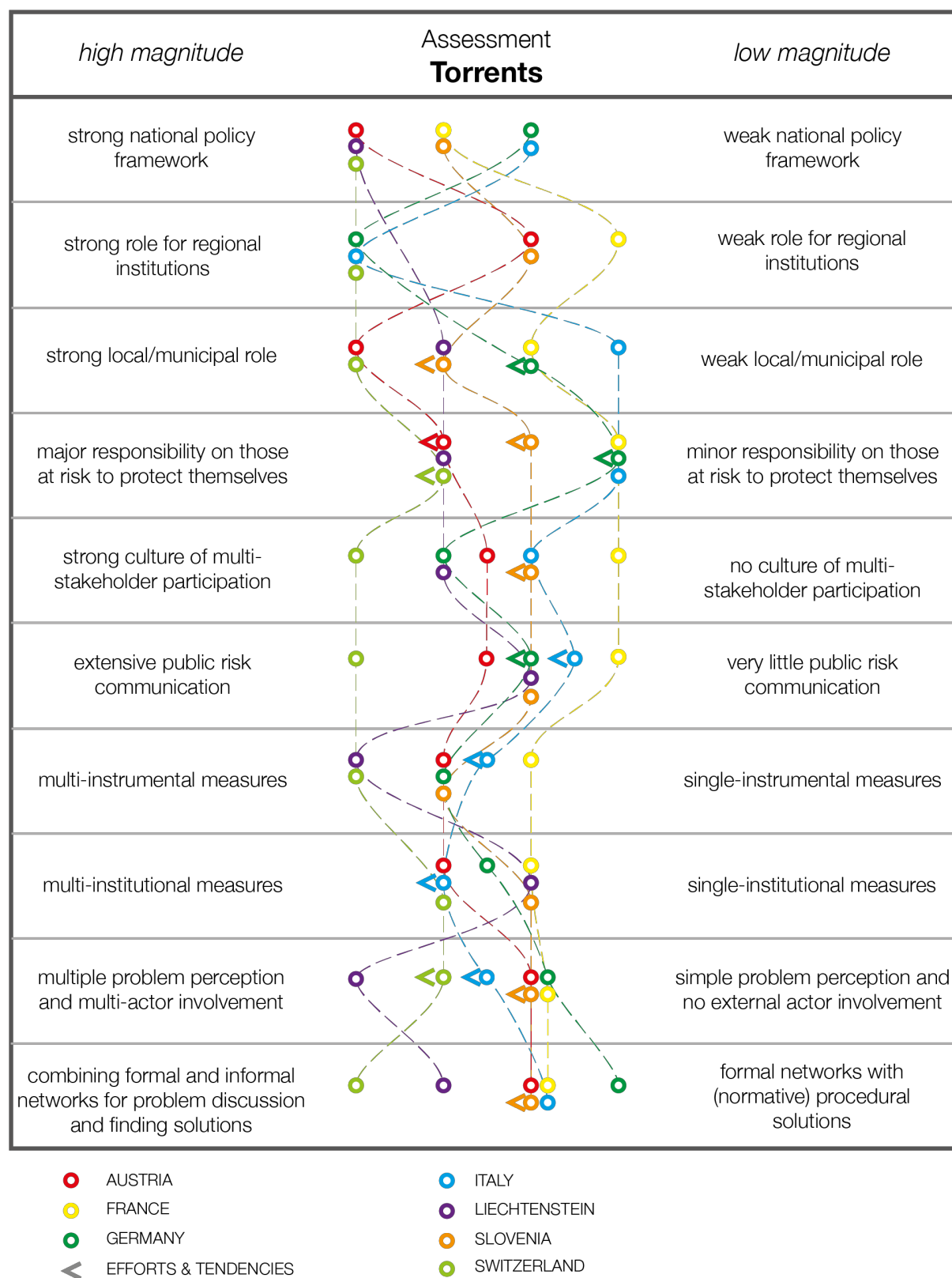


Source: AG8 Workshop 15/16.03.2017, Zugspitze. Drawing by Schindelegger ©.

5.2.3 Torrential Hazards

Torrents hold generally potential for different natural hazards. Especially debris flows, carrying flood water, rock and gravel, pose a major threat to many alpine settlements – many of them located traditionally on debris cones. The discussion within EUSALP AG8 showed, that again the actual status quo of handling differs among member states. **Italy and Germany** have like for avalanches a **weak national but strong regional framework**, while the **other member states** tend to address torrential hazards **already on national level**. The **role of municipalities does not show** any **clear tendency** and like for avalanches the responsibility of those at risk to protect themselves exists especially in Liechtenstein and Switzerland and is rather low in the other member states. Initiatives and efforts are obviously underway. **Multi-stakeholder participation** in the development of solutions for prevention and risk reduction is for torrents also **not generally established** and interestingly the **risk communication** has been **evaluated as low**. For measures there is a clear shift towards the left and thus to multi-instrumental measures, while there is no clear picture on the institutional setting. The problem perceptions differ as well very widely and the majority of member states has rather formal procedures to develop prevention measures. On the whole, **no tendencies** between member states **are distinguishable** and **torrential hazards are handled in very different ways**. Like for other hazards Liechtenstein and Switzerland consider torrential hazards within their consistent hazard management system which can be seen by the self-assessment pointing out the participatory and multi-stakeholder oriented approach.

Figure 35: Risk Profiles, Torrents

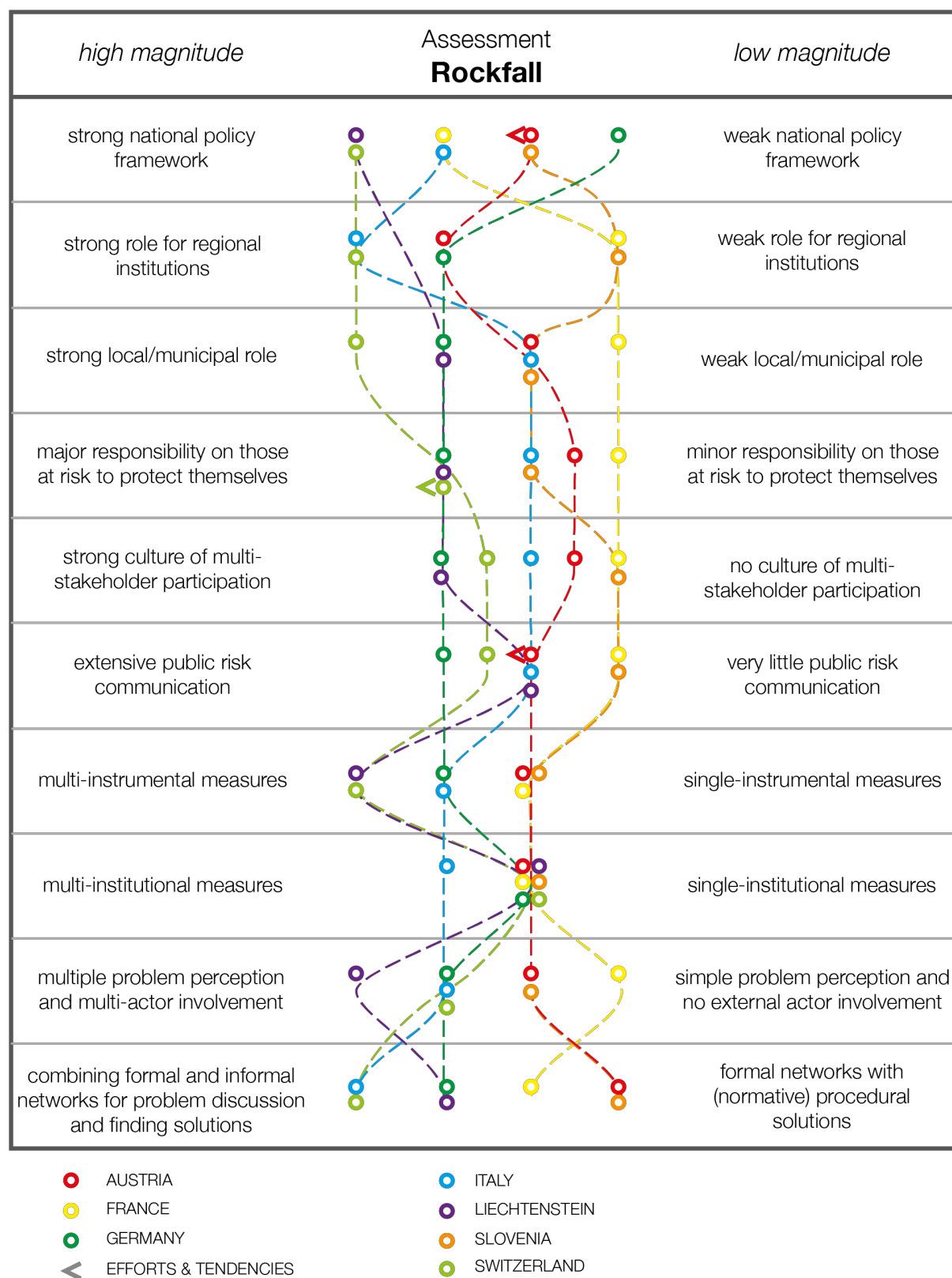


Source: AG8 Workshop 15/16.03.2017, Zugspitze. Drawing by Schindelegger ©.

5.2.4 Rockfall

Large scale rockfall events are rare and prevention has foremost to deal with small scale dangers threatening settlements and infrastructure. Topography and geological aspects play a crucial role for such hazards and exposure differs widely within the EUSALP member states. Therefore, very different approaches of managing such hazards have been chosen. **Liechtenstein** and **Switzerland** again have a rather **clear and strong national regulatory framework** also for rockfall hazards while the picture differs widely for the others. So, the comparison of the EUSALP member states concerning the distribution of **responsibilities** on municipal, regional and national level again reveals **no overall tendencies**. The complex distribution has its origin once more in the legal framework and responsibilities set by constitutional laws. Interestingly the **responsibility of those at risk** to protect themselves is rather **low in Italy, Slovenia, Austria and France** although individual countermeasures to protect own property are for small scale events often possible. **Multi-stakeholder participation** in the development of measures are on the whole so far **not well established**. **Risk communication** is due to the difficulties of demarcating areas for rockfall also **not generally existing** so far. **Measures** although are by trend multi-instrumental and at the same time **rather single institutional**. This also leads to a rather established involvement of other actors. The combination of formal and informal networks for problem discussion and developing solutions does not show any clear tendency. The only overall concentration in the self-assessment is the handling of rockfall prevention rather by single-institutional measures.

Figure 36: Risk Profiles, Rockfall

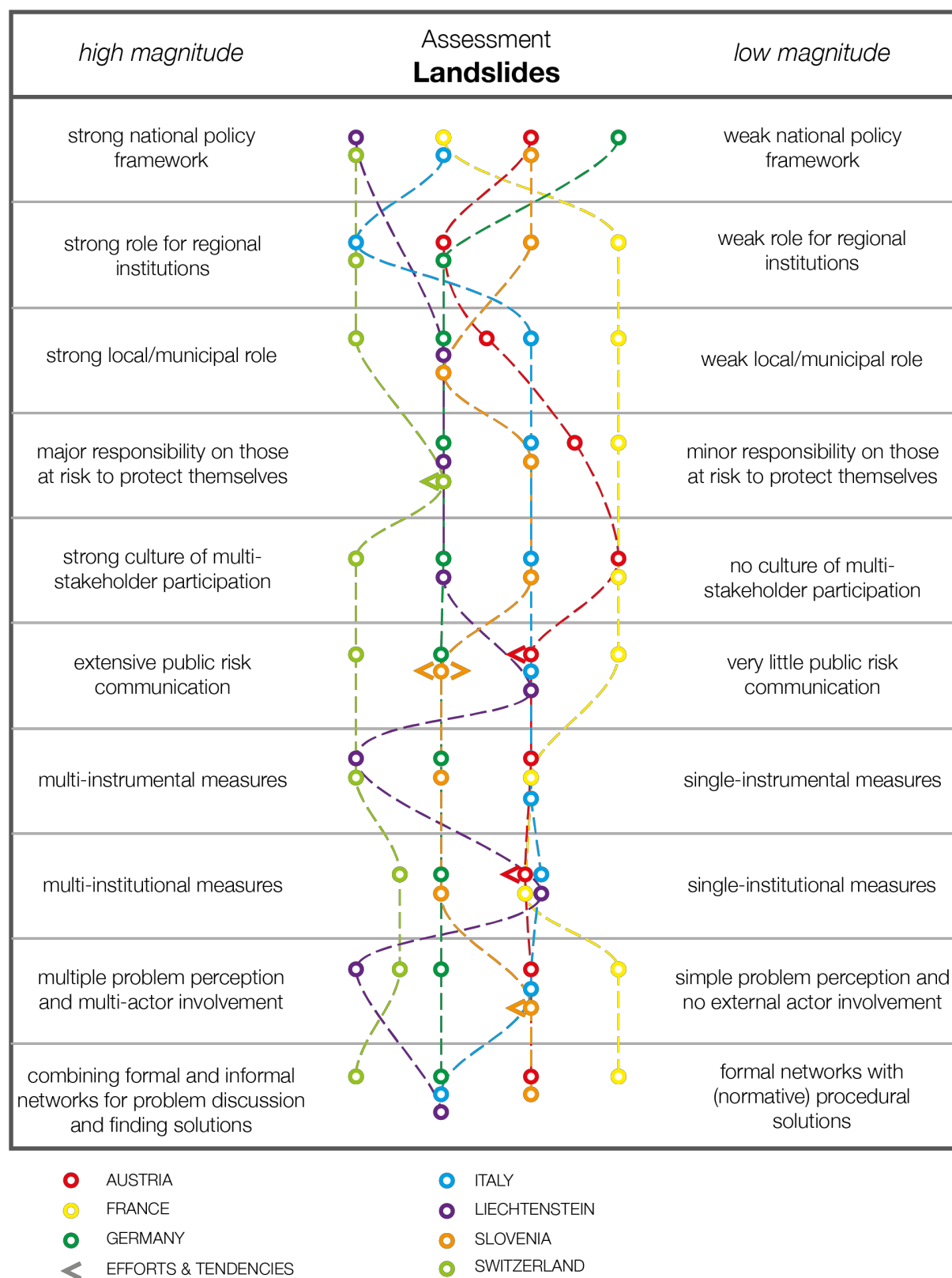


Source: AG8 Workshop 15/16.03.2017, Zugspitze. Drawing by Schindelegger ©.

5.2.5 Landslides

Landslides can occur at various scales and are caused by different triggers. Therefore, countermeasures and prevention **measures are very specific** for every **single case**. The discussion within EUSALP AG8 did show, that there exists at the moment no major focus on landslides. They are simply addressed in the existing hazard management systems. The risk profile for the responsibilities therefore shows a very **divers picture with no overall tendencies**. Partly, responsibilities are assigned on all levels (e.g. Switzerland) or with a focus on certain levels (e.g. regional responsibilities in Italy). Due to the nature of landslides, responsibilities on **those at risk to protect themselves** are **generally rather low** and multi-stakeholder participation partly existing. The risk communication is widely well in place and represents the efforts in mapping activities undertaken in the past years. Multi-instrumental and multi-institutional perspectives were assessed in the discussions to be generally existing. For the problem perception a technocratic understanding prevails. Formal and informal networks are already linked to some extent for the development of prevention measures. On the whole, the discussion on **handling landslides did show no** concentrations or **overall tendencies**. Risk governance mechanisms exist to some minor extent, but there is generally no specific focus on landslides in the national discussions and efforts.

Figure 37: Risk Profiles, Landslides



Source: AG8 Workshop 15/16.03.2017, Zugspitze. Drawing by Schindelegger ©.

5.3 Risk Governance – Status Quo

An overall judgement on the status quo of risk governance in the EUSALP member states has to face and accept certain methodological difficulties. Especially, because the study did foremost rely on the input of the EUSALP AG8 members and does not have an extensive survey as a basis for statements. Therefore, the overall aim was the identification of trends, tendencies and current efforts concerning the consideration of the risk concept and governance mechanisms in managing natural hazards.

Limitations to the significance of the study are:

- Inaccurate and incomplete information on the legal and regulatory frameworks; due to ongoing amendments, changes and development that makes it difficult to provide up-to-date information.
- Personal perceptions and experiences determine the possible contributions to the discussion within the AG8; other AG members might have different views of the risk governance status quo.
- AG8 members rely in their contributions on personal networks and institutional/training background; this means that not all relevant aspects are considered in the same depth.
- Discussing risk governance from a local to a national scale in one study poses the challenge of identifying and classifying relevant aspects in a comparative manner.
- Risk governance had not even within a group of experts a common understanding in the forefront of the study. Such an understanding is needed to be defined by the group and is dynamic and sensitive to personal development or replacements in the group.

The limitations for a general governance status quo analysis are manifold. Therefore, the study does not claim to provide such a universal assessment. To achieve a basic objectiveness internal feedback loops and consistent frameworks were used. The provided information does therefore not only represent personal views, but instead outcomes of the group discussions and nationally clarified and approved information. The core findings on the general status quo of risk governance within the EUSALP perimeter are:

- There is **no** such a thing as a **single static risk governance status quo** within the EUSALP area. Frameworks, involved people and the political focus are dynamic networks and changing permanently. Governance processes depend on many parameters (people, institutions, legal background, financing etc.) and do not need to be initiated by state authorities but need the involvement of responsible authorities and experts for the implementation risk reducing measures.
- Both concepts “risk” as well as “governance” are depending on the different national regulatory frameworks. They need to be sensitive to these concepts and allow the inclusion of risk as a basis in decision making processes and be open for the inclusion of different stakeholders in a negotiation process. Strict and excluding procedures have low potential for allowing governance. Planning regulations and the planning of structural measures tend to exclude the concerned people. The **involvement of the public** takes place on a more **strategical level at the moment**.
- The discussion showed, that **governance is widely understood as participation of people** and that there exists a shortcoming in understanding the concept. Talking about participation leads to a focus on procedures and the legal frameworks and not the possibilities and qualities that might develop by sharing responsibilities and commonly develop prevention measures for common problems.

-
- The discussion showed furthermore that there exist certain tendencies in the scientific and practical discussion on risk governance within the EUSALP region. First, **risk gains** as a parameter for preparation against natural hazards **importance**. Second, excluding – rather technically orientated – procedures tend to fail the public expectations and public institutions are perceived far more critically. The public demands generally for more participation and not just information.
 - The discussion within the EUSALP AG8 showed as well, that **risk governance mechanisms** are **implemented on different scales** (local, regional, national, international) and are not normed or limited to a certain understanding. Problems differ and so do the solutions and forms of negotiation differ.

The discussion and research within EUSALP AG8 were strongly based on examples to identify governance mechanisms and evaluate the initiatives that are underway. Some of them are presented and evaluated in a comparable manner in the following chapter. Key messages and recommendations from the work within AG8 are highlighted in chapter 7.

