

Contingency Planning in the Area of Natural Hazards

A comparative analysis of challenges, strengths and weaknesses between contingency planning and natural hazard management

Report of the Natural Hazard Working Group of the Alpine Convention

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Report of the Natural Hazard Working Group of the Alpine Convention (Short version)

FOREWORD

Author: Florian Rudolf-Miklau

The Alpine space is an attractive area to live, work and recreate in. The power of Alpine nature is beautiful and untamed at the same time, while humans were never able to control it. With the early settlement, an awareness of the special conditions of this mountainous environment was developed - its special advantages but also its dangers. Alpine hazards such as floods, mudflows, rockfalls and avalanches threatened the human habitat both then and now.

People in the Alps have learned from their experiences and are adapting to nature. Advances in technology, traditional local knowledge and the ever-increasing connectivity of our society provide a powerful motor for this adaptation to the Alpine environment and its hazards. An avoidance of risk and the preparation for catastrophic events is one of the great challenges of our daily life in the Alpine region. We build protective constructions made of wood, iron and concrete, promote ecological solutions and cultivate protection forests, inform our local population and support our decision-makers with expert knowledge to ensure a higher level of protection in the future.

But what are the consequences for us, if an extreme event is unforeseeable? What happens if our knowledge or financial resources are not sufficient to protect us from a catastrophic event?

Successful management of disaster events needs a good preparation and a well-established collaboration in the response phase. Contingency planners prepare plans at national and regional level that consider local knowledge, existing material resources and documentations of past events. In the response phase natural hazard management experts, with their professional knowledge and understanding of the hazard process, profit from an appropriate contingency plan.

Successful collaboration between contingency planners and natural hazard management experts is subjected to the task of translating the natural hazard as a scenario for contingency planning and improving the understanding of a disaster event as a situation in operational management.

The Natural Hazards Working Group of the Alpine Convention (PLANALP) is dealing with strategies for protection against natural hazards since 2004. Leading experts from all member states of the Alpine Convention exchange views on the protection of the population and the living environment discuss new developments and coordinate joint activities in the Alpine region. By means of these activities the working group strengthens national strategies, supports decision-makers and promotes the entire Alpine region as a forerunner in the management of natural hazards.

Over the last two years, PLANALP was mandated to investigate the question, what natural hazard managers can contribute to contingency planning and how to approximate and reconcile forecasting (planning) and response (management).

With this report, the interface between contingency planners and natural hazard managers is highlighted. The focus is on the translation of the knowledge available in contingency planning for the actors in natural hazard management and vice versa, and how the communication between these two groups can be improved in future. Not only strengths and weaknesses, but also similarities and differences between the various Alpine countries are emphasised, and recommendations for action derived from them.

Just as nature amazes us every day with its beauty, it sometimes hits us just as hard and mercilessly and presents us with challenges that we can only overcome together. This publication will help to improve natural hazard risk management in the future in the Alpine countries and to increase society's resilience to disaster events. The report provides a trend-setting basis for joint and coordinated efforts to protect the inhabitants and improve living conditions in the Alpine region.

My sincere thanks go to the members of PLANALP, who have made a valuable contribution to this report through their exemplary commitment under the currently difficult conditions caused by COVID-19!

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EXECUTIVE SUMMARY

The successful avoidance and defence of disaster events, particularly with respect to the conditions of a changing climate, require a professional collaboration between risk managers and hazard planners in all phases of the hazard risk management cycle. While contingency planners mainly have to implement their expertise efficiently in the preparation phase, the hazard managers have to deal with the comprehensive effects of disaster events in the response and recovery phase.

Ideally, a lively exchange between all actors, e.g. by developing and passing on lessons learned protocols, will lead to mutual interactions, which will help to optimise the management of natural hazards. The challenge, however, is that approaches vary greatly between emergency planners and natural hazard experts and in between countries. Therefore, the consortium designed an online survey and held workshops with several experts from different areas all over the Alps with emphasis on predefined, relevant natural hazards (avalanches/ ice falls, floods, soil slope failures, forest fires).

The PLANALP consortium was commissioned with the question to what extent the natural hazard managers can support the emergency planners in their challenges. A central question was to find out how the requirements of the actors in management (phase of response) could be taken into account by the planners (phase of prevention) and how the two groups could be brought closer together in the Alpine space. The general objective of the study is therefore to ask to what extent natural hazard managers can contribute to emergency planning and how emergency planning can be improved for civil protection actors in order to make information at local level more user-friendly and easier to understand.