6 Good Practice – Natural Hazard Risk Governance

Risk Governance as a concept is difficult to grasp, so good practice examples help to illustrate governance mechanisms in natural hazard management. The below presented examples were provided in close cooperation with the working group for natural hazards of the Alpine Convention – PLANALP. The basic text drafts were provided by the participating delegations of the working group. Regarding a consistent presentation and evaluation of the single examples coordinated amendments were carried out by the authors. An outline was provided for the good practice examples to receive comparative text. Besides, a description of the example with a word limit and a judgement on the aspects of risk governance was asked for and given to great extent in the replies. The evaluation of the governance perspective uses the scheme of governance characteristics, qualities and capacities (see Table 1) and is based on the judgement on the provided information and data.

The good practice examples are **not clustered in a thematic way**, but instead **by country**. This due to the aim of the report to receive a risk governance profile for each country. As presented in Table 19 the single examples can be assigned to certain natural hazards and the kind of prevention measure they represent. **Most of the examples have flood hazards as a driver**, while especially organisational measures serve for different hazards processes. There are two examples with an avalanche and two with torrential hazard background. France provided an example in connection with rockfall and landslide events. The selection of good practice examples passes very clearly the message, that floods as natural hazards with a mostly regional dimension, have great potential for risk governance processes as well as organisational measures, that incorporate local people as well as non-governmental institutions.

Table 19: Overview of the good practice examples

Example		Relevant Hazard	Prevention Measures			
			Nature-based	Organisational	Planning	Structural
AT	Water Boards	General	x			x
	Programme for Flood-Safe Development in Settlement Area	Floods			x	
FR	Natural Risk Prevention Plan (PPRN)	Rockfall, Landslides	x		x	x
	Action Programmes for Flood Prevention (PAPI)	Floods	x	x	x	x
GE	Licca liber- The free Lech river	Floods	x			
	Communal Flood Audit: Floods, how well prepared are we?	Floods	x	x	x	x
IT	Local Management of Lacial Risks in Aosta Valley Region	Avalanches		x		
	Intervention Maps	General		x		
	Local Management of Avalanche Hazard on the Aosta Valley's Roads	Avalanches		x		
LI	Contingency Plans for Torrents	Torrents		x		

SL	Flood hazard and flood risk mapping in Slovenias' flood risk Management	Floods			x	x
	Mitigation of large landslides and debris flows in Slovenia	Torrents		x	x	x
CH	The OWARNA Project	General		x		
	Reserved open spaces for the long-term reduction of residual risk	Floods	x		x	x

Source: Own adaptation.

6.1 Austria

Austria provided two good practice examples, both dealing with **aspects in flood prevention**. The first example presents a legally binding decree by the province of Styria for the **further development of the settlement area in flood prone areas**. Land-use planning is carried out by the single municipalities that have the aims and regulations of the planning law as a fundamental framework for their further development. To incorporate a regional perspective in taking flood hazard zones into account the adopted programme serves as a foundation for municipal decision and sets clear which developments are prohibited and which are acceptable although there exists a certain threat by potential floods. The second example deals with the **mechanisms of financing the construction and maintenance of flood prevention measures**. By forming cooperatives municipalities or even the people concerned by protection measures take over responsibility for certain implemented measures. Concerning governance mechanisms, this means that the ones getting the benefits are also the ones who are in charge of the operational capability of a measure.

6.1.1 Programme for Flood-Safe Development in Settlement Areas¹⁷⁹

Regulation adopted by the Styrian government

A “flood-safe” development of the settlement area poses a major challenge in spatial planning and integrated risk management. In 2005, the Styrian government adopted a development programme to minimise the risk in case of floods occurring in torrent and avalanche catchment areas by taking appropriate regional spatial planning measures. The interface between water management and spatial planning is crucial for an effective and efficient risk reduction and control. The development programme represents an essential document for integrated risk management and an important guideline for the coordination of various stakeholders.

Principles and priorities

Minimising the risk associated with flood events is a challenge that needs integrated management. The financing and planning of active preventive measures are predominantly set at the federal state level, while land-use planning itself is undertaken on a municipal level. This emphasises the need for a regional coordination between responsible institutions and other relevant stakeholders to mitigate hazards risks. The Styrian government had been discussing hazard risk mitigation for some time, when in 2002 a major flood event struck the province. The political conditions after the event sped up the discussion, and binding guidelines

¹⁷⁹ Good practice example provided by the Styrian government. Leading author: SCHINDELEGGGER, Arthur.

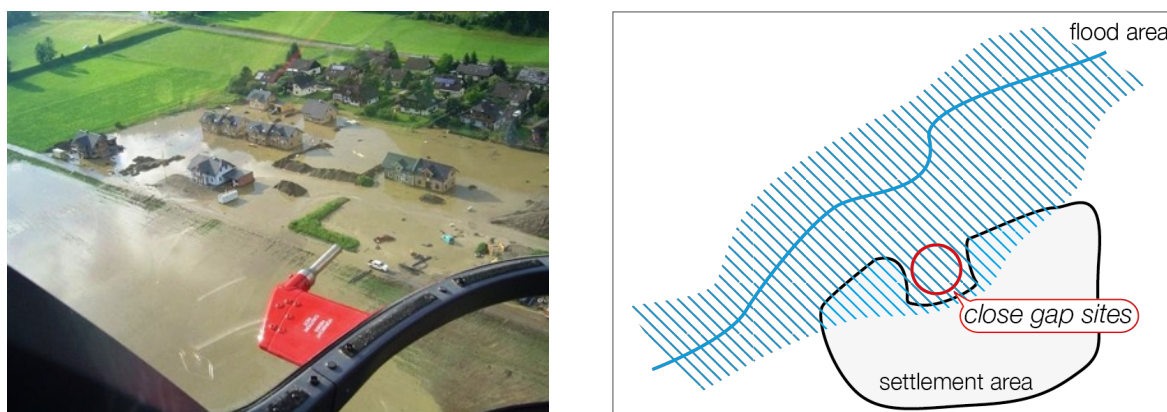
for spatial planning were developed. The **Programme for Flood-Safe Development in Settlement Areas**¹⁸⁰ was subsequently adopted in 2005.

The overall aim of the programme is the consideration of hazard risk in local and regional political decision-making when it comes to developing the settlement area. Binding principles were formulated and need to be applied by planning authorities. The focus is on regional planning because only at a regional level can retention areas be created and the further development of existing buildings and structures be managed. At the same time, isolated municipal decisions in land-use planning might cause long-term negative effects on overall risk development. Therefore, the key principles of the development programme are:

- keeping flood plains free of development,
- protection of existing and future settlements,
- formulation of exemptions.

Summarizing the essential statements of the development programme, risk reduction should be achieved through a variety of measures undertaken by the responsible authorities. Spatial planning thus receives a binding framework¹⁸¹ for securing flood retention areas as well as principles for developing the settlement area on a local and regional level.

Figure 38: Unfavourable municipal land-use planning, Styria and exemptions for settlement development



Government of Styria ©, (see § 4 Programme for Flood-Safe development in Settlement Areas), graphic by Schindelegger, 2017 ©

The development programme strongly relies on binding prohibitions for municipalities in land-use planning. Basically, general principles are defined and complemented with exemptions to settlement development. The following areas must not be used as building land, as open space increasing the hazard potential and obstructing discharge, as well as for any new construction:

1. flood discharge areas for floods with a 100-year recurrence interval (HQ 100);
2. red hazard zones as identified in the hazard zone maps according to the provisions of the Forestry Act;
3. areas which are especially suitable for flood protection measures, and blue restricted areas as identified in the hazard zone maps according to the provisions of the Forestry Act; and

¹⁸⁰ Programme for Flood-Safe Development in Settlement Area, Styrian Law Gazette. No. 117/2005, Online: <http://www.raumplanung.steiermark.at/cms/beitrag/10107064/2863310/>, 07.05.2017.

¹⁸¹ Styrian Spatial Planning Act 1974, Styrian Law Gazette No. 127/1974 and Styrian Spatial Planning Act 2010, Styrian Law Gazette No. 49/2010.

4. *riparian strips along naturally flowing water courses of at least 10 metres in width as measured from the top edge of the embankment (in some cases, if required to fulfil its function, also wider).*

The development programme formulates very strict and far-reaching principles by referring to areas for 100-year flood events. Along major rivers, large and very well-suited areas for settlement development are now inaccessible for further development. Nevertheless, certain exemptions were introduced to balance local interests and requirements. Permissions for existing buildings as well as for specified designations are still possible. Exemptions may be granted to close gap sites if they are moderate in extent. In case of a major public interest, a settlement area may be expanded, or even solitary locations may be developed.

Risk governance in the programme formulation process

The development programme is a legal decree based on a traditional perception of state duties. Process-oriented development and stakeholder analysis were not an integral part of the formulation process, and therefore there is no specific governance focus. Nevertheless, the interface between water management and spatial planning is crucial, and responsibilities are set at different levels and institutions. With the overall aim of reducing hazard risks, the formulation process of the development programme shows many aspects of a formalised governance process.

In a first stage, the **Styrian government** took over the role of a coordination and communication platform for involved stakeholders and at the same time the leadership in preparing the drafts for the development programme. On 14 October 2002, a resolution by the government aiming to formulate a development programme was adopted. In discussion rounds, the ideas and aims of the planned programme were examined. The basic framework for risk management, the rules for financing, and certain responsibilities are defined in federal Austrian laws and could thus not be argued in the discussions. Instead, this general framework served as a basis for evaluating possible regional and local strategies in settlement development. The discussion rounds were joined by official representatives from different departments within the Styrian government, **special interest groups** and **spatial planners**. The **municipalities** as well as other relevant stakeholders were asked to state relevant interests. This served as a basis for the discussion. Spatial planners were specifically involved because, as consultants of the municipalities, they had a crucial role in implementing the programme.

The development programme has been effective since 2005. In 2017, an evaluation was launched. This shows that even legal decrees are only part of an ongoing discussion process and require supervision and continuous efforts.

When it comes to **governance characteristics**, the process itself is strongly rooted on the regional level and addresses public authorities. To consider private interests, special interest groups were included. The development programme as an essential outcome of the discussion process is single-instrumental, has a long-term strategic component, and is institutionally established.

The **capacities and quality** of the governance process are difficult to evaluate. The process certainly shows a high degree of transparency, equity and legitimacy. The effectiveness and efficiency can be expected to be positive but are currently under evaluation by the Styrian government.

On the whole, the **Programme for Flood-Safe Development in Settlement Area** represents a major and unique planning instrument in Austria that picks up the idea of integrated risk management and risk governance by balancing and managing hazard risk on the level of spatial planning. For an overview of governance characteristics, capacities and qualities Table 20 provides an assessment by Styrian government officials complemented with comments for clarification.

Table 20: Governance Characteristics – Programme for Flood-Safe Development in Settlement Area

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	regional	enacted for the province of Styria
Organisation	institutional establishment	by a legal decree; assignment of responsibilities to public authorities
Actors	provinces, municipalities, NGOs, planners, interest groups	the formulation of the programme incorporated many stakeholders, but no national ones
Problem perception and goal	disaster driven; preventive measures, risk reduction, securing retention areas	the discussion of the programme was driven by certain events; planning was thereby for the first time holistically incorporated in flood hazard management in Styria
Strategies	mid-term effects, strategic approach	due to binding principles effects should be measurable in local planning within years; the basic idea is to have a long term strategic programme for flood hazard management
Instruments	single instrumental	the programme addresses municipal planning and zoning activities; it does not establish a connection to other prevention measures
Resource and organisation of implementation	formal implementation; public administrative resources; planning consultants	within the planning competence of the municipalities; 100% public financing
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, within state authorities	the programme is in the application comparatively formal and focused on the public administration; different actors on different administrative levels are involved
Coherence	multiple problem perceptions; multiple actor responsibilities in implementation	
Efficiency	cost-benefit analysis, resource input and outcome, evaluation of programme	evaluation is underway; keeping areas undeveloped is cheaper in the long run for sure
Effectiveness	achievement of key aims	not yet confirmed; evaluation underway
Equity	transparent regulations and mechanisms for the local planning	concerned people can easily identify the relevant regulations for themselves
Legitimacy	institutionalised and based on legal decree; easy accessible	the programme can be found on the web in German and English language

6.1.2 Water boards¹⁸²

A cooperative financing mechanism based on the principle of solidarity

Water boards and cooperatives (according to the Austrian Water Act) are an alternative form of financing and maintaining protection measures for flood, torrent and avalanche control in Austria. They are based on the principle of solidarity and can be regarded as a cooperative regulation model within the framework of risk governance. Water boards and cooperatives offer ample possibilities in the design of autonomous decision-making processes and internal conflict resolution in the context of hazard protection projects.

Principles and priorities

Cooperative financing mechanisms are one way of boosting resilience to natural hazards in Austria. They also tackle the question of increased privatisation of risk. This includes a stronger engagement of non-governmental actors such as private households and businesses to increase investments in self-protection and also to increase risk awareness and perception.

In Austria, municipalities are normally the promoters of projects for the protection from torrents and avalanches. However, according to the Austrian Water Act 1959¹⁸³, a water board or cooperative can also function as an initiator and operator of protection measures.

A water board (resp. cooperative) is a legal body composed of individuals, municipalities, companies etc. The tasks of these statutory bodies include sharing of (financial) risk associated with water-related hazards at a specific site – mainly valleys and regions – as well as the maintenance of the structures. Each member financially contributes to a common fund, which is devoted to developing mitigation or prevention measures. The underlying idea is to share risks and financial burdens, e.g. to develop protection measures in a torrent or river with all stakeholders and organisations wanting to achieve a certain safety level in a region – regardless of whether they are directly affected by the actual hazards.

Structure of water boards and cooperatives¹⁸⁴

Water boards and cooperatives all have a similar structure and have to meet certain legal requirements, such as:

- a minimum of three partners,
- a manager or a managing committee,
- a chair and a deputy, and
- (regular) assemblies.

The statutes of water boards and cooperatives define the area of the statutory body, criteria for membership, voting rights and principles for cost-sharing among members. They also include precaution measures for mediation to resolve potential conflicts among the members or between the members and the water board.

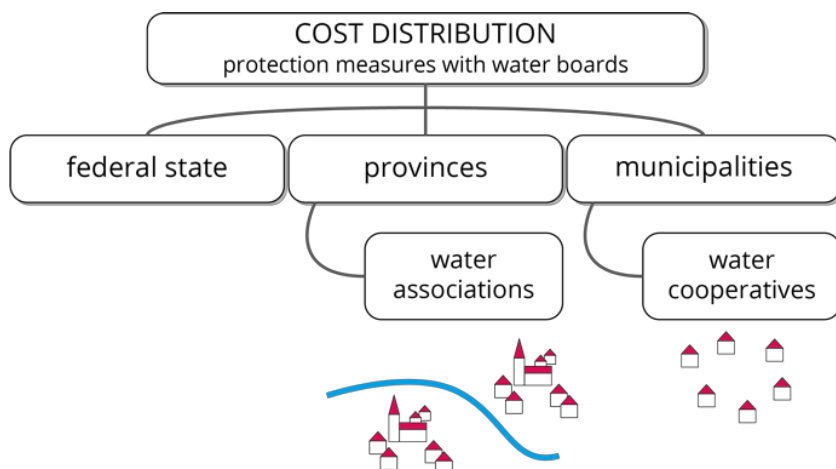
Water boards can be founded through a voluntary consolidation of stakeholders, a majority decision with concurrent involvement of resistant minorities or by decree of the provincial governor (enforced water board).

¹⁸² Good practice example provided by the Austrian Service for Torrent and Avalanche Control. Leading author: *PROMPER, Catrin*.

¹⁸³ Austrian Water Act 1959, National Law Gazette No. 215/1959 as amended 58/2017.

¹⁸⁴ *RUDOLF-MIKLAU et al.*, 2015.

Figure 39: Cost distribution of protection measures



Source: BMNT, own adaptation by Schindelegger ©

Water boards and cooperatives – status quo

In Austria, the system of water boards for torrent and avalanche control is only common in the province of Salzburg, where 230 water boards for torrents have been established to date. Among these, there is only one “enforced” body (see above definition). Detailed statistical data on the boards and cooperatives are only available for the Pinzgau district, where 103 cooperatives boards exist. These data are detailed in the following table.

Table 21: Statistical data on water boards in the district Pinzgau, Austria

Number of members	between 3 – 630 (average 109)
Contribution of WB on project costs on average	20,5% (up to 28%)
Contribution for each member on average	€ 2.500 – 7.000

Source: Survey of Austrian Service for Torrent and Avalanche Control, Provincial Headquarter Salzburg, 2015

In 2014, water boards (and intermunicipal cooperatives) contributed approximately 5.5 million euros to measures of the Austrian Service for Torrent and Avalanche Control in Austria.

Governance aspects in water boards

Communities are often restrained by necessary building restrictions in endangered areas. Municipalities have to ensure safe living conditions but also promote regional development. In the municipal risk management, public instruments face certain limitations and can be substituted by cooperative processes, especially for decision-making. Therefore, cooperatives can be regarded as a regulatory model of risk governance. Their form is self-administrated in water management with participative character. This means that rules are set autonomously, decisions are made democratically, and conflicting interests are solved internally.

The **foundation** of water boards and cooperatives usually involves all owners of benefiting properties. The **membership** is bound to the property. This ensures reliable financing and sustainable maintenance of the measures. The **rules and regulations** can be adapted to the needs and relations of the members, always based on the minimum set described above.

The **funds** for activities and purposes of the water associations or cooperatives are raised based on the solidarity principle, and the contributions are based on how big the gained advantage or reduced

disadvantage is. The **decision-making process** within the water board or cooperative is based on democratic principles or on an autonomous set of rules agreed upon in the statutes.

Controversies are normally regulated by a conciliation body defined in the statute.

To summarize, water boards and cooperatives are groups of interest comprising multiple stakeholders with a high degree of self-determination on a democratic basis defining rules and regulations. In natural hazard protection projects, these groups of interest can enhance local awareness and knowledge, while also increasing acceptance of measures. These aspects are presented in a structured manner in Table 22.

Table 22: Governance Characteristics – Water Boards, AT

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	local to regional	
Organisation	voluntary or legally enforced	the Austrian Water Act 1959 is the basis for water boards
Actors	private members, companies, NGOs, etc.	wide range of possible members
Problem Perception and goal	disaster driven; preventive measure for risk reduction; securing retention areas	clear goal in the formulation process; risk reduction is the core idea; different perceptions possible
Strategies	mid to long term effects; strategic approach	
Instruments	single instrumental	one instrument on regional/local level; complemented by other instruments
Resource and organisation of implementation	Water boards can act as part of a financing mechanism for protection structures	
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level; multi-actor, within state authorities; involving NGOs	wide extent; addressing mainly local actors
Coherence	consideration of multiple problem perceptions; multiple actor responsibilities in implementation	
Efficiency	unknown	depends on evaluation processes; not mandatory
Effectiveness	achievement of key aims	evaluation is underway; by trend positive
Equity	high level of equity	Due to general principles for judging on individual situations/projects
Legitimacy	institutionalised; legal degree; transparent	

6.2 France

France provided two good practice examples regarding risk governance. The first one is a **hazard and risk mapping tool** to provide a sufficient decision basis for different stakeholders. The planning of structural, biological or organisational measures is an essential outcome of this tool. For land-use planning it serves as a basis for zoning decisions taking the actual risk into account. The second example is a short introduction to **Action Programmes for Flood Prevention**. Such programmes incorporate different public actors, and to some extent concerned people, in a discourse on the implementation of protection measures and result in a formalised contract on the protection/hazard prevention strategy.

6.2.1 Natural Risk Prevention Plan

A tool for a comprehensive prevention strategy

The Natural Hazard Risk Prevention Plan (Plan de Prévention des Risques Naturels – PPRN) is a tool within the state's natural hazard risk prevention policy in France. Its aim is to fully control urbanisation in risk zones and reduce the vulnerability of people and existing structures.

Principles and priorities

More than half of the French municipalities are exposed to natural hazard risk to varying degrees. These result from a combination of one or more hazards (flooding, rockfall, landslides, cave collapse, earthquakes, avalanches, forest fires, etc.) and existing local features (people, property, activities, resources, natural and urban heritage features that are likely to be affected by a natural phenomenon). It is within this context that the Law on Strengthening Environmental Protection passed in 1995 provides the state with a regulatory tool that is dedicated to the prevention of risks: the Natural Hazard Risk Prevention Plan.¹⁸⁵

Figure 40: Rockfall in Morzine (Haute Savoie, 2013), Rockfall in Veyrier-du-Lac (Haute Savoie, 2009)



Source: Restauration de terrains en montagne (RTM) ©

The PPRN's aim, with sustainable development in mind, is to prevent people and properties from being increasingly exposed to natural hazard risks, and to reduce the negative impact of natural hazards on human lives, the environment, economic activity and cultural heritage:

¹⁸⁵ Plans de prévention des risques naturels prévisibles, Guide général. Ministère de l'environnement, de l'Energie et de la Mer, Ministère du logement et de l'habitat durable. Online: http://www.side.developpement-durable.gouv.fr/EXPLOITATION/ACCIDR/doc/IFD/IFD_REFDOC_0535712.

- The PPRN contributes to decreasing exposure to natural hazards by defining high risk zones where buildings or other facilities are prohibited, and by allowing other zones to be developed in a thought-out and safe manner complying with certain requirements in line with the potential hazard intensity (medium or low).
- The PPRN contributes to the reduction of potential damage by defining prevention, protection and conservation measures, alongside measures relating to the development or use of buildings, civil engineering structures, and agricultural areas existing on the date of the plan's establishment.

The contents and role of a PPRN

A PPRN consists of three parts:

- **A project outline:** This indicates the geographical area concerned, the nature of the natural phenomena in question and their possible consequences based on the current state of knowledge. It justifies preventive choices made, indicating the principles governing the PPRN's development and explaining the regulations in place.
- **A regulatory zoning plan:** This zoning plan combines hazard map information, existing features and the zones defined by the PPRN. These are the current zones at risk, but also zones where any development could aggravate the existing risks or cause new ones. The hazard map characterizes the hazards to which the risk area is exposed and determines a reference hazard. This makes it possible to locate and classify the various hazard zones. Existing features are assessed qualitatively regarding land use and occupation patterns.
- **A regulation:** This regulation specifies the rules applicable to each of the zones. It therefore defines the conditions in which any construction, civil engineering works, developments, and agricultural, forestry, artisanal, commercial or industrial operations are to be carried out. It also regulates the preventive, protective, and conservation measures for which individuals or local authorities are responsible, but also any mandatory measures applicable to existing property and activities.

The methodology regarding the development of risk prevention plans is described in a general guide, and the specificities regarding the particular hazards dealt with are found in thematic guides.

As the PPRN is in the public interest it is attached to any urban planning document. It applies to everyone: individuals, businesses, local authorities, and the State. It can deal with a single type of risk or with several and may extend over one or more communes.

Example: Rockfall Risk Prevention Plan

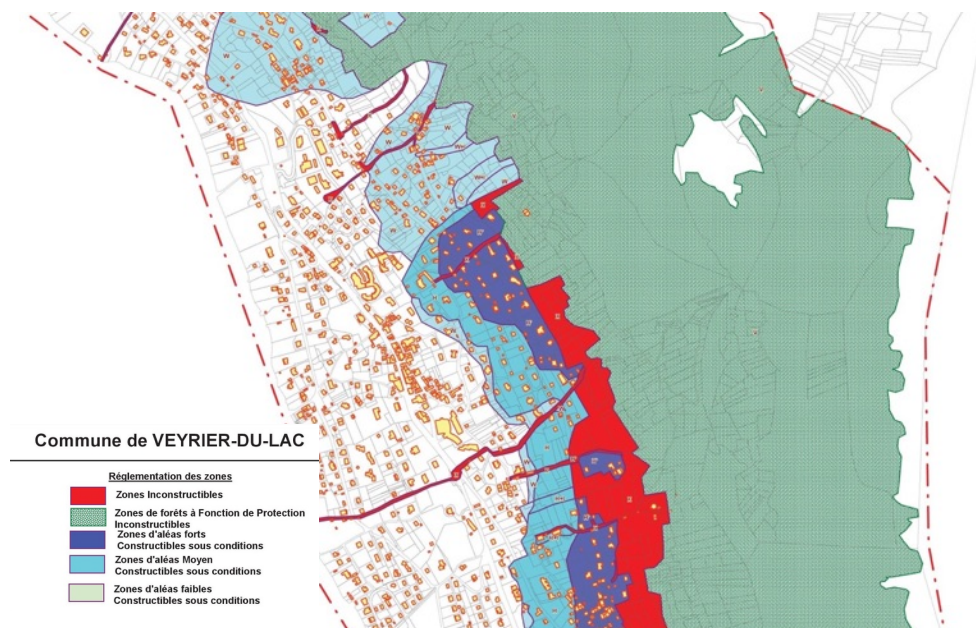
For the development of a rockfall risk prevention plan, the estimation of risk is based on the analysis of phenomena likely to occur at any given point with a given intensity. This hazard includes a range of phenomena ranging from an isolated rockfall to large scale phenomena.

There are several steps necessary prior to establishing zoning regulations:

- defining the risk area and the scope of the study;
- identifying and describing past and current phenomena: bibliographic survey, use of databases, aerial photographs, thematic maps, land surveys, personal accounts;

- qualifying hazards in terms of intensity (defined according to physical parameters or a damage potential scale), and definition of reference scenarios (plausible within 100 years);
- creating a “hazard map” (1/10.000 scale) demarcating homogeneous hazard zones;
- evaluating features that are at risk

Figure 41: Regulatory zoning, Veyrier-du-Lac PPRN



Source: © ONF-French National Forests Office – Restoration of Mountain Territories Department

Governance and risk governance aspects

PPRNs are established for the most exposed areas under the authority of the department prefect. Their development is financed by the state through the fund for the prevention of major natural hazards. PPRNs are carried out within a collaborative and consultative framework together with the regional authorities in charge.

Collaboration is essential for public funding to be effective. It creates the trusting climate necessary for accepting the analyses and decisions that form the basis of the PPRN project. The various stakeholders –particularly regional authorities responsible for their territorial planning – are therefore involved from the very beginning of the process, mostly through meetings.

Consulting the general public is a fundamental success factor and should be done as comprehensively as possible. The objective is for the process to be shared by everyone concerned. It allows for an open debate and public discussion between the various players on a project that affects the area and the local population. Public consultation can take several forms (public meetings, websites, discussion forums, town hall registers, etc.) and is particularly effective during the following stages:

- first discussions
- hazard, feature, and vulnerability studies
- local preventive strategy and PPRN project

Official authorisation is given after conducting a public inquiry. Then, the PPRN must be approved (and authorised by the prefect) within a period of three years, extendable once with an 18-month limit.

To conclude, the PPRN is an operational tool that has been available since 1995 with the aim of reconciling development and risk, while reducing the vulnerability of people and property. It requires a coherent approach involving all stakeholders (state, regional authorities, civil society, etc.) and a consultative and instructive spirit. The involvement of the public is a fundamental factor to ensure that the plans are accepted by the local stakeholders and public. This approach should lead to a suitable formulation of the PPRN's regulatory requirements, so as not to hinder urbanisation unnecessarily. These requirements should also ensure suitable construction conditions in risk zones, taking into account the local landscape and architecture whilst respecting the preventive objectives that have been set. The existence of a PPRN also creates opportunities for financing and subsidies – especially for local authorities – to reduce vulnerability.

To summarize, the risk prevention plan is an important integrative planning tool for stakeholders to assess actual risk and base decisions solidly. Table 23 provides an overview of governance aspects of the instrument.

Table 23: Governance Characteristics – PPRN, FR

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	local, regional (inter-communal)	risk prevention plans are established under the authority of the department prefect
Organisation	institutional establishment	development process set out in articles L.562-1 to L561-9 and R.562-1 to R562-12 of the French Environmental Code
Actors	public administration, local people	PPRN established by government departments within a collaborative and consultative framework with the regional authorities concerned
Problem Perception and goal	preventive measures, risk reduction	avoiding people and property being increasingly exposed to natural hazards; reduce negative impacts on human lives, the environment, economic activity, and cultural heritage
Strategies	short to long term approach, strategic approach	establishing a common local strategy with the regional authorities
Instruments	single instrumental	establishing communal or intercommunal PPRNs supplemented by other risk prevention tools (information tools, communal emergency plans, etc.)
Resource and organisation of implementation	financing by the State via the use of funds	different financing models in place
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-actor	the development of risk prevention plans is under the State's responsibility with close consultation with the regional authorities concerned and involving the general public

		via meetings, seminars, and involvement in the public inquiry, during which inhabitants of the areas concerned may share their opinion on the PPRN project
Coherence	consideration of multiple problem perceptions	reconciling regional development objectives and natural risk prevention
Efficiency	evaluation of program/project	PPRN implemented in the most exposed areas. Since 1995: progressive improvement of the development process; no socio-economic evaluation of the decisions made with regard to zone demarcation and the corresponding regulations; environmental evaluation of the project's effects on a case-by-case basis
Effectiveness	achievement of key aims	more than 11.000 municipalities benefit from risk prevention plans approved in 2017, which helps control the increase in the vulnerability of property and people
Equity	mechanisms for compensation	subsidies granted by the State for studies and works for vulnerability reduction imposed by a risk prevention plan
Legitimacy	institutionalised, relevant legal basis, transparent	legitimacy of a PPRN that results from compliance with applicable regulations and laws but also from its acceptance by regional authorities (incentive to involve them in its development)

6.2.2 Action Programmes for Flood Prevention (*Programmes d'action de prévention des inondations, PAPI*)

A tool for a comprehensive prevention strategy

In France, the Action programmes for flood prevention (Programmes d'action de prévention des inondations – PAPI) are led by local authorities and aim at generally reducing the vulnerability of areas exposed to flood risks. PAPIs cover areas with consistent risk potential and can deal with different kinds of flood risks. The actions cover all aspects of the flood risk management policy. These action programmes are based on national specifications established by the State and are certified either by the Joint Flood Commission (CMi) or by the authorities within the respective catchment basin, depending on the programme budget. Certification allows the local authorities to benefit from financial support from the prevention fund for major natural hazards (FPRNM). PAPIs are an agreement signed between the local authority implementing the project, the State, and the primary financing partners. A steering committee and a technical committee ensure the management and monitoring of the implementation of such programmes. New national specifications applicable since 2018, called PAPI 3, provide a number of additional requirements designed to improve the implementation conditions for these programmes.

Principles and priorities¹⁸⁶

Floods represent the most important natural hazard in France. It is currently estimated that 17 million people in France live in areas exposed to the risk of flooding, in other words one in four inhabitants. Additionally, the average annual cost incurred by damage caused by floods in France that is covered by the national natural disaster solidarity fund is estimated to be around 400 million euros per year.

The objective of the action programmes for flood prevention is to take a holistic approach to reducing the vulnerability of areas exposed to flooding. PAPIs are the preferred method for operational implementation of local flood risk management strategies developed for each significant flood risk area (TRI) under the 2007 Floods Directive. But PAPIs may also be provided outside the context of local flood risk management strategies.

The PAPI scheme aims to promote action programmes:

- led by regional authorities or groups of such authorities;
- applied in an area with coherent flooding risks;
- based on a rigorous diagnosis of the area's potential flood risks;
- making use of a strategy shared with the area's various stakeholders and the general public;
- seeking consistency with other public policies, with territorial and urban planning priorities, and the preservation of aquatic environments;
- bringing together the various aspects of flood risk management policy, particularly non-structural actions;
- related to the area's particular challenges and potential PAPI impact;
- based on transparently discussed decisions and objective criteria;
- for which the various implementation steps (public sector contracts, operational studies, environmental authorisation, land acquisition, etc.) have been anticipated to optimise their application in the field after certification, and to ensure practicability within the PAPI implementation time frame.

PAPIs must comply with national specifications. To ensure such compliance, PAPIs are certified by the Joint Flood Commission for projects with an amount above or equal to three million euros, excluding taxes. In other cases, PAPIs are certified by basin authorities. Certification allows the local authorities to benefit from state subsidies and from financial support from the fund for the prevention of major natural hazards.

So-called "Proposed PAPI" programmes allow local authorities to get state and FPRNM financing for the studies necessary for the preparation of a full PAPI programme. The new 2018 PAPI 3 specifications seek to take into account the lessons learned from PAPIs certified since 2011, in particular regarding the improvement of implementation conditions for action programmes.

¹⁸⁶ The PAPI specifications are available on the Ministry of Ecological and Social Transition website: <https://www.ecologique-solidaire.gouv.fr/prevention-des-inondations>, 15.09.2018.

The contents and role of PAPIs

A PAPI dossier comprises the following principal elements:

- a. presentation by the project owner (status, experience in the water and flood management field);
- b. a comprehensive and shared diagnosis of the area with regard to flooding risk;
- c. a coherent strategy suited to the problems identified, based on analysis of the area concerned, and presenting the proposed objectives. It presents the measures to be implemented covering all aspects of the specifications;
- d. a section dedicated to governance: this details the project's terms with regard to local governance and the interface with water management procedures, as well as territorial planning policies;
- e. a note on risk integration in territorial and urban planning;
- f. the comprehensive and interdisciplinary action programme, the schedule and financing plan;
- g. the multi-criteria analysis and/or the cost-benefit analysis for works related to dykes and water flow management (dynamic slowdown works, watercourse recalibration, rehabilitation of natural zones for increased water levels, etc.);
- h. the PAPI's environmental analysis;

The actions set forth in the action programme must be initiated within a six-year period covered by the framework agreement. However, amendments to the original agreement are possible. Amendments calling into question the overall nature of the initial programme must be re-certified.

Example: the Brévenne-Turdine, PAPI

The Brévenne-Turdine PAPI was certified by the Joint Flood Commission on 12 July 2012. This PAPI led by the Brévenne-Turdine river union amounted to 10.2 million euros, with state support at 156,000 euros and FPRNM support at 5 million euros. The other financing partners were the Région Rhône-Alpes (11%) and the Rhône departmental council (10%). The rest of the project was financed directly by the implementing contractor.

The Brévenne catchment basin is located in the Rhône department between the Monts du Lyonnais and the Monts du Beaujolais. The Brévenne is the last major tributary of the Azergues, which is a tributary of the Saône. The Brévenne's main tributary is the Turdine. The almost 400 km² Brévenne-Turdine catchment basin contains nearly 160 kilometres of waterways. A total of 66,000 inhabitants are exposed to the floods in this catchment basin.

As a continuation of work carried out in this area relating to the management of the aquatic environment, the Brévenne-Turdine PAPI management preferred natural solutions and wished to minimise any impact on the aquatic environment. As the basin did not originally include a dyke, the decision was made not to build one. The programme was therefore based on the principle of accepting overflows in designated areas and on a return to natural watercourse functioning.

The chosen strategy therefore had to focus on reducing the risk for the population: implementing communication campaigns (sharing the flood risk prevention plan, organising a seminar every other year, defining a family safety plan, and free vulnerability assessment for

inhabitants), raising awareness amongst elected representatives, who would act as a relay, setting up a network with voluntary residents who would send out information or alerts, etc. The area's vulnerability has thus decreased but, more importantly, awareness of the risk itself has significantly improved. A decisive factor in the choice of actions has been consultations and discussions with local people and agricultural stakeholders, taking an open, constructive approach instead of an informative one.

The union appointed a mediation firm and was able to count on local mayors being heavily involved, facilitating links with the local population. Certain modifications were made to the programme during the course of its implementation: deciding on two flow management units out of the initial five, reducing land impact, use of natural materials, intentional flooding of certain areas to protect those living downstream, and increased action relating to rainwater runoff. The practicability of these changes was then reassessed.

Governance and risk governance aspects

The national flood risk management policy is discussed within a national decision-making body, the Joint Flood Commission (CMI). This body brings together national and local elected representatives, representatives from civil society, various qualified persons as well as state representatives.

The new PAPI 3 national specifications were drawn up by a national working group that included members of the CMI. The primary source of funding for PAPIs is the fund for the prevention of major natural hazards. This fund is financed by a levy on insurance premiums or additional contributions relative to the guarantee against the risk of natural disasters, as defined in the French insurance code. For each PAPI, the action programme's management and monitoring are carried out by a steering committee that is supported by a technical committee.

The steering committee guarantees the PAPI project's proper implementation as well as the achievement of the objectives that were set and validated by the certifying body. The agreement relating to the particular PAPI provides the management framework. The signatories coordinate their action within the steering committee, which meets periodically. The steering committee comprises representatives of the financing partners, contractors and the state. It is jointly chaired by the state's representative and the project leader's representative. It meets at least once a year.

The steering committee ensures the progress of the action programme's various components and also makes sure that the programme is consistent during the various annual stages of implementation. In particular, it monitors the indicators intended to enable assessment of the effectiveness of actions that are carried out.

The technical committee is responsible for the technical monitoring of the project's actions. It is composed of officials who are appointed respectively by the representatives of the financing partners, the contractors, and the state. It informs the steering committee of the progress of the implementation of the action programme, any indicator developments, and any difficulties arising during implementation. It ensures the implementation of decisions made by the steering committee. Additionally, the SAFPA (PAPI administrative and financial monitoring) web tool enables national monitoring of PAPIs with regard to the physical progress of actions, and the monitoring of the use of state and FPRNM credits.

Concerning risk governance aspects, the action programmes for flood protection focus on a holistic catchment-based approach and take risk and vulnerability closely into account. At the same time, public institutions as well as the local communities and people are included in this still quite formal and state-framed process. The programmes require immense efforts concerning the coordination and actual implementation of measures. Nevertheless, successful examples support the chosen approach and foster governance processes in flood risk management.