Similar to a transdisciplinary research project, we started with a real-world problem defined by the PLANALP country representatives. A mismatch between contingency planning and management was perceived and should be further investigated. A mixed methods approach was applied: the first part consisted of a quantitative survey to find out the status quo about challenges, strengths and weaknesses specific to natural hazards as well as the expert groups natural hazard management and contingency planning; in the subsequent second part qualitative workshops with focus group interviews using the so-called Rapid Risk Appraisal (RRA) were conducted in a total of 5 Alpine countries. The workshops in Italy and Switzerland focussed on the topic of soil slope failures. Avalanches were included in the austrian and italian workshops, whereas floods were of main interest in austrian, swiss, slovenian and german ones.

In the following, we summarize the key points and recommendations of the workshops and the corresponding online surveys:

1. Key points from the quantitative analysis and recommendations based on the online survey:

The online survey was set up to examine the interface between contingency planning and disaster management. 484 completed online surveys from experts from seven PLANALP countries (Austria, Italy, Germany, Switzerland, Slovenia, France and Liechtenstein) were taken into account. The questions focused on the area of responsibility of the experts. They were questioned about data availability, risk communication, structural quality as well as their material and human resources within the contingency planning or natural hazards management.

The quantitative analysis concentrated on the challenges and weaknesses in order to identify key points for improvement in the emergency planning in the area of natural hazards and further allowed to pinpoint common strengths. Although the data availability and risk communication were mostly not rated negative, there are some specific issues that allow further improvement:

- It is recommended to standardize the documentation of damage events with definition of at least necessary parameters. The data about historical events as well as for the management of current events should be available online and on the move.
-

- Regular meetings and mandatory cooperation at the development of hazard maps should improve the information exchange and relation between contingency planning and natural hazard management as well as between local and supraregional experts.
- More exchange of data and information is not just wanted between contingency planning and disaster management, but also between the countries.

2. Key points from the qualitative analysis and recommendations based on the workshops

- The workshops highlighted the need for discussion on data availability and related risk communication. The former was frequently cited as a best practice example in all natural hazards. Best practice examples are all characterised by a very high level of data availability, data diversity and systematic data collection. In the case of best practice, local knowledge is already integrated into planning instruments, especially when personal contacts support data exchange. Both tourism and major damage or frequent local events bring attention towards risk prevention and help to improve it. However, good political support and funding is also mentioned as an essential feature for the development of best practice. Furthermore, a high qualification in emergency management at local level and high local commitment (e.g. local construction company's support with heavy equipment like excavators) were repeatedly mentioned.
 - Politicians are generally called upon to invest in the expansion of digitisation and the creation of a central natural hazards database with a harmonized, defined data acquisition for each natural hazard process.
 - The type of knowledge transfer must be improved at various interfaces. For example, the different levels of planning (hazard zone planning) and local contingency planning need to be better linked in order to achieve a continuous updating of planning instruments. At the interface between contingency planning and natural hazard management, it is necessary to incorporate local knowledge and experience more strongly into planning.
 - Risk communication between experts and laypersons must be supported, since without civil society solidarity, neither sufficient data collection at local level nor successful risk prevention and crisis management is possible.
 - The need for more training and knowledge transfer between planners and managers, different generations, regional and local volunteers and the use of new digital tools was mentioned in several contexts during the workshops. Cross-national training can also be used to improve risk management and contingency plans.
-

TERMS AND DEFINITIONS

The following terms and definitions represent a specific understanding that is valid for this report.

Avalanches

Snow avalanches are gravitational mass flows that quickly move down steep slopes¹. Beside snow, they can also contain stones, soil, vegetation or ice. Avalanches are classified according to various criteria. In addition to the type of movement (e.g. dense or powder snow avalanches²), a distinction is made between avalanches regarding to their initiation: snow slab avalanches, loose snow avalanches, and glide snow avalanches.

Snow slab avalanches involve the release of a continuous slab of snow over an extensive weak layer. Loose snow avalanches begin at a point in a relatively cohesionless surface layer of dry or wet snow. The initial failure is analogous to the rotational slide of non-cohesive sands or soils but occurs within a small volume (1 m³) compared to much larger initiation volumes in landslides. Glide snow avalanches are caused by a frictional loss between the snow cover and the soil layer.³

Contingency planner/ Natural hazard planner

Those people preparing a contingency plan at a national/regional level. Contingency planner need to consider hazard zone plans but also local knowledge about existing material resources, local data and information e.g. event documentation etc. In the Integrated Risk Management Cycle, they are rather located in the PREVENTION PHASE.

Disaster management / Operations management

Management of a natural hazard event at the local, regional, national level in the phases of preparedness and response.