Table 24: Governance Characteristics – Action Programmes for Flood Prevention, FR

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	national, regional, local	PAPIs developed by a local authority or a group of such authorities, certified by the CMi or the appropriate agencies within the basin itself, based on national specifications.
Organisation	institutional establishment	Process defined by national specifications and an accompanying memorandum.
Actors	Ministry of environment, national consulting instance, basin instances, local authorities	The Joint Flood Commission (CMi) (for PAPIs < €3 million, excl. tax) or the basin agencies certifying the PAPI. The Minister of the Environment is responsible for the administrative duties of the CMi and the operational management of the FPRNM. PAPIs are led by local authorities.
Problem Perception and goal	disaster driven, preventive measures, risk reduction, securing retention areas etc.	The PAPI scheme aims to take a global approach to reducing the vulnerability of an area by bringing together all types of actions related to flood risk management.
Strategies	long term/short term effects, strategic approach, ad-hoc solution(s)	A PAPI's action programme is based on the development of a strategy that sets out objectives to be achieved that are shared by the area's various stakeholders.
Instruments	multi-instrumental	A PAPI's action programme makes use of the various aspects and tools of flood risk management: tools to improve risk awareness and knowledge (communication, information, training), tools for flooding and increased water level forecasting, crisis management organisation, taking risks into account with regard to urban planning, reducing the vulnerability of existing features, work on dyking systems, flow management actions (dynamic slowdown works, rehabilitation of natural zones of increased water level, watercourse recalibration, redefining watercourses, etc.).
Resource and organisation of implementation	Financing by the State and via the use of funds from the fund for the prevention of major natural hazards (FPRNM).	The FPRNM is financed by a levy on insurance premiums.
GOVERNANCES		
Extent	multi-actor	PAPIs are developed by a local authority or a group of such authorities. The contractors for a PAPI's actions may include many organisations, such as: local authorities, the State, businesses, private individuals, associations, etc.

Coherence	consideration of multiple problem perceptions/multiple actor responsibilities in implementation	<p>The PAPI scheme promotes action programmes combining flood risk management with other public policies within the same area, with priorities being both territorial and urban planning, and the preservation of the aquatic environment.</p> <p>Furthermore, a particular challenge with regard to the implementation of PAPIs concerns managing and monitoring multiple stakeholders to ensure a consistent approach.</p>
Efficiency	cost-benefit analysis, resource input and outcome, evaluation of program/project	<p>Works relating to dykes and flow management are subject to a cost-benefit analysis (CBA) or a multi-criteria analysis (MCA).</p> <p>PAPIs are subject to having their implementation monitored, especially with regard to ad hoc implementation indicators. An implementation assessment must be made at the end of the programme.</p>
Effectiveness	achievement of key aims	<p>PAPIs are subject to having their implementation monitored, especially with regard to ad hoc implementation indicators. An implementation assessment must be made at the end of the programme.</p>
Equity	mechanisms for compensation	<p>PAPI certification allows PAPI action contractors to benefit from State and FPRNM subsidies, with their average amount being 40% of the PAPI's total.</p>
Legitimacy	institutionalised, relevant legal basis, transparent	<p>PAPIs are certified based on national specifications that are validated at a national level by the Minister of the Environment. These specifications and the accompanying memorandum define all the criteria for certification as well as the project appraisal stages.</p>

6.3 Germany

The two good practice examples provided by Germany are both set in the field of flood management. The **communal flood audit** for example is a **cooperative tool to help municipalities identify and realise the status quo of prevention** and develop strategies and solutions for risk reduction and raising resilience. Experts and representatives from the state administration are participating in the audit process but are in the first place a support for the municipalities. The analysis and discussion are therefore strongly bottom-up orientated and incorporated governance principles. The second example from Germany is the “**Licca Liber**” project on the river Lech. This was a **participatory regional process** to help understand local actors that not only flood hazard issues but also ecological and other aspects need cooperation and a regional perspective. As a starting point the project should help to establish bottom-up initiatives

6.3.1 Municipal flood audit: How well prepared are we?

A governance approach by the German Association for Water, Wastewater and Waste (DWA)

To cope with possible scenarios of rising flood risk due to climate change, limited means of protection, and additional risks such as flash floods, municipalities need to think of further strategies beyond technical measures. This for example refers to raising awareness regarding the need for human resources. The German Association for Water, Wastewater and Waste (DWA) therefore developed a comprehensive audit procedure for municipalities to assess how well prepared communities are and where they need to develop further non-structural measures.

Principles and Priorities

The municipal flood audit by the DWA has been devised because the general public – despite expert warnings – often believes that floods are controllable and technical measures guarantee complete safety. With the European Floods Directive, the legal framework was built for a paradigm shift from mere flood protection to integrated risk management. Hazard risk management is a task of the state and the public administration, but more importantly it's a task of the public to reduce potential damages. Extreme events that overload technical measures are to be considered regularly. Thus, damages in areas behind protection structures can be reduced if risk is known. With planning sovereignty at local level, municipalities have a high responsibility but also diverse possibilities of action. Here the communal flood audit helps municipalities to determine their individual need for action.

The communal flood audit is a special offer for local authorities to sustainably improve local flood prevention. It offers municipalities a possibility to comprehensively survey their flood prevention programmes independent from actual events and without time pressure. Subsequently the audit can be used to devise proper action plans to further develop municipal flood prevention programmes.

The audit can also be used as a basis for public communication of flood risks as required by the EU Floods Directive.

Content and procedure of the flood audit¹⁸⁷

The municipal flood audit assesses the risk awareness of all persons involved in the audit. This includes local administrative stakeholders as well as firemen. The audit evaluates the degree of risk awareness, not the risk itself. It is expected that well informed administrative bodies as well as the general public can only react properly if the relevant information and practical solutions to minimise risk are available. The audit also deals with the implementation of reduction measures, focusing on local non-structural measures. Structural measures such as dykes, retention basins etc. are regarded as given boundary conditions but they are not subject to the evaluation itself.

Besides risks linked to fluvial floods, the audit also incorporates local flash floods which are also of great importance in the Alpine area. Due to their different boundary conditions, both hazards are considered separately in the scenarios of the audit. In line with the Floods Directive, three scenarios are taken into account: frequent floods (HQ_{low}), floods with average probability (100-years flood, HQ₁₀₀) and extreme floods (HQ_{extr}).

The audit is divided in four different fields of evaluation. These are spatial prevention, technical prevention, precautionary behaviour and risk prevention.

Figure 42: Flood audit meeting



Source: German Association for Water, Wastewater and Waste, DWA ©

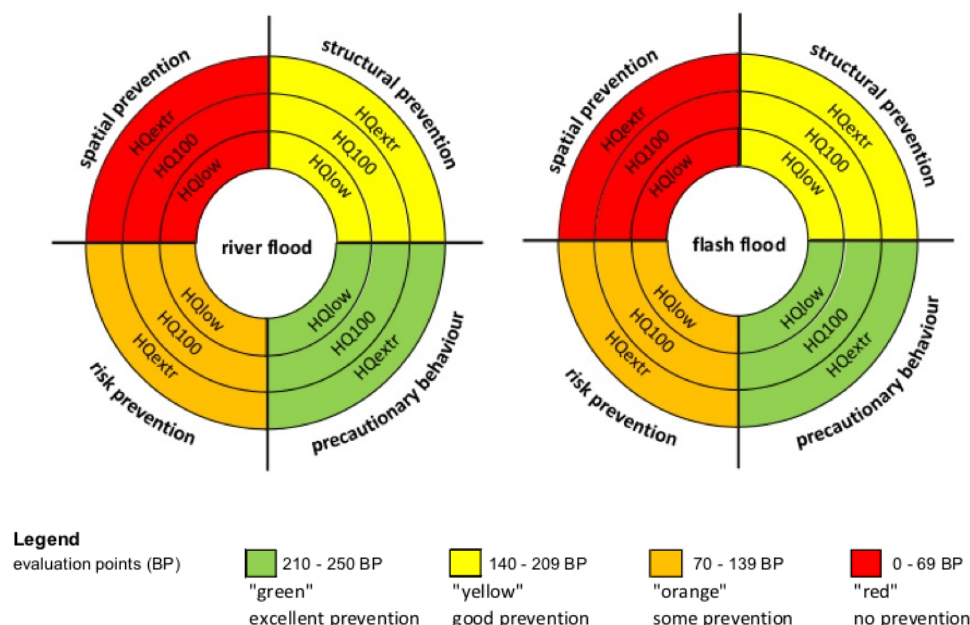
When the DWA receives an audit request from a municipality, it commissions a certified auditor. This auditor gets in contact with the municipality to understand which relevant stakeholders need to be integrated in the audit. For the initial audit, no specific documents are asked for. This means that the municipality generates the audit based on their own specific knowledge and information. The level of knowledge thus determines how accurate the results of the audit are.

The audit procedure usually takes two days on-site and is documented in standardised minutes. The concept is to have an active dialogue between the auditor and the relevant stakeholders of the community. These should be decision-makers and experts from the following fields: water management authority, forestry, building authority, structural engineering, health authority, civil protection, fire brigade, rescue services and many more.

¹⁸⁷ DWA, 2010.

At the end of the on-site visit, the auditor presents the preliminary results. A detailed documentation is then developed. Based on 35 questions the status quo of the community is clearly described. With “traffic light” graphics, the results can easily be communicated (see Figure 43). Ideally, a re-audit is commissioned after six years to map the progress made.

Figure 43: Exemplary “traffic light” graphic for an imaginary commune



Source: German Association for Water, Wastewater and Waste, DWA ©

So far approximately 40 audits have been carried out in communities of between 1,500 to 1 million inhabitants.

The results show that municipalities are better prepared for the scenario of fluvial floods than flash floods. This might be based on the fact that flash floods have only recently gained importance in the public discussion with increasing climate change debates.

As expected, the biggest lacks in prevention were found for extreme event scenarios. This is because historically flood protection was only designed for 100-year floods. Municipalities frequently report that the audit has helped to make decision-makers more aware.

The audit is financed by the municipalities. Since late 2016, it has been subsidized by the Free State of Bavaria. It is currently being discussed whether to add the audit as a compulsory element for municipalities to get financial aid from the Free State of Bavaria for future flood protection measures.

Governance and risk governance aspects

The audit is to be understood as a helpful tool in a consultation process with the aim of strengthening the local risk awareness and consolidating integrated risk management planning systematically.

The flood audit brings together relevant actors in the process of flood protection at a local level. It aims at helping communities to identify gaps in their prevention programmes and to prioritize planned measures. Ideally, the audit will also have medium- to long-term effects on a strategic level through regular re-audits.

The audit is a multi-actor instrument that includes relevant actors within municipal authorities and their administration. Thus, it is a single-level instrument that does not include individual citizens or regional bodies. It is judged as highly efficient for a first status quo analysis. Its long-term efficiency cannot be assessed yet. Medium- to long-term effects will depend on the realization of proposed measures and will have to be monitored with a re-audit.

Table 25: Governance Characteristics – Flood Audit, GE

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	local level	municipalities are the main stakeholders
Organisation	institutional establishment, informal cooperation	
Actors	German Association for water, wastewater and waste (DWA); stakeholders from the commune e.g. mayor, building authority, business development, civil protection etc.	
Problem Perception and goal	Identification of the status quo in flood risk management, risk awareness building	helps identifying their gaps in flood risk management and to prioritize measures
Strategies	Mid to long-term effects, strategic approach	through regular re-audits a consolidated process is envisaged
Instruments	single instrumental	the audit represents a starting point for further initiatives
Resource and organisation of implementation	financed by the municipalities; subsidies by the state (in Bavaria)	two days on site audit with subsequent documentation of results
GOVERNANCE QUALITIES/CAPACITIES		
Extent	single-level, multi-actor, within municipal authorities and their administration	
Coherence	consideration of multiple problem perceptions/multiple actor responsibilities in implementation	
Efficiency	as first step for status quo analysis highly efficient	Mid- and long-term effect dependent on realization of proposed measures and follow-up audit
Effectiveness	achievement of key aims	those communes which did the audit provided positive feedback
Equity	high degree, as all relevant municipal actors are involved	citizens are not included
Legitimacy	so far informal	

6.3.2 Licca liber – the free Lech river

Public participation for the renaturation of the Lech river

The Licca Liber project is a major renaturation project along the Lech River in Bavaria. To raise public acceptance of planned measures, a public participation concept was implemented based on the Austrian “Flussdialog” (river dialogue) approach. This “river dialogue” consisted of four phases including workshops, a public consultation phase, the definition of development goals and a final public presentation of results. This project shows that involving important stakeholders can result in productive discussions, joint solutions and increased public acceptance of major projects.

Principles and Priorities

The Licca Liber project¹⁸⁸ is a major river restoration project in the Free State of Bavaria along the Lech River. The project aims to stop the progressive degradation of the river bed due to erosion. Additionally, a “good ecological potential”, as defined by the European Water Framework Directive, has to be achieved. The project also creates synergies by ensuring nature conservation and providing recreation areas. The project started in 2013 and is managed by the Free State of Bavaria, with the Donauwörth water management authority as the coordinating body. The project area is situated between hydropower plant 23 south of Augsburg and the confluence of the Lech and the Danube. Several planning sections will be realized successively.

Figure 44: Location of the project Licca liber inside the Free State of Bavaria



Source: Bayerische Vermessungsverwaltung ©

For the first section between hydropower plant 23 and the city of Augsburg, it was decided that an active form of public participation is desired and needed. The reason for that was the high groundwater level in the cities on both riversides, where inhabitants were worrying about negative impacts. The water supply of Augsburg today is based on the canalized river course. Several wells close to the river provide Augsburg with drinking water. On both sides of the river, there are protected Natura 2000 areas, where the concept of “no deterioration” must be considered. Furthermore, protected forests have to be conserved in quality and size by law.

¹⁸⁸ Wasserwirtschaftsamt Donauwörth (s.a.). Further information: www.wwa-don.bayern.de/fluesse_seen/massnahmen/liccaliber/index.htm.

Even for high water levels, the former alluvial forest no longer interacts with the river. Other factors are recreation zones in the surroundings of the Lech and hydropower generation.

All these different interests and uses of the Lech River need to be integrated into a concept to fulfil the above-mentioned aims. By basing the concept on public participation, the water management authority hopes to increase awareness and tolerance for hydrological measures.

The process of public participation¹⁸⁹

Figure 45: The four phases of the public participation gear into each other



Source: Wasserwirtschaftsamt Donauwörth ©

The overall aim of the public dialogue was to formulate and agree on river development goals and to create a common understanding of different perspectives and requirements. The stakeholders and residents participated through an information and consultation process. Stakeholders from the following fields were involved: nature conservation, fishery, forests, municipalities, mayors, state parliament members, public administration, tourism and water suppliers. The participation process increased awareness and tolerance for hydraulic measures, water ecology, flood protection and water usage. Additionally, it served as an orientation for politics, authorities and stakeholders.

In the **first phase**, workshops with all the different stakeholders were organized. These workshops collected the different positions and ideas of stakeholders. Finally, the participants of the workshops agreed on the questions for public consultation.

This laid the foundation for the **second phase**, in which an online survey was conducted between January and February 2014. The online survey dealt with the topics of renaturation, recreation zones, integration of nearby lakes, hydropower generation and public funding. Around 6,800 citizens of the surrounding municipalities participated. More men than women answered the questions, and the generation 50+ was overrepresented. There was a broad consensus about rebuilding a near-natural stream course and for the preservation and development of habitats and species. A negative attitude was shown towards the relocation of wells and hydropower usage. The integration of lakes was seen controversially. Here, regional differences became apparent.

In a **third step**, river development goals were defined as a result of the workshops and of the online survey. These goals aim at (i) preventing further degradation of the river bed, (ii) fostering a stable environment for fish and gravel, (iii) creating new meadows and habitats, (iv)

¹⁸⁹ WINTER, 2016.

maintaining and improving flood protection, (v) preventing increasing levels of ground water in villages, and (vi) enhancing accessibility and local recreation. All stakeholders brought a symbol to the meeting to illustrate what they associated with the Lech River and to document their final agreement on the development goals (see Figure 466).

Figure 46: Final agreement on the development goals.



Source: Wasserwirtschaftsamt Donauwörth ©

The **fourth phase** comprised a public presentation and fair booths of the different stakeholders to inform the population about the process, the resulting development goals and further steps.

Based on the development goals, the administration formulated an implementation concept for the renaturation of the Lech River. The public participation clearly showed that everybody wanted a change for the Lech.

The public participation now continues through a Licca Liber working group, a Licca Liber forum and a Licca Liber newsletter. An interesting result of the process was that in the end not the “leading” water resources administration was asked about consequences of ideas or scenarios. Instead, the different users and stakeholders themselves answered the questions. For example, the drinking water company explained what the renaturation idea of a nature conservation organization would mean for the drinking water supply. These direct explanations found much more acceptance.

Governance and public participation

The Licca Liber project was based on wide public participation to ensure a smooth and transparent project planning phase. Therefore, **multiple stakeholders** were integrated in the process. Furthermore, a “river dialogue” was used to inform people and raise public awareness on flood protection measures, hydraulic engineering measures, nature conservation, hydropower use and water ecology. Moreover, the interaction between the different interests and the resulting restrictions were actively discussed in the workshop.

Experiences show that the involvement of stakeholders and the population is decisive. The workshops give room to stakeholders to introduce and exchange their ideas. The online survey gives a clear picture of how the population perceives the Lech River as it represents the silent majority. This project is a good example of risk governance on a local and regional level. Selected elements might serve as a good practice example for further project sections of the overall Licca Liber project. The results of the “river dialogue” also have long-term strategic effects on the future progress in transforming the Lech River. The evaluation of the public

participation process showed that it was a multi-level, multi-actor process, involving local people via online survey.

A study is currently evaluating if the measures defined in the realization concept can be technically achieved. Therefore, all available data is used to model different approaches for stabilizing the Lech River and for ensuring flood protection. The study also assesses whether the “good ecological potential” required by the European Water Framework Directive will be accomplished.

Table 26: Governance Characteristics – Licca Liber, GE

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	local to regional level	
Organisation	regional water management authority	
Actors	nature conservation, water suppliers, fishery, forest, tourism, municipalities, politics and public administration including the regional water management authority.	regional water management authority as managing body
Problem Perception and goal	multiple problem perception	(i) preventing further degradation of the river bed, (ii) improving the transmissibility for fish and gravel, (iii) creating new meadows and habitats, (iv) maintaining and improving flood protection, (v) preventing increasing levels of ground water in villages and (vi) enhancing accessibility and local recreation
Strategies	mid to long term	“river dialogue” constitutes a good basis. Public relations activities have to be done periodically.
Instruments	workshops, surveys, round table	
Resource and organisation of implementation	Public participation financed by the Free State of Bavaria, voluntary cooperation with all actors	all actors took voluntarily part in the formulation process of the realization concept
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, involving local people	
Coherence	considering multiple problem perceptions	
Efficiency	evaluation of online survey, result supported by a broad basis	around 6.800 citizens of the surrounding communes participated in the project
Effectiveness	achievement of key aims	
Equity	consultation of all actors	
Legitimacy	European Water Framework Directive, Natura 2000, national laws	

6.4 Italy

Italy provided three good practice examples taking risk governance in the field of Natural Hazard Management into account. **Intervention Maps** are an instrument in the field of disaster management in South Tyrol to improve the local response and coordination of rescue and relief forces in case of events. From the region Aosta come two examples dealing with avalanches. On the one hand the **local avalanche committees** and on the other hand the **glacial risk monitoring plan**.

6.4.1 Intervention Maps

Intervention planning plays a crucial role in integrated natural hazard and risk management. The Civil Protection Agency of the Autonomous Province of Bolzano in South Tyrol, Italy, has created a new instrument to improve emergency preparedness together with the voluntary fire brigades: the *intervention map*. This tool helps the fire brigades to manage the first emergency phase in the immediate aftermath of debris flow or avalanche events.

Motivational background

The Alpine area, located in the heart of Europe, is constantly affected by natural hazard events such as floods, landslides or avalanches. Integrated natural risk management goes beyond mere structural measures to protect settlements and infrastructure. It uses spatial planning instruments, initiatives to raise awareness among the affected population and training to deploy preventive emergency measures. To support preventive emergency planning, an intervention map for water-related hazards and avalanches was developed for the local fire brigades in South Tyrol.

The objectives of intervention maps are to:

- reduce damage to people, goods, the environment and economic activity caused by natural hazards;
- optimise personnel and resource allocation;
- ensure information transfer during the emergency phase;
- support rational decision-making and appropriate situational response;
- improve the safety of the deployment forces.

By analysing the risk and defining potential response measures, the intervention map helps decision-makers to gain extra time and knowledge.¹⁹⁰

Structure of Intervention Maps¹⁹¹

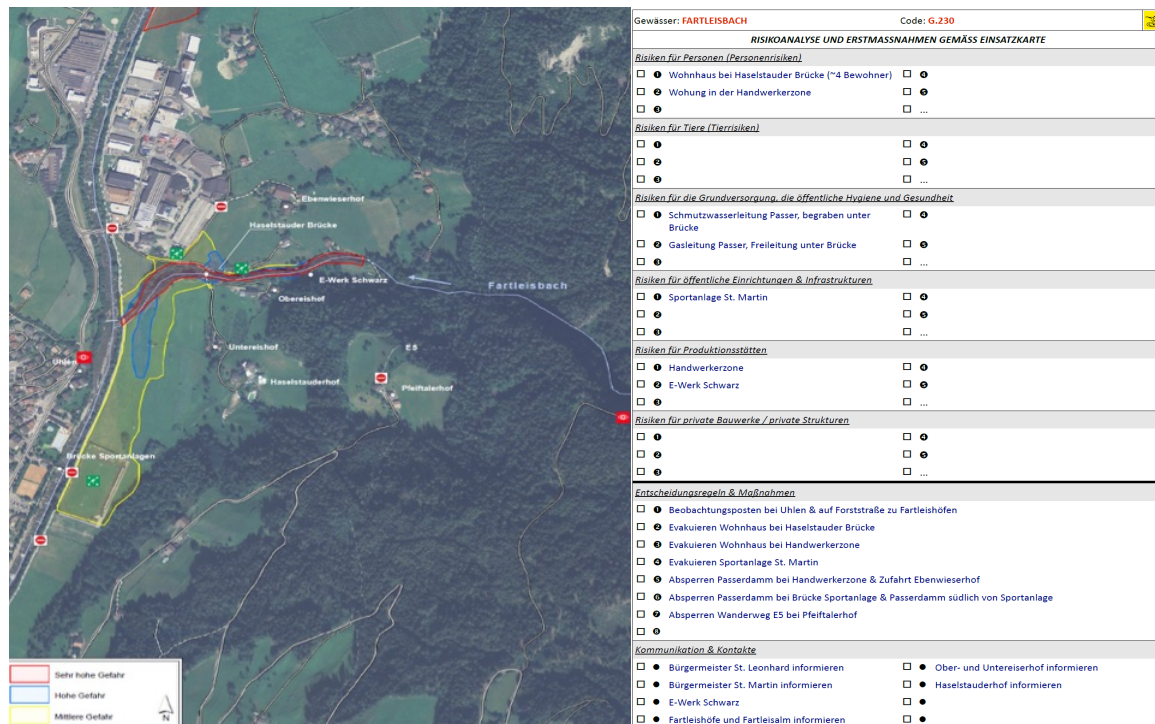
The intervention map is a simple support instrument for the effective management of the operational organisations. It is composed of two interconnected parts: a **cartographic** and a **text component** with a basic risk analysis.

The cartographic component consists of general information about the location, the name of the watercourse or avalanche, information about hazard-prone zones and symbols showing initial measures on an aerial photograph. Event documentation, hazard maps or hazard studies provide realistic and scientifically based data about the development and the dynamics of hazard processes.

¹⁹⁰ GALLMETZER et al., 2016.

¹⁹¹ ESCHGFÄLLER 2012.

Figure 47: Example of an Intervention Map



Source: (Author: Martin Eschgfäller)

The textual component on the back of the map consists of a list of the risks classified into risk categories. This is followed by a section on decision-making procedures and initial measures that need to be implemented in case of an event. The decision-making rules and measures take into account the knowledge of the volunteers in the fire brigades and are ranked according to priority. The final part of the textual component is a list of the bodies and persons to be contacted during an event.

To generate an intervention map, a specific hazard zone is selected. Then, trained personnel (external consultant) accompanies the local fire brigades in the preparation of the maps. The maps are compiled by the local fire brigades. The experience and knowledge of the personnel involved in past events, the local knowledge and the knowledge about the available resources are incorporated into the work. The external consultant provides the fire brigades with the cartographic and textual bases, organises the process and compiles the final products. The intervention map is therefore a product developed at the local level. This increases the quality and the acceptance of the product. At the same time, this instrument also serves for training purposes.

Governance and risk aspects

Intervention maps represent valuable planning tools for fire brigades to effectively deal with field operations in the first emergency phase in the immediate aftermath of occurring debris flow or avalanche events. It also optimises complex interventions in settlement areas with high risk potential. This planning instrument complements the existing planning tools for natural hazard risk management. Using such tools helps to improve the safety of the task forces, to optimise personnel and resource allocation, to enhance the flow of information and to support rational decision-making and the associated situational response in order to reduce damage to people, animals, goods and the environment.

Figure 48: Training exercise of rescue units



Source: Civil Protection Agency, Autonomous Province of Bolzano ©

Intervention maps are based on an informal cooperation with a local voluntary organisation in which the public authority provides expertise and a certain framework. The actual responsibility for organising training and keeping information up to date is at the local level. Intervention maps clearly have a strong risk governance aspect, focusing on risk reduction by improving the local response and involving the voluntary fire brigades.

Table 27: Governance Characteristics – Intervention Maps, IT

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	local	
Organisation	informal cooperation	
Actors	Local fire brigades	with the support of an external expert the fire brigades elaborate the <i>Intervention Map</i>
Problem Perception and goal	improvement of emergency preparedness	deal with field operations in the first emergency phase aftermath of debris flow or avalanche events
Strategies	strategic approach	two-page document that contains a textual part and a map to represent the position and a risk analysis
Instruments	single-instrumental	it sustains the decision-making during the accomplishment of the operation.
Resource and organisation of implementation	voluntary, informal cooperation	elaboration of the intervention map in a participatory way
GOVERNANCE QUALITIES/CAPACITIES		

Extent	single-level, single-actor, involving local fire brigades	
Coherence	consideration of multiple problem perceptions	on the basis of hazard zone maps the intervention maps shows how to manage emergency measures during or after a natural hazard event
Efficiency	reduction of damages during emergency phase	reduction of damages to people, goods, environment and economic activities caused by natural hazard events
Effectiveness	achievement of key aims	support of rational decision making during emergency phase; optimization of personnel and resources allocation, improvement of the security of the deployment forces
Equity	high	elaboration of the intervention map in a participatory way, increasing the quality and acceptance of the product
Legitimacy	informal cooperation	institutionalized if included as a part of the civil protection plan of the municipality

6.4.2 Local Avalanche Risk Management on the Aosta Valley Roads

The Local Avalanche Committees

In the Aosta Valley Region sixty percent of the territory is at altitudes above 2000 metres. In the regional cadastre, 2159 avalanche sites were recorded from 1970 to 2016, affecting a total area covering slightly over 17% of the region. Over the years, the construction of several avalanche shelters has greatly reduced the hazard of avalanche events on roads and on vulnerable assets. However, they are not sufficient to totally control the danger that avalanches pose to these infrastructures. To improve avalanche risk management further, the Autonomous Region of Aosta Valley introduced a system of Local Avalanche Committees (CLV) in 2010.¹⁹²

Principles and priorities

In the last 35-40 years, snow bridges and snow nets have been built in 172 sites together with numerous passive structures, such as deflecting or restraining dams, and 36 tunnels were built to prevent closures caused by avalanches on the national and regional roads (Figure 49). The region is still far from having a complete *structural* protection – which is actually unachievable for technical and economic reasons – but additional *non-structural* measures can be applied to improve protection.

Road closures, evacuations, artificial triggering of avalanches, snow modelling of the deposition area¹⁹³ and *remote-event* controlled traffic lights are some examples. They are, however, very difficult to manage on a large scale by the central avalanche warning service. Therefore, local management is needed in order to increase the effectiveness of the measures. Furthermore, interaction between local management and a regional forecast can make forecasting more effectively and timely, allowing the optimisation of risk management.

¹⁹² RAVDA, 2014.

¹⁹³ SEGOR et al., 2010.

Regional law

Several villages in the Aosta Valley Region are located in remote valleys only accessible by a single road. In the past, it was quite usual for inhabitants to remain isolated for several days because of intense snowfalls and avalanche danger. Nowadays, most of these villages have high numbers of tourists, and the residents need to be able to commute to work or school. The last large-scale critical situation for such villages happened during the 2008-2009 winter season, when almost 200 spontaneous avalanches were registered from 14 to 17 December. They also reached the valley floors, affecting roads and infrastructure, disrupting power and communication lines, and isolating entire villages. To better manage such critical situations in the future, the Regional Council of Aosta Valley passed a regional law in 2010 to establish Local Avalanches Committees (CLV) and to regulate their powers and functions. The council further defined the CLV's operating method including the support of the regional avalanche warning service, the municipalities and the operators of the local ski resorts. It also regulates how to forecast and to evaluate weather conditions and the stability of the snowpack. Furthermore, it defines how to manage surveillance, early warning and possible intervention in risk and emergency situations and how to ensure local control of dangerous situations in the territory of competence based on uniform criteria and methodologies.

Figure 49: Example of deposition area that blocks the tunnel entrance



Source: Region of the Aosta Valley ©

Seventeen CLVs have been set up for part of the municipalities with a high avalanche risk. Each CLV is composed of: one to three mountain-guides, the operational managers of the ski resorts within the area of relevance and the commander of the forest ranger unit having jurisdiction. All of them are trained by the regional avalanche warning service following the professional education guidelines of the AINEVA National Association of Snow and Avalanche Warning Services.¹⁹⁴

¹⁹⁴ Web-Platform CLV: <http://piattaformaclv.regione.vda.it/info>.

The CLVs are advisory bodies which support the Autonomous Region of Aosta Valley, the municipalities and the operators of the ski resorts and aim to ensure the local control of dangerous situations within their territory of competence.

Essential activities established by law to be carried out by the CLVs are:

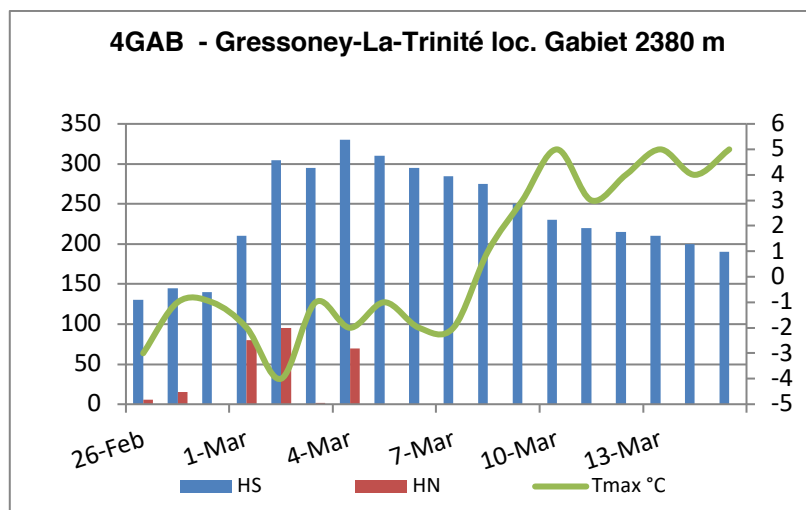
- preparing the avalanche management activity plan (PAV);
- obtaining data and information related to the avalanche danger and its likely development;
- providing, on request, technical advice about the avalanche danger in the territory of competence and its likely development;
- supporting the activities of the mayors for the adoption of any measures and initiatives to be taken in relation to a critical state;
- cooperating in emergency management with the municipal operations centre and the joint operations centre as well as the coordination of relief efforts.

Example of critical situation managed by CLV between march 1 and 16 March 2014

On 1 March 2014, there was a snowfall of 50-80 centimetres at an altitude of 2,000 metres in mid Gressoney Valley and Val d'Ayas. These snowfalls, associated with moderate winds, formed new drifts at altitudes above 2,000 metres, further overloading the slopes. The regional snow and avalanche bulletin for 1 and 2 March quoted a high danger level of 4 for the Gressoney, Ayas and Champorcher valleys and for the high parts of Valtournenche. On 1 March, the Regional Gressoney Valley road was closed, and on 2 March three avalanches went off.

During the night of 3 to 4 March, 70 centimetres of additional fresh snow fell in the lower part of the valley. On 4 March, at the end of the bad-weather period and for the first time during the winter, the temperature began to rise progressively and steadily. This continued throughout the following days. In particular, the maximum temperatures at 2,300 metres from 8 to 16 March exceeded the +5°C mark (see Figure 51). As a consequence of the rising temperature, there were numerous avalanches, some reaching the floor of the valleys.

Figure 50: Snow level data and maximum temperatures from February 26th to March 15th in Gressoney Valley



Source: Region of the Aosta Valley ©

The closure of the Gressoney Valley regional road in conjunction with the heavy snowfalls on 1 and 2 March turned out to be an adequate and timely precautionary measure. The hazard in this case, proved by the events, was high, and the economic loss was relatively limited. However, the risk connected to the increase in temperature was underestimated. The CLV should have closed the road from 8 March until the most important events had taken place, given that the temperature did not fall again until 16 March. In retrospect, one could have reasonably considered a closure of at least three days (Saturday 8, Sunday 9, and Monday 10), but in this case, the economic loss would have been high.¹⁹⁵

Local evaluation allows to optimise the road closing times and thus reduce the disadvantages for the population as well as economic losses. This requires thorough knowledge of the territory and an ever-greater interaction with the regional administration to handle the forecasting.

Governance aspects of local avalanche risk management

The CLVs have several advantages for local avalanche risk management. They can provide:

- adequate monitoring in several areas of the region;
- prompt action before and after the events;
- enhance local knowledge based on past events.

To effectively manage CLV activities during forecasting, in times of avalanche danger and when an actual event occurs, a homogeneous instrument for storage, transparency, accountability and traceability is necessary. Such a tool was developed within the *Start-It-Up* Alpine Space project.

The newly established CLVs strongly rely on local knowledge of the people living and working in relevant areas. The regions' role is mainly to provide data and tools, but actual risk assessment and decision-making happens within the CLVs. This local focus helps to be flexible for site visits and integrates information provided by locals. The CLV system can therefore be considered a successful avalanche risk management practice with a clear risk governance approach.

¹⁹⁵ SEGOR et al., 2014.

Table 28: Governance Characteristics – Local Avalanche Committees, IT

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	local to regional	binding regional evaluation of danger level to local evaluation
Organisation	institutional establishment	
Actors	regional administration; municipalities, avalanche committees	mainly official authorities; local people
Problem Perception and goal	preventive measures, risk reduction, securing retention areas	clear goal in the local evaluation to reduce risk
Strategies	short to long-term effects, strategic approach, ad-hoc solution(s)	scenario of risk, data base
Instruments	single instrumental	
Resource and organisation of implementation	financing for implementation by the region/state	
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, involving local people	wide extent, addressing mainly local actors
Coherence	consideration of multiple problem perceptions; multiple actor responsibilities in implementation	
Efficiency	cost-benefit analysis	preliminary analysis exists
Effectiveness	achievement of key aims	trend positive, contemporary multi-actions
Equity	high level of equity	
Legitimacy	institutionalised, legal degree; transparency	

6.4.3 Local Management of Glacial Risks in Aosta Valley Region

The regional glacial risk monitoring plan

The Region of the Aosta Valley, situated in the far north-western part of Italy, borders with Switzerland and France in the North and West. Four percent of Aosta Valley territory is covered by glaciers. The regional glacier inventory counts 209 existing glaciers. Because of its high Alpine environment and special geomorphology, the Aosta Valley population is highly exposed to risks related to glaciers. In 2003 the government of the Autonomous Region of Aosta Valley therefore founded the *Fondazione Montagna Sicura* (FMS) organisation. The organization deals with all aspects of risk mitigation regarding avalanche and glacial risks, from vulgarisation and communication to risk mapping and management.

Introduction on glacial risks

Glacial risks are well known in mountainous regions around the world. Different dynamics and phenomena are involved. The worst disaster related to glacial hazards ever documented happened in 1970 in Peru, where 20,000 people died in an avalanche triggered by the fall of a massive serac on Mount Huascaran. The Alps also have had major catastrophic events,

such as the Tête Rousse glacial lake outburst in 1892 causing 175 fatalities and the Allalin glacier tongue destabilization in 1965 causing the death of 88 people. Glacial risk can be principally summarized in serac fall, destabilization of glacier tongues, glacial lake outbursts and rock-ice avalanches.

The Aosta Valley Region has historically been subjected to all of these types of glacial risks and is facing a continuous evolution of these risks because of the current climate.¹⁹⁶

The monitoring plan

Because many different potentially hazardous glaciers are located in the surroundings of populated areas or near major infrastructure, the Autonomous Region of Aosta Valley has devised a regional glacial risk monitoring plan together with the FMS.

The monitoring plan is primarily based on the GIS database of the glaciers of Aosta Valley. A series of potentially hazardous glaciers has been identified in a study of historical glacial hazardous events. Part of this study was carried out on the entire Alpine territory, thanks to the **Glaciorisk project**. The database has been completed with additional local research and is updated annually. Every year, local stakeholders such as Alpine guides and refuge owners report new glacial lakes, serac falls and other hazardous events. FMS then has the responsibility to verify the risk level of these events. At the end of every summer, technicians from the FMS glacier office perform a helicopter flight with a precise flight plan covering all of the 209 Glaciers of the region. During the flight, photographs of all Aosta Valley glaciers are taken. This gives them an overview of the regional risk situation.

Every potentially hazardous glacier has a detailed folder linked to the GIS database containing historical material, updated photographs etc. Whenever any of the existing or new potential risk situations seem to require further investigation, field surveys take place, and the respective phenomena can start to be monitored in precise spots. The population is encouraged to report any relevant observations. As of now, the GIS database contains 26 potentially hazardous glaciers. On three of them, special monitoring actions have been activated (Whymper Serac/Gran Jorasses, Planpincieux Glacier tongue, and the Brenva glacier and rock face).¹⁹⁷

¹⁹⁶ Web-Platform Glacier inventory of Aosta Valley, Online: <http://www.catastoghiacciai.partout.it>.

¹⁹⁷ FAILLETTAZ et al., 2015.

Figure 51: Example of deposition of debris on a regional road caused by the outburst of a water pocket of Rochefort glacier



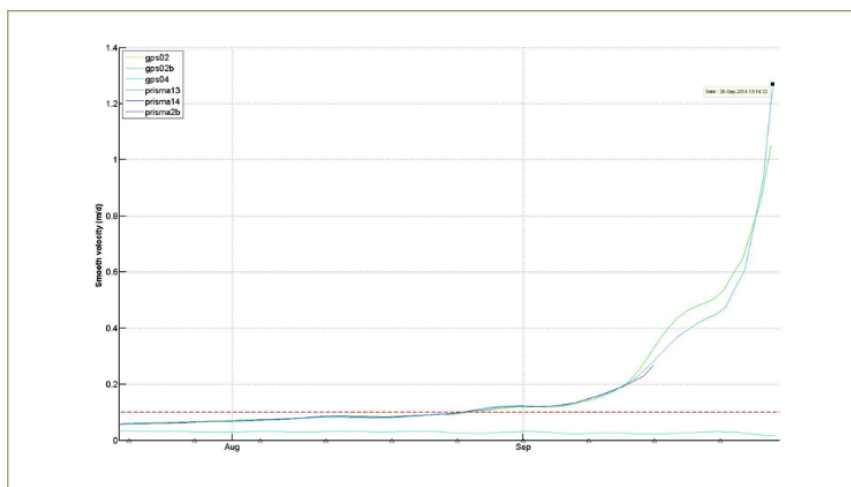
Source: Autonomous Region of Aosta Valley ©

Example of critical situation managed on Grandes Jorasses in September 2014

During August 2014, the monitoring systems of the Whymper Serac on the Grandes Jorasses registered an acceleration of the unstable mass of ice towards the critical threshold of 10 cm/day of slope motion. FMS informed an expert consultant from the ETH Zurich, who confirmed the high level of risk of the situation. The geological survey office of the Autonomous Region of Aosta Valley and the civil protection authority (*Protezione Civile*) were alerted. Authorities decided to prohibit the access for climbers and hikers to all trails and climbing routes on the Italian side of Grandes Jorasses on the 16 of September. Authorities, upon advice of experts, decided not to evacuate the village of Planpincieux. This decision was based on an existing study that included a numerical modelling of the serac fall and ice-avalanche propagation. The fall of the serac was predicted exactly ten days in advance, to happen on 23 September. On that day, 50,000 cubic meters of ice fell from the serac but neither reached the valley floor nor the village of Planpincieux, exactly as predicted by the models. A second fall of 50,000 cubic meters happened six days after.¹⁹⁸

¹⁹⁸ MARGRETH et al., 2011.

Figure 52: Velocities of the Grandes Jorasses serac in August and September 2014



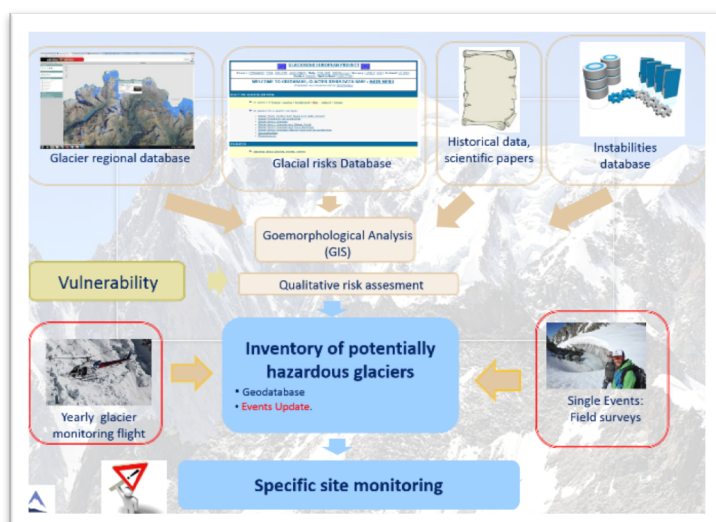
Source: Montagna Sicura Foundation ©

Governance aspects to the monitoring plan

As shown in the example above, support for decision-makers came from the tool developed by FMS together with a safety concept by the Davos Institute for Snow and Avalanche Research (SLF). Numerical modelling of the ice-avalanche phenomenon was linked to the existing vulnerable elements and portrayed in hazard maps. Appropriate safety measures to be taken for different scenarios were defined based on different estimated volumes of ice break-off. This clearly shows the risk dimension in the decision-making process on whether to evacuate villages or close roads.

During emergency situations, the FMS works in close cooperation with the authorities of the Autonomous Region of Aosta Valley for the monitoring of the phenomena. Together, they provide data to the civil protection organization, which arranges evacuations or citizen assistance. Public information is mainly provided by involved or affected municipalities, and FMS enhances the scope of the municipality communication via its official website and its Facebook page.

Figure 53: Scheme of the monitoring plan organization



Source: Montagna Sicura Foundation ©

Table 29: Governance Characteristics – Glacial Risk Monitoring Plan

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	regional	
Organisation	institutional establishment	yearly convention
Actors	regional administration; municipalities, Mountain Safety Foundation, expert consultants	
Problem Perception and goal	preventive measures, risk reduction	clear goal in the regional evaluation to reduce risk
Strategies	strategic approach, ad-hoc solutions, specific monitoring	scenario of risk, data base
Instruments	Single-instrumental (experimental backups)	
Resource and organisation of implementation	financing for implementation.	
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, involving local people	wide extent, addressing mainly local actors
Coherence	consideration of multiple problem perceptions; multiple actor responsibilities in implementation	
Efficiency	cost-benefit analysis	preliminary analysis
Effectiveness	achievement of key aims	contemporary multi-actions
Equity	High-level of equity	
Legitimacy	institutionalised	

6.5 Liechtenstein

Liechtenstein provided one good practice example, that shows that the **handling of protection structures** makes a **substantial difference** on the effectiveness in case of events. Therefore, contingency plans have been developed which rely strongly on local capacity building and training and represent an important aspect of risk governance when it comes to taking over responsibility on different levels.

6.5.1 Contingency plans for torrents

Know-how transfer and capacity building with local forces

In Liechtenstein, preventive measures against natural hazards use probabilities as a basis for calculations as well as decision-making. However, events can be bigger than the profile of a torrent or the dimension of a structural measure was designed for. Contingency plans are an appropriate instrument to transfer the knowledge of those limitations to the local forces. Accordingly, the existence of a contingency plan describing each torrent as well as the function, handling and limitation of each technical structure is eminent. To fulfil this target, the developed contingency plan system describes the functions of the torrents and their structures depending on the size of the event. To guarantee an effective use by the local forces, an easy, understandable and applicable plan is compulsory. The Liechtenstein contingency plan programme also includes instructions for application as well as the establishment of special local water brigades.

Principles and Priorities

There are three main aspects to be analysed as a basis for contingency plans: First, the knowledge about the possible effect of an extraordinary event is crucial. Therefore, all contingency plans must be based on accurate hazard maps of the relevant processes, which not only show event sizes up to a 100-year event, but also extreme events (1.000-year event). Second, the function, limitation and handling of each structure have to be known and described, especially for the case of an overload. Once these aspects are in place, the third aspect comes into play: this is the circulation of the content of the contingency plans to the responsible people in the local communities. As past events have shown, the lack of knowledge is not only caused by missing contingency plans, but also by the missing awareness of those plans. To guarantee stable knowledge, each municipality established a water brigade that takes the lead in all events caused by torrents or landslides. The brigade is usually headed by the local forester, whose daily work assures the necessary know-how about the catchment area and the existing structures in the torrents. Additionally, each municipality is divided into different sections, each with its own person in charge.

Key factor: Capacity building

The water brigade programme was established after the 2005 event, when various substantial damages occurred to settlements and infrastructure. An analysis showed that a lack of the missing know-how about the function and handling of the preventive structures was responsible for the inadequate hazard response. It also revealed that the training of the fire brigades alone could not guarantee expertise since the fire brigade operates based on a generalist mode. After the water brigades were established, their specialized training started on the basis of the hazard maps. The contingency plans were implemented with their detailed

description of each major structure. All this was to fulfil the aim of minimizing damages caused by potential inadequate or ineffective actions.

Figure 54: Detailed overview of the different technical structures in a torrent (Office for Civil Protection ©)



Office for Civil Protection ©

Table 30: Detailed measure for each structure or element for different phases during an event

Scenario	System Element	Condition	Measure	Phase
HQ 30 <u>water:</u> 8.0 m ³ /s <u>bed load:</u> 2'000-3'000 m ³	1 gravel trap	✓ ok (bed load deposition) ? danger of clogging	gravel trap: none Monitoring screen, spillway and culvert Organizing log grapple	yellow
	2 mud trap	!! clogging	Cleaning screen with log grapple	
	3 relief structure	✓ ok	none	
HQ 100 <u>water:</u> 12.0 m ³ /s <u>bed load:</u> 3'000-10'000 m ³	1 gravel trap	✓ ok (bed load deposition) !! clogging	gravel trap: none Cleaning screen, spillway and culvert with log grapple,	orange
	2 mud trap	!! clogging	Cleaning screen with log grapple	
	3 relief structure	? danger of clogging	Monitoring of relief structure: Removing logs	
HQ 300 <u>water:</u> 15.0 m ³ /s <u>bed load:</u> ≥15'000 m ³	1 gravel trap	✓ ok (bed load deposition) !! clogging	gravel trap: none Cleaning screen, spillway and culvert with log grapple,	red
	2 mud trap	!! clogging / overloaded	Cleaning screen with log grapple	
	3 relief structure	? danger of clogging	Monitoring of relief structure: Removing logs	
EHQ	1-3 all	analogue HQ 300 water 25 m ³ /s, bed load ?	analogue HQ 300	

Source: Office for Civil Protection ©

The contingency programme is led by the Office for Civil Protection. In cooperation with the local forester and the fire brigades, it was easy to convince the local authorities of this necessary shift in torrent management. Once introduced, the system can only be sustained if the local responsible persons are willing to keep the contingency plans updated and have

regularly trainings. The example in Figure 54 and Table 30 shows the necessary measures depending on the actual phase and condition of each element of the structure. The scenarios are specified during the hazard mapping process. The functions and limits of particular elements are known from existing structures. So, the main task is to bring all this information together into an easily readable paper that can be easily used during an event also by non-professionals.

Governance and risk governance aspects

The programme's goal was to reduce damages caused by big events or by unforeseen processes through contingency plans. Governance was not an issue initially. However, an effective contingency programme requires an active and ongoing collaboration between actors on the national and local level. Different stakeholders at different levels, from the federal state to the municipal level, as well as certain local actors need to be involved in the process. Although there is a legal basis that defines federal and local responsibilities in case of an event, the newly established water brigade system is rather informal. Knowledge transfer and capacity building ensure coherence for all involved levels and actors.

Table 31: Governance Characteristics – Contingency Plans, FL

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	national to local level	national know-how transferred to local forces
Organisation	institutional establishment and informal cooperation	legal base but in detail informal cooperation
Actors	federal state, municipalities, local people	federal state as leader, local people involved in application
Problem Perception and goal	preventive measures, risk reduction	risk reduction is core idea, managing residual risks
Strategies	long term effects, strategic approach	
Instruments	single instrumental	
Resource and organisation of implementation	no separate financing for implementation, voluntary cooperation, formal and informal organisation of the process	Responsibility for managing local hazards is by the local authorities. Offered solution is informal
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, within state authorities, involving local people	wide extent, involving certain local people
Coherence	multiple actor responsibilities in implementation	
Efficiency	resource input and outcome,	positive cost-benefit, no evaluation done
Effectiveness	achievement of key aims	positive trend in reducing residual risk
Equity	mechanisms for compensation (efforts, costs etc.)	no compensation for updates, compensation for local people involved
Legitimacy	legal basis, transparent	

6.6 Slovenia

A large landslide and debris flow event in north-western Slovenia triggered interesting **integrative processes to mitigate the hazard damages and to build back better**. The examples of Stovže landslide and Predelica torrent debris flow represent a certain change and turning point in the Slovenian hazard management discussion also towards risk governance. A second example from Slovenia presents the latest developments in hazard and risk mapping in connection with the European Flood Directive.

6.6.1 Mitigation of large landslides and debris flows in Slovenia

Examples of Stovže landslide and Predelica torrent debris flow

In the last decades, the Slovenian National Assembly adopted a series of legal acts that provide the (financial) resources for the mitigation of large landslides and debris flow events. The main incentive for the new legislation were the damages caused by the Stovže landslide in the municipality of Bovec and other large-scale landslides in autumn 2000. Following the relief and repair measures, detailed regulations for zoning and real estate development in the affected area of Log Pod Mangartom were adopted. Buildings were constructed to allow the evacuated inhabitants to return. This special case is an example of a successful reaction to a large-scale catastrophe in a multi-sector and multi-disciplinary approach. It involved many actors as well as formal and informal solutions in the four phases of risk management – response, recovery, preparedness and prevention.

Principles and priorities

For mitigating the impact of large landslides, the Slovenian National Assembly adopted a law for landslides triggered by heavy rainfalls. According to the Public Finance Act and the Financing of Municipalities Act, financial resources for disaster mitigation are a shared financial responsibility of the state as well as the municipalities. 1,5% of the general annual budget is dedicated as a reserve for occurring disasters. In case of an event, the first step is an estimation of the direct damage (done by Ministry of Defence). For the state financial funds to be activated, the estimation of mitigation costs for all landslides triggered within a period of 90 days must be at least 0.3% of the annual budget of the Republic of Slovenia. Implementation of the reconstruction is coordinating by the Natural Disaster Reduction Division in the Ministry of the Environment and Spatial Planning. The ministry provides beneficiaries/victims counselling, assistance in planning, designing and financial and construction supervision in the reconstruction. The municipalities are in charge of the reconstruction of public infrastructure facilities of local importance.

Geo-hazards in Slovenia¹⁹⁹

The territory of Slovenia is characterised by high geological and tectonic complexity. The principal geologic feature of Slovenia is its very diverse lithology, which is mainly composed of sediments or sedimentary rock. Approximately one third of the land and 20% of its inhabitants are highly exposed to mass movements due to morphological, geological and tectonic conditions. In general terms, slope movements occur in almost all parts of the country. In recent years, intense rainfall events caused numerous shallow landslides, which represent one of the predominant types of mass movements in Slovenia. Although landslides are a local

¹⁹⁹ MIKOŠ and MAJES, 2010, p. 105-131.

phenomenon, the 15-year average landslide damage represents 7.6% of total damages due to disasters in Slovenia. In the past 15 years, over ten people were killed in landslide events.²⁰⁰

For this reason, effective risk reduction strategies in risk management for landslides and debris flows are crucial in Slovenia. Effective protection against landslides means developing settlements outside hazard-prone areas. This can only be achieved by the joint efforts of experts and responsible authorities. Nevertheless, prevention through risk and hazard-sensitive land-use planning is an appropriate and effective prevention strategy. As a general basis for such decisions, geohazards are assessed and depicted in maps. One such map is the landslide susceptibility map and another one the debris-flow susceptibility map of Slovenia, both on the scale of 1:250.000.

Despite the developed methodologies, geohazard assessment is still rarely used in spatial planning on the local level, mainly due to the lack of adequate landslide protection legislation. The relevant legal act is the 2002 Waters Act that foresees several legislation documents to be accepted by the ministry in charge for water management in Slovenia. Thanks to the European Floods Directive, procedures have already been regulated in the field of flood management but still have to be regulated in the field of other water-related natural hazards and geohazards, such as landslides, rockfall and debris flow. In all recent national regulations, prevention is prioritized over intervention during natural disasters. However, how to act during and after hazardous events is more precisely defined than how to prevent them.²⁰¹

Disaster Management of Landslide Stovže and Predelica Torrent Debris Flow in 2000

On 17 November 2000, the village of Log Pod Mangartom, Bovec municipality, was hit by a debris flow of the magnitude of 1.2 million m³. The Stovže landslide, which reached the valley in the form of debris flow, destroyed the torrential beds of Mangartski Potok and Predelica as well as a part of the Log Pod Mangartom village. Seven people lost their lives during the event. The inhabitants of the village were evacuated. In total, six houses and seven farm buildings were destroyed. Eleven houses and one farm building were damaged. Two bridges on the state road to Italy were destroyed. Two small hydropower plants were damaged. The total damage amounted to 36 million euros.

Warnings by the Administration for Civil Protection and Disaster Relief were passed to the competent authorities, the rescue services and the public. The local disaster management system was activated. The whole village was evacuated to Bovec, two ad-hoc teams of experts were formed, and a 24-hour observation of the landslide area together with a special mobile public alerting system were put in place. The Civil Protection Headquarters adopted emergency measures: observation of the entire area affected by the landslide and the debris flow; immediate landslide consolidation measures; urgent torrent control measures; reestablishment of the road connections; assurance of the basic living conditions and economy in the affected area; necessary corrections in spatial planning. The local fire brigade units were activated: rescue, transportation and supply for affected people; observation of the torrents and landslide; care for the property and animals left in the village; informing the evacuated inhabitants about the situation in the village.

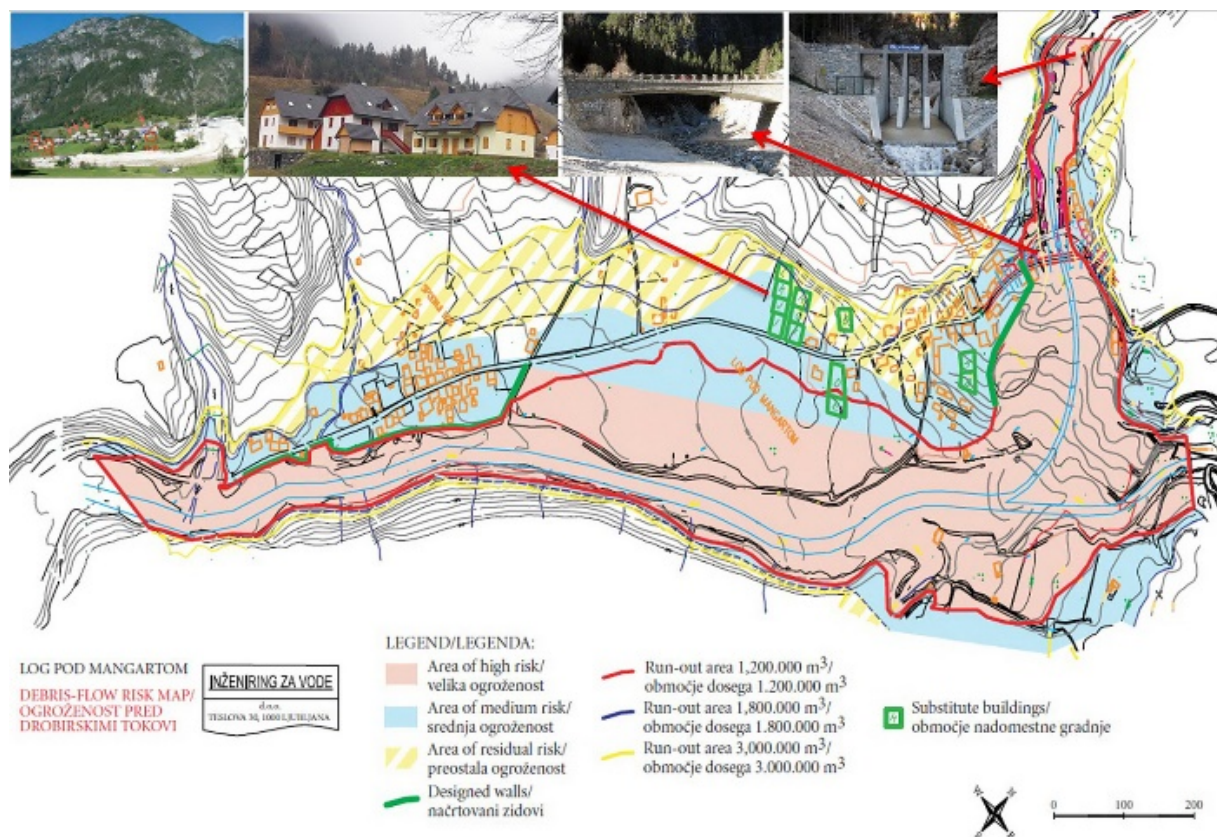
The intervention of civil protection units during the event and in the following days and weeks was immediately followed by the reconstruction of the devastated area. The area of Log Pod

²⁰⁰ MIKOŠ et al. 2014.

²⁰¹ MIKOŠ et al. 2014.

Mangartom, though, remained threatened by possible new debris flows from the Stože slope above the Mangart mountain pasture. Therefore, limitations for the reconstruction in the debris-flow risk area of the village were necessary. A special decree was issued by the Slovenian government. This regulation was the first of its kind in the field of spatial planning in Slovenia and has been serving as a valuable basis for successful risk mitigation. An expert group prepared a debris flow hazard and risk map (Figure 55) of Log Pod Mangartom with run-out areas of debris flows shown and a classification into three risk areas (high, medium, low/residual). The third category was the basis for the location of new buildings during reconstruction. At the moment, 15 new buildings have been built and all inhabitants of Log Pod Mangartom have moved back to the village.

Figure 55: Debris-flow risk map with location of substitutional buildings (green) and some recovery and prevention measures²⁰²



Governance and risk governance aspects

The experiences gathered during the Stovže landslide event and the Predelica torrent debris flow, as well as the flowing legal regulations, served as starting point for handling other large landslide disasters in the last few years and have had an important influence on today's approach on how to mitigate landslides. Despite the existing regulatory framework, there are no standard solutions. Problems need to be addressed and solved case by case. Concerning risk governance, the Slovenian way of handling landslide and debris flow events shows how important the inclusion of all phases in risk management are and what role risk could have. Many different stakeholders (authorities, NGOs, the general public) were involved in actual rescue and relief actions, the recovery phase and the decision on future prevention strategies, in particular regarding planning issues. The described event was a trigger for extensive

²⁰² MIKOŠ, 2007.

discussions that resulted in the formulation and adoption of comprehensive regulations, legal acts and better coordination between municipalities and the state administration.

Table 32: Governance Characteristics – Case Study Logpod Mangartom, SL

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	National to local level with high degree of cooperation in problem solving approach and legal adjustment	binding legal act on state level; local land use planning has to obey rules
Organisation	strong institutional establishment	legal decree supervised by Ministry of the Environment and Spatial Planning
Actors	state, municipalities, ministries, civil protection units, water management operational units, local firefighters units, local people, different expert (faculty, private ...)	mainly official authorities; local people via special interest groups (coordinative body of the village with main representative)
Problem Perception and goal	disaster driven, preventive measures, risk reduction, land use management, monitoring remaining hazard	clear goal in the formulation process; risk reduction is the core idea
Strategies	Quick and effective rescue, help and protection measures, ad-hoc expert solution(s), long term/short term effects, strategic approach,	Constant attention on adequate direct communication with local population; competent media cover
Instruments	multi-instrumental	
Resource and organisation of implementation	Mainly state financing of implementation; besides well-functioning mandatory cooperation also important voluntary cooperation.	all stakeholders took voluntarily part in the formulation of short-medium-long term solutions
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, within state authorities, involving local people and official local representative	Local to regional extend, if is affected more local communities
Coherence	consideration of multiple problem perceptions, multiple actor responsibilities in implementation	addressing all relevant actors for settlement development
Efficiency	evaluation of program/project, final state approval	After intervention phase come time-consuming procedures
Effectiveness	achievement of key aims; still some has to be done	evaluation is for now positive
Equity	high level of equity	
Legitimacy	institutionalised, relevant legal basis, transparent	

6.6.2 Flood hazard and risk mapping in Slovenia

A fundamental basis for national and local flood risk reduction

The European Floods Directive constitutes an important improvement for the reduction of flood risks, introducing the principle of flood risk management on a supranational level. The provisions of the directive were transposed into Slovenian national law by adopting amendments to the Water Act as well as decrees on the establishment of flood-risk management plans and on the conditions and limitations for construction and activities in flood-risk areas. Together with the methodological rules defining flood risk and flood-related erosion areas in 2007, these regulations form an effective legal framework in Slovenia to prevent an increase in damage potential in flood risk areas. For the purposes of flood hazard mapping, 10-year floods (high probability scenario), 100-year floods (medium probability scenario) and 500-year floods (low probability scenario) were chosen for the classification. All Slovenian flood hazard and flood risk maps are publicly accessible and downloadable via the *eWater* web portal or the Slovenian Water Management Atlas. Publicly available maps have an important role in local awareness raising and informing affected people about hazard zones and risks.

Principles and priorities

Preventive flood risk management creates retention areas to reduce damage potential and flood extent. It also limits construction in flood-prone areas and thus avoids additional damage potential. Since 2008, Slovenia has been achieving this through legal restrictions for public or private investments by limiting different types of construction activities in flood risk areas. The legal decree on the conditions and limitations for construction and activities in flood risk areas presumes that, in case of changed hydrological conditions, compensatory measures must be provided to maintain the retention capacity and not to worsen the hydrological situation downstream.

This legal approach has been applied in municipal planning. Therefore, required spatial data is continuously provided by hydrologic and hydraulic studies conducted by investors in line with the Floods Directive as well as national legislation. The state and the municipalities, as well as private investors are obliged to map the flood hazard classes when preparing spatial planning documents or projects for obtaining water and building permits if the area of interest is located in a floodplain.

Flood hazard and risk maps are an important basis for the Flood Risk Management Plan for Slovenia, which addresses the flood risk in 61 areas with potentially significant flood risk. Slovenia's flood risk management plan therefore includes 17 detailed plans which are logically (inter)connected and include a detailed identification and prioritisation of the necessary flood protection measures that have already been going on or still have to be implemented. The flood protection measures were chosen from Slovenia's catalogue of flood protection measures, which consists of 20 such measures. Furthermore, the flood protection measures are divided into flood protection projects.²⁰³

The first version of the National Disaster Risk Assessment drafted in 2015 presents and evaluates the risks for 12 disasters and shows that floods represent the highest risk in the Republic of Slovenia. The combination of the significance of the impacts and the likelihood of a disaster means that floods have the highest level of risk. These findings stress how important

²⁰³ ŠTRAUS, 2015.

it is to seize all opportunities to properly manage flood risk and to reduce the flood damage. Slovenia has had approximately 100-150 million euros of annual flood-related damages in the last 25 years. Flood hazard and risk maps already contribute to more effective preparedness and response phases, as well as a more effective prevention phase.

Lessons learned from 2007-2017 period

In Slovenia, decisions on whether and how to allow construction are based on studies. Prior to 2007, Slovenia had no official methodology on how to prepare flood hazard or risk maps. In the 2008-2015 period, over 300 hydrologic and/or hydraulic studies on modelling water depth and speed were made and certified for more than 1,000 km² of valid result areas. Data from studies are collected in polygon data layers and published in the environmental atlas for Q10, Q100 and Q500, four hazard classes, and three water depth classes for Q100.²⁰⁴

Figure 56: Publicly available flood hazard maps²⁰⁵



Regulations define the methods and criteria for the classification of land into flood and erosion risk classes. They determine which spatial interventions are permitted or prohibited depending on the corresponding hazard classes in flood-prone areas.

Protection against the adverse effects of water in risk areas should be provided by state and local authorities. The state is basically responsible for the protection of people, the environment, economic activities and cultural heritage. In periods of increased risk it should ensure the implementation of emergency measures. Landowners in landslide-prone areas are limited in their property owners' rights and are not allowed to freely intervene in such risk areas. The Waters Act defines the conditions under which landowners may intervene in the risk areas, but the detailed conditions and restrictions are defined by the government in a permit. Such a permit is also issued for interventions in risk areas and must precede building permits.

The municipal spatial plans (MSP) govern spatial arrangements of local importance and define land use requirements and conditions for where objects can be placed, i.e. the so-called spatial implementation conditions (SIC) for both the entire territory of the municipality and specifically

²⁰⁴ Online: gis.arso.gov.si/atlasokolja/.

²⁰⁵ eWater web portal, Online: <http://evode.arso.gov.si/>.

for each individual planning unit. However, those plans have not been produced yet because no regional administrative units have been formally established. At present, only the MSPs are valid for building procedures. The SICs are determined on the basis of development policy and land use and also determine, inter alia, measures to protect people and property from natural disasters. Flood, erosion and fire safety are addressed separately.²⁰⁶

Development on floodplains is commonly in the interest of national and social progress and has to be enabled to some extent. However, these areas need to be managed wisely and require adequate spatial planning that relies on flood hazard maps. Regulation of land use is most effective when it is directed at future development and includes residential development, commercial development and public infrastructure development. It is important that adequate non-structural measures for managing residual risk are provided. This set of measures requires careful planning and regular reviewing of plans to ensure preparedness and swift mobilization of planned actions during flood emergencies. Adequate precautions can reduce vulnerability to floods if applied prior to flooding.²⁰⁷

Governance and risk governance aspects

In the wake of the European Floods Directive, the procedures for flood hazard mapping were successfully regulated in Slovenia. The 2007-2008 flood hazard mapping legislation creates the preconditions for more effective and sustainable flood protection in Slovenia. Publicly available flood hazard maps have proven to be a useful starting point for public discussion and increased flood risk awareness. They are also useful for the participatory process, provide indispensable input in spatial planning, and serve as a basic platform for integrated flood risk management. Flood hazard maps help residents and users to better understand risks. They show that even after the implementation of structural measures, hazard zones may have been reduced but never fully eliminated. Hence, a residual risk remains.

The major goals of the above-mentioned rules and decree are the establishment of clear binding terms to protect unsettled flood-prone areas with significant flood retention capacity and to ensure proper spatial planning of adequate compensation measures. Experiences from the last ten years have shown that the evaluation and definition of an optimal set of flood protection measures (structural and non-structural) is a complex risk governance process that demands active involvement of all stakeholders on a local and state level.

On the whole, flood hazard and risk mapping in Slovenia proves to be a key aspect for a more active and effective bottom-up approach to risk reduction at a local as well as national level. Good practice examples from proactive communities encourage others to change their behaviour from not only expressing requests to the state, but instead doing as much as possible already on the local level. The knowledge about hazard and risk zones clearly raises awareness and sensitivity on the municipal level. This makes mapping an integrated and important part of risk governance processes.

²⁰⁶ MIKOŠ et al. 2014.

²⁰⁷ BABIČ-MLADENOVIC, 2015.

Table 33: Governance Characteristics – Hazard Mapping, SL

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	national to local level with high degree of cooperation in problem solving approach and legal adjustment	binding legal act on state level; local land use planning has to obey rules and maps
Organisation	strong institutional establishment; maps ordered by private investor have to respect the same rules	legal decree supervised by Ministry of the Environment and Spatial Planning
Actors	state, municipalities, ministries, water management operational units, NGOs; special interest groups; spatial planners; included aspects of public participation and consultation	mainly official local and state authorities; local people via special interest groups; active balancing interests with facts and possibilities,
Problem Perception and goal	land use management, preventive measure for risk reduction; securing retention areas,	limiting of additional damage potential on flood areas; awareness raising, prevention
Strategies	short-mid to long term effects; strategic and systematic approach in land use planning	Flood risk awareness, direct communication with people at risk d
Instruments	single-instrumental	introducing cost-benefits analyses
Resource and organisation of implementation	State and local communities financing of realisation of maps & implementation of flood protection measures; maps for 61 APSDR areas are financed by the state	maps are mainly produced by private expert consulting companies
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, within state authorities, involving local people and official local representative	Local to regional extend, if it is affected more local communities
Coherence	consideration of multiple problem perceptions, multiple actor responsibilities in implementation	addressing all relevant actors for settlement development
Efficiency	evaluation of maps and programs/project, final state (Water agency) approval and cooperation in using	legal obligatory consequences of flood hazard classes via case by case approach
Effectiveness	achievement of key aims; still some has to be done	evaluation is positive, costs decline
Equity	high level of equity	Free LIDAR data for whole territory of SI
Legitimacy	institutionalised, relevant legal basis, transparent, publicly available	involvement of informal and innovative approach with state coordination

6.7 Switzerland

Switzerland is well known for its comprehensive commitment in the field of hazard management profound research and the establishment of new approaches. The two provided good practice examples therefore present very current aspects. The OWARNA project aims to **optimise the warning, alerting and intervention in civil protection** and disaster management. The example of Engelberger Aa shows how **areas** can be **kept undeveloped for a long time and reserved for extreme events**.

6.7.1 The OWARNA Project

Reduction of natural hazard damage through optimised warning, alerting and intervention in Switzerland

With the aim of protecting the population more effectively against natural hazards, the Swiss Federal Council initiated a project to optimise warnings and alerts in the event of natural hazards, known as the Optimisation of early warning and alerting of natural hazards project (OWARNA)²⁰⁸. OWARNA has enabled the implementation of measures for improving the quality and availability of flood forecasts, for strengthening and standardising cooperation at the federal level, for providing better information to local authorities and to the public, and for training local natural hazard advisors. The significant progress achieved by this project has led to a well-functioning warning system. Future challenges include establishing crisis-proof forecast and warning systems as well as increasing the willingness of the population to respond to warnings appropriately. To meet these challenges, the authorities and the population will essentially need to understand the potential impacts of natural hazards better.

Introduction

The flood events of 2005 caused over three billion Swiss Francs in economic losses in Switzerland. An event analysis has shown that damage could have been reduced by approximately 20 percent through appropriate warning and intervention. Following the events, the Swiss government commissioned a report on how to optimise preventive protection measures, warnings and alerts for natural hazards. The Steering Committee for the Intervention on Natural Hazards (LAINAT) was established with the mission of improving the coordination between the federal authorities and establishing efficient intervention strategies.

Priorities

Following the conclusions of the report commissioned by the Swiss government, a set of measures was passed with a view to improving warnings and alerts in the event of natural hazards.²⁰⁹ The aims of these measures were to:

(1) Improve the forecast system

This measure included the extension and updating of the existing precipitation radar network, the extension of the automatic ground measurements network, the improvement of weather and flood forecasts, and the implementation of higher-resolution thunderstorm warnings.

²⁰⁸ *Optimierung von Warnung und Alarmierung bei Naturgefahren* (Optimisation of early warning and alerting of natural hazards).

²⁰⁹ OWARNA-Report 2007 und Follow-up report 2010, Online: <http://www.planat.ch/de/infomaterial-detailansicht/datum/2010/05/26/owarna-bericht/>.

(2) Intensify and standardise cooperation at the federal level

This measure included the establishment of a natural hazards expert staff for crisis management, the publication of a joint natural hazards bulletin, common standards for warnings and for the communication of warnings to the public, and a Business Continuity Management system to guarantee 24/7 operation in case of an event.

(3) Improve communication and information products

This measure included the definition of common warning levels, the launch of a joint natural hazards platform (GIN) as a tool for regional and local authorities, the creation of a natural hazards web portal for public information (Figure 5758), the establishment of general behavioural recommendations for the public, and the publication of joint media releases and natural hazards bulletins.

(4) Train local natural hazard advisors

This measure included the provision of support for local authorities in developing emergency plans and training local natural hazards advisors (Figure 5859) who will support intervention forces by providing knowledge about hazard processes.

Partners and organisation

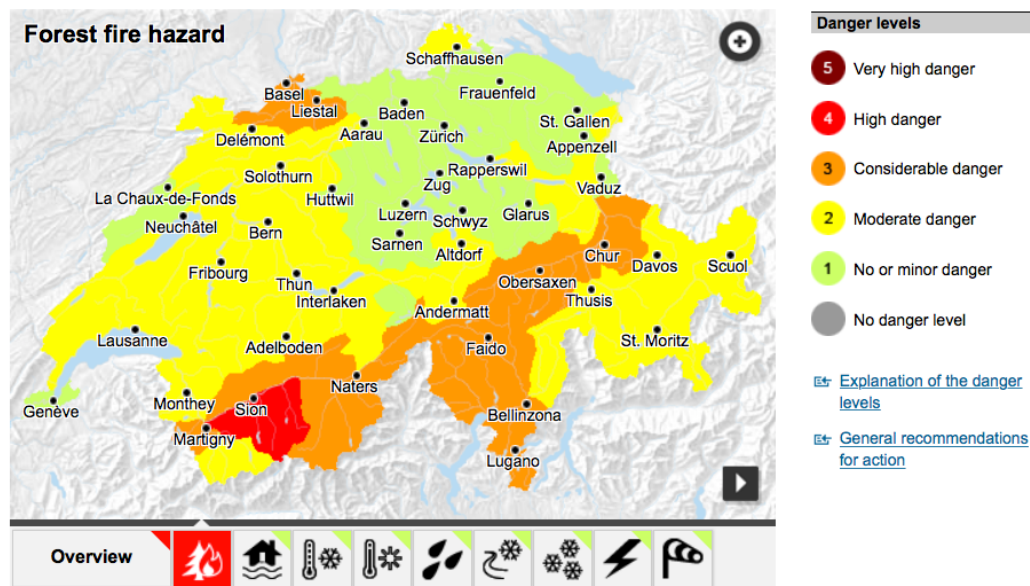
The responsibility for dealing with natural hazards in Switzerland is shared by three different administrative levels, i.e. the federal, cantonal and municipal level. The federal government's natural hazard experts warn the regional and local authorities about upcoming natural hazards and provide measured data and forecasts online. Direct information and warnings for the population are provided by federal authorities via dedicated information platforms. In case of a very high danger level (levels 4 and 5 out of 5), federal authorities have the possibility to use a "Single Official Voice" procedure, legally requiring public radio and television to broadcast the warning information. The responsibility for any intervention measures lies within the local and regional authorities.

Figure 57: Web Platform on Natural Hazards for the population²¹⁰**Current natural hazards situation in Switzerland**

Updated on: 20.07.2017, 10:17

location / ZIP

Search location



Source: Natural Hazards Portal, Switzerland, 2018

The federal offices of the Swiss Confederation deal with the following threats:

- Dangerous weather events: Federal Office for Meteorology and Climatology.
- Floods and associated landslides and forest fires: Federal Office for the Environment.
- Avalanche risk: Institute for Snow and Avalanche Research of the Federal Research Institute for Forest, Snow and Landscape.
- Earthquakes: Swiss Seismological Service.

In addition, the Federal Office for the Protection of the Population supports the involved offices in the prevention of collective risks and the management of hazard events. The Federal Office of Topography (swisstopo) provides the documentation of events.

Figure 58: Training of local natural hazard consultants



Source: Federal Office for the Environment ©

²¹⁰ Online: www.natural-hazards.ch.

Conclusions and future challenges

Ten years after the severe flooding event in Switzerland in 2005, several measures for the optimisation of warning and cooperation have been implemented. During the flood events of 2013 and 2014, the new procedures and cooperation measures were applied successfully and helped to prevent further severe damage. Furthermore, public awareness has been considerably raised through extensive media coverage since the beginning of the events. Cooperation at a federal level is essential for effective intervention and must therefore be continued and strengthened. Future challenges that will need to be addressed in the coming years pertain to the following areas:

Crisis-proof forecasting and warning: availability of forecasts, warnings and communication must be guaranteed, also in case of power shortage or infrastructure failure. Corresponding projects are currently being implemented.

Impact-based warnings: The accuracy level achieved by forecast and warning products is high. However, the consequences of natural hazard events could be further reduced through impact-based warnings. These would take into account parameters such as exposure and vulnerability²¹¹. Studies are currently being conducted to assess the implications of this new paradigm and the possibilities it would offer.

Adaptation to climate change: It is forecasted that climate change and global warming will lead to more extreme and more frequent weather-related events. Hence, there is a risk for more natural disasters. We therefore need to be prepared to face these new challenges in order to better react and reduce potential damages and casualties.

Concerning risk governance aspects, the OWARNA project is a good example of an integrated approach that has improved forecasting and warning systems by involving different authorities as well as local people and has created a transparent institutional framework.

Table 34: Governance Characteristics – The OWARNA project, CH

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	national	coordination at national level
Organisation	institutional establishment	enshrined in legal ordinance
Actors	federal state, provinces, municipalities	coordination at national level, involvement and interaction at regional and local level
Problem perception and goal	preventive measures, risk reduction	actions relating to prevention for efficient interventions
Strategies	Long-term effects, strategic approach	long-term solutions
Instruments	multi-instrumental	
Resource and organisation of implementation	mandatory cooperation, formal organisation	partners legally committed

²¹¹ WMO, 2015.

GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, within state authorities	
Coherence	consideration of multiple problem perceptions, multiple actor responsibilities in implementation	
Efficiency	evaluation of project	regular reporting of goals and costs
Effectiveness	achievement of key aims	
Equity	-	
Legitimacy	institutionalised, legal basis, transparent	enshrined in legal ordinance

6.7.2 Reserved open spaces for the long-term reduction of residual risk

The following example shows how open spaces are reserved and embedded in an integrated risk management concept for the Engelberger Aa River. Reserved open spaces are strategic spatial-planning measures for the reduction of residual risk. They guarantee the long-term availability of the space necessary for the safe diversion of floodwater with minimal damage in the event of overload. This limits damage potential.

The implementation of such extensive measures requires cooperation among different disciplines and comprehensive risk governance.

Principles and Priorities

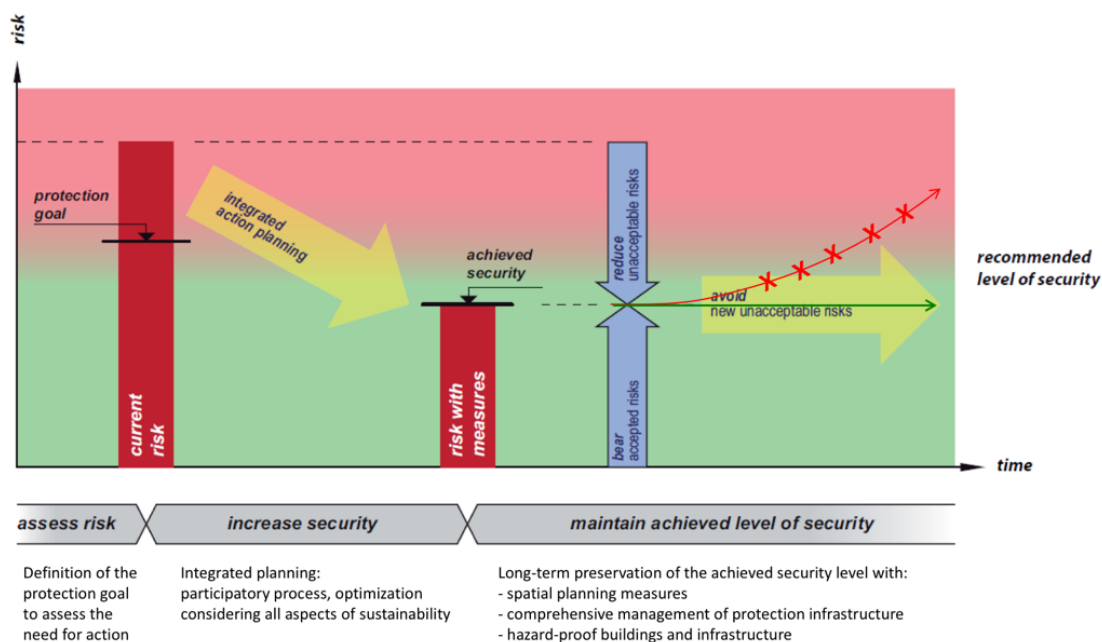
Observations show that the magnitude of natural hazard events today often exceeds previously observed levels. There is no absolute safety when it comes to natural hazards, and a residual risk always remains. The impacts of climate change have also prompted the realisation that a strategy shift is needed from a purely safety-focused approach towards a comprehensive risk culture concept. Integrated risk management as practised in Switzerland is representative of this shift. In this concept, the optimum combination of planning, organisational, nature-based and structural measures is implemented with a view to managing natural hazards holistically. With the combination of these measures, unacceptable risks are reduced to an acceptable level.

Risk consists of hazard probability and damage potential. In times of growing settlements and large-scale infrastructure construction, as seen in recent decades, the damage potential posed by natural hazards increases considerably. The change with respect to hazards, on the other hand, is less pronounced, even when climate change is taken into account. The essential finding is that the risk posed by natural hazards cannot be managed through structural preventive measures alone, as acceptable risks move into the unacceptable risk range due to the continuous increase in the damage potential. For this reason, spatial-planning measures that prevent or at least reduce the increase in damage potential must be implemented along with merely hazard-focused measures.

The allocation of land uses is the central factor in reducing the increase in damage potential. For this reason, in accordance with Switzerland's legislation, flood protection measures must be implemented primarily through spatial planning. The corresponding instruments include the securing of space for flood protection with watercourse zones, bans on the construction and

the creation of new development zones, and the designation of reserved open spaces as a strategic element. The reserved open spaces ensure the availability of the areas necessary for the safe diversion of floodwater with minimal damage in the event of overload, irrespective of intensity and return periods.

Figure 59: Risk development

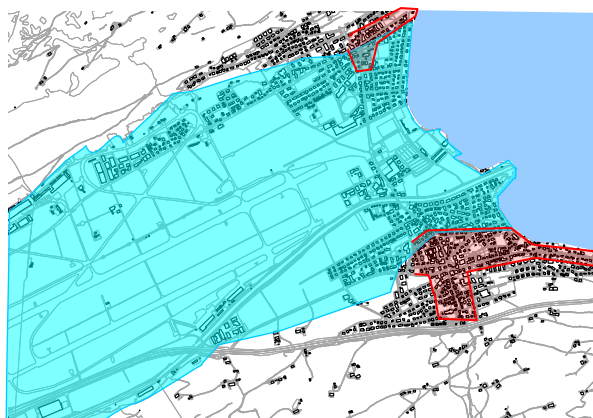


Source: PLANAT, 2014.

Reserved open spaces: example of the river Engelberger Aa²¹²

In the period 1920-40, the course of the river Engelberger Aa was improved to accommodate a discharge rate of 20 m³/s, a level that corresponds to a 20-year flood. As it can be seen in Figure 60, residential settlements extended further and further from the village centres into the former flood plain.

Figure 60: Potential flood plain of the Engelberger Aa before entering into Lake Lucerne with the historical villages Buochs and Ennetbürgen.

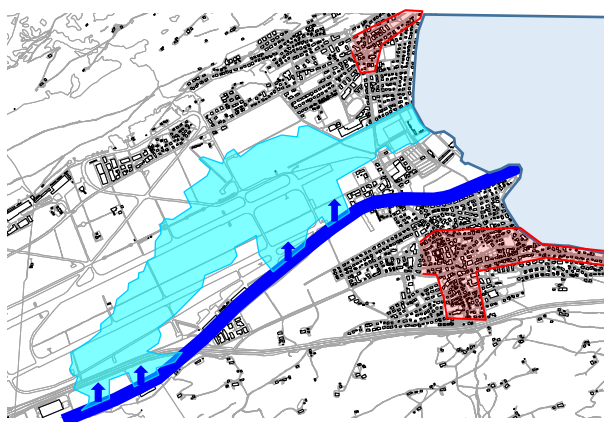


Source: Tiefbauamt Nidwalden, 2006 ©

²¹² KOLB, 2017.

Due to the expansion of the settlements and infrastructures, the flood risk had increased so strongly that a further improvement of the Engelberger Aa was necessary. This work was carried out from 1998 to 2007 in accordance with the principles of IRM. The potential overloading of the flood prevention measures was also taken into account in that the dikes near areas with low damage potential were designed to be floodable. Thanks to the consideration of the impact on the bedload transport, in the event of excess flooding, the dimensional water volume flows safely into the Engelberger Aa. Only the “excess” water flows into the low-damage discharge corridors. The settlement area is protected against the residual risk by back dikes (see Figure 61).

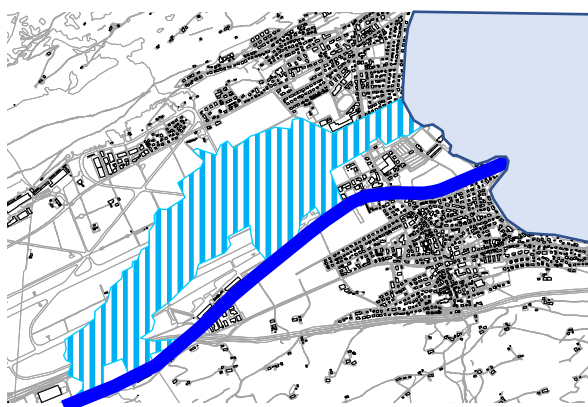
Figure 61: Situation after constructional adaptation with four floodable dike sections, reduced residual risk area, back dikes for the protection of the settlements



Source: Tiefbauamt Nidwalden, 2006 ©

Another important component of the holistic Engelberger Aa flood protection project is emergency planning with a view to reducing damage in the event of a flood. Simultaneously with the flood protection measures, the ecology along the Engelberger Aa was improved considerably, and recreational use was integrated consistently into the project.

Figure 62: Reserved open spaces as defined through spatial planning. Reserved open space A (dark blue hatching) with construction ban and other land-use restrictions; Reserved open space B (light blue hatching) with construction authorized under special conditions



Source: Tiefbauamt Nidwalden, 2006 ©

The discharge corridors were secured on a spatial-planning basis through the designation of reserved open spaces in 2004. The inner reserved open space (A) has a construction ban as well as protection against the planting of tall agricultural crops, the erection of fences, use for parking etc. The outer reserved open space (B) is subject to less stringent regulations and can be used both for the implementation of safety measures and rezoning as a development area.

Governance and risk governance aspects

The project was commissioned by the Public Works Department of the Nidwalden canton. It was authorised by the regional parliament, and the Nidwalden State Council was responsible for its environmental compliance. The decision to provide federal funding for the project was taken by the then Federal Office for Water Management. The designation of the reserved open spaces and other spatial-planning measures was approved by the inhabitants of the affected communities, who were also involved in the decisions relating to the sums provided for co-financing the project.

The fact that most of the agricultural areas were in the ownership of the land cooperatives simplified matters since they jointly manage agricultural areas.

The Engelberger Aa project was a pioneering undertaking based on integrated risk management. The project was not triggered by a damaging natural hazard event but by the acknowledgement that the potential flood risk was no longer acceptable due to settlement growth.

Both of these circumstances posed a particular challenge in facilitating the implementation of the project. The factors that led to its success were the personal commitment of those in positions of responsibility and the involvement of all stakeholders. The commitment shown by the canton's hydraulic engineer and the inspector from the supervising federal authority deserve particular mention.

To obtain the necessary authorisations, the regional parliament also had to be convinced of the need to improve the river – despite the fact that no damaging event had occurred – and of the expediency of the integrated approach. To fulfil this objective and obtain the support of the population, the process was supported by numerous public information events and a consistent press campaign over many years. Parliamentary approval was ultimately obtained without any opposing votes. This positive result was achieved in particular through the high level of commitment to the project on the part of the responsible cantonal councillor. Another key success factor was the active involvement of all of the affected authorities, such as the spatial planning and environment offices, the municipalities, associations and property owners.

Table 35: Governance Characteristics – Reserved Open Areas, CH

ASPECT	ASSESSMENT	COMMENT
GOVERNANCE CHARACTERISTICS		
Level	regional	
Organisation	institutional establishment	strong involvement of all relevant stakeholders
Actors	Federal authority, canton of Nidwalden, municipalities, NGOs (e.g. sculpture park organisation), local population	approval of reserved open spaces through referendum

Problem Perception and goal	preventive measures, risk reduction, long term securing of retention areas	guaranteeing of reserved open spaces for the long-term reduction of the residual risk
Strategies	long term effects, development and implementation of new strategy	
Instruments	multi-instrumental	the reserved open spaces were implemented as the most important long-term risk-reduction measure in the context of the biological, planning, technical and organisational measures
Resource and organisation of implementation	formal organisation including voluntary participation/cooperation	each stakeholder group financed their specific sub-projects themselves
GOVERNANCE QUALITIES/CAPACITIES		
Extent	multi-level, multi-actor, within state authorities, involving local communities and NGOs	
Coherence	consideration of multiple problem perceptions; multiple actor responsibilities in implementation	
Efficiency	cost-benefit analysis	natural hazard events following the implementation of the measure proved that the overall cost-benefit is about 1:9 for the technical measures, the cost-benefit ratio is around 1:8 and for the emergency planning, it is around 1:9
Effectiveness	achievement of key aims	long-term guaranteeing of the achieved risk-reduction
Equity	Very high level of equity	
Legitimacy	institutionalised, new created legal basis; high degree of transparency	additional legitimization through parliamentary approval and referendum

7 Conclusion – Recommendations

The discussion within EUSALP AG8, the analysis of a wide set of documents, the results of workshops and information provided by the AG8 members enabled an extensive analysis of the status quo of risk governance mechanisms in the field of natural hazard management. Due to certain limitations, the study cannot display a complete evaluation, however a comparative and discursive approach to identify advanced applications as well as gaps based on lessons learned in the field. The following conclusions point out the challenges and weak spots and serve as a basis for formulating recommendations.

(1) Risk Governance understanding

The process of discussing the risk governance status quo within the governance mapping activities in EUSALP AG8 underlines that the concept of risk governance in natural hazard management is complex and has many different aspects that need to be considered. Therefore, the following target groups and actions towards a better understanding of can be formulated.

- According to the EUSALP objective "Cross-cutting Policy Area: Governance, including Institutional Capacity" governance mapping plays a crucial role. The presentation of mapping methods and good practice examples helps to receive practical results.
- The specific understanding of risk governance should be clearly displayed throughout the EUSALP action groups activities.

(2) Spatial Planning as one aspect in a governance process

The evaluation of planning frameworks and their relation to natural hazards did reveal that hazards are widely considered but the concept of risk as a dynamic parameter is difficult to include in planning decisions. Planning regulations use hazard zones as essential basis for land-use planning and aim to accomplish and guarantee a certain level of safety. The planning mechanisms are rather formal and allow certain participation but have no basic governance aspect/perspective. Therefore, risk governance in the field of planning implies the following potentials:

- Integrate planning institutions and planners widely in discussions of holistic prevention.
- Establish governance-based discussions already on a regional and strategical orientated level.

(3) Decisions on protection measures

Especially planning and implementation of structural measures for hazard prevention are widely based on strict procedures. Opening these procedures for more discussion holds large potentials to foster risk governance:

- Involve local people on a local to regional level in the discussion of long-term strategical concepts to establish holistic concepts for raising resilience and risk reduction. This needs educating people to be equal in discussion and find common solutions.
- Awareness raising, educational programmes and similar activities need long term perspectives and financing. Subsequently the institutional framework needs slight adaptations to shift the focus on such measures.

(4) Organisational Measures

Organisational measures for prevention and preparation in disaster control and management are already strongly governance based and involve many different stakeholders on different levels and formalise responsibilities, warning/alarming and actual operational tasks. There is further potential that was identified in the discussion:

- Involve local people and assign them responsibilities. Public authorities ought to coordinate and supervise such action.

(5) Mapping as a basis for communicating risks

The provision of sound hazard maps for planning prevention measures has been a major focus in the past decades in all EUSALP member states. Meanwhile, these maps are widely accessible online and help to raise the level of information on actual dangers and partly on existing risks. The following aspects are critical:

- Hazard and risk maps differ in their legal effect and are difficult to read and interpret. To help interested as well as concerned people to educate and inform themselves appropriate support is needed and initiatives by the member states could help to generally improve the presentation of hazard and risk maps.

The **key messages** of the gathering of information on the single national systems for NHM and their status quo on *Risk Governance* are:

- **Risk Governance is not an independent state-owned instrument:** The development to integrate risk governance mechanisms in the way society handles and manages natural hazards demands innovations and adaptations in the existing management systems. A standardised and universal scheme is not applicable because risk cultures and institutional embedding differ. Integration of risk governance in existing ways of managing hazards would mean certain administrative reorganisation and establish a dialogue among peers accompanied by experts.²¹³
- **Holistic perspectives matter:** Spatial planning, disaster control and other sectors engaged in the field of hazard management need to be linked via platforms, frameworks etc. to incorporate different kind of stakeholders and concerned people. Risk governance aims to foster an open process of deliberation and negotiation as a learning process that transcends conservative modes of regulation.²¹⁴
- **Regional risk perceptions and cultures matter:** Holistic and strategical development of effective prevention measures are often only possible, if causal links and interdependencies are considered. Local and regional risk perceptions and risk cultures differ and are important criteria that need to be considered.²¹⁵
- **Be sensitive to emerging initiatives:** People no longer perceive public authorities and institutions as invulnerable representatives of the state but instead want to participate in the discussion for solutions such as developing measures for hazard prevention. Public administration needs to respect peoples' opinion and be sensitive to emerging local or regional initiatives. Public administration should aim to give people the possibility to participate, consider individual experiences, motivations and personal abilities to take action.²¹⁶
- **Risk governance needs to be practical:** Risk governance has to be carried out and not exclusively framed by a scientific discussion. It is more about negotiating solutions of stakeholders with a common risk, than constructing frameworks and procedures. These should evolve within governance processes which then can be transferred to areas with similar challenges.

²¹³ LINK & STÖTTER, 2015.

²¹⁴ ASSMUTH et al, 2010.

²¹⁵ AGNIGARD, 2011.

²¹⁶ WACHINGER et al., 2010.

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