Floods

Water level or outflow exceeding a limit to be determined - generally the lowest (smallest) annual flood. This limit is determined from the water level or flow values or local topographical conditions. In hydrographic statistics, also known as the peak value of a flood hydrograph.⁴

Forest Fires

A forest fire is any uncontrolled fire which partially or completely covers the forest or forest floor, regardless of the type of fire (smouldering fire, ground fire, crown fire), the cause, the type of vegetation (also grass fire below a high forest, fire on a clear-cut area or in the wind protection belt) or the area of the fire (e.g. also rootstock fire or fire of a single tree by lightning).⁵

Ice avalanches / Ice falls

Glacier ice, which breaks and plunges over a steep step, sometimes sweeping snow in the avalanche track with it. Often responsible for large-scale disasters.⁶

¹ Harvey et al., 2012

² De Quervain, 1981

³ EAWS, 2020

⁴ ÖNORM, 2003

⁵ Müller, 2015

⁶ EAWS, 2020

Natural hazard

Natural process or phenomenon that may cause injury or other health impacts, as well as property damage, loss of life, loss of livelihoods and services, social and economic disruption, or environmental damage.⁷

Natural hazard management expert

Those people who manage a natural hazard event at the local, regional, national level. This group need to profit from an appropriate contingency plan. In the Integrated Risk Management Cycle, they are rather located in the RESPONSE PHASE.

Rapid Risk Appraisal approach

The Rapid Risk Appraisal approach (RRA) was developed within the EU Interreg Alpine Space Project “*GreenRisk4Alps*”⁸. It was conceived as a participatory tool to identify the strengths and the points for improvement in the field of risk management in the different Pilot Action Regions for the implementation of future nature based risk reduction measures. The RRA makes use of local knowledge through the involvement of experts in a short (few hours to half-day), collaborative workshop. The *GreenRisk4Alps* RRA approach follows a series of steps, adapted from the ISO standard 31000 for risk management. The three steps are risk identification, risk analysis and risk evaluation.

Risk

Risk is a combination of the consequences of an (hazard) event and the associated likelihood/probability of its occurrence. In a simplified understanding, risk is the product of hazard probabilities and damage potential.⁹

Risk management

A concept that can be outlined with three simple questions. What are the potential hazards? What risk are we willing to take? Which measures of the integrated risk management cycle should we adopt? This idea follows the approach to take into account the effects and damages of natural hazards while defining accepted risk as well as mitigation and adaptation measures. The term risk management is used throughout the report, incorporating the terms natural hazard protection and natural hazard management as certain perspectives.¹⁰

Soil slope failures

„A form of landslides which include soil and/or loose rock material, initiated by a failure in form of a slide (translational slide) or slump (rotational slide) and partly developing a flow-movement (depending on several conditions e.g. water content). Channelized processes as well as spontaneous hillslope failures are considered.

⁷ Alpenkonvention, 2019

⁸ Interreg, 2020

⁹ Alpenkonvention, 2019

¹⁰ Alpenkonvention, 2019

1 INTRODUCTION

The XV Alpine Conference in April 2019 decided to renew the mandate and continue the format of the Natural Hazards Working Group of the Alpine Convention (PLANALP). During the ongoing period one focus of the PLANALP mandate was on the contribution of prevention in contingency planning with special regard to synergies and faced challenges within the Alpine region.

The general objective of this study is to approximate and reconcile theory (planning) and practice (management) - asking the question, what natural hazard managers can contribute to contingency planning.

The starting point for a deeper examination of the possible contribution of natural hazard management in contingency planning was the Interreg IIIb CADSES project MONITOR. This project has successfully developed a methodology for monitoring hazard processes and demonstrated their practical usability. The presented solutions are a good basis for the further development of risk management, but for a significantly improvement, some major obstacles have been identified that need to be overcome. In the subsequent project MONITOR II, a harmonized methodology for hazard maps and contingency plans was developed. The project addressed the challenges for an improved risk management, like e.g., the lack of availability and usability of hazard maps and contingency plans and the lack of communication support between stakeholders. The resulting common guidelines could have a sustainable impact at the communication of expert information like forecasts and warnings to allow an efficient trans-border cooperation in preparedness and response.

PLANALP started with a scoping of existing instruments in the Alpine region. A discussion of these tools soon revealed that different internal structures and responsibilities across the Alps lead to major challenges for a uniform approach. One of those challenges is the fact that the approaches between contingency planners and natural hazard experts vary. As a first step, it was agreed within the PLANALP to focus on how to prepare contingency planning for civil protection actors and what information is needed to make the information from the contingency/emergency plans more user friendly and easy to understand at a local level. The premise was to best translate expert knowledge into usable maps and information, and not to create common standards for maps. In the preparation, social aspects and the demographic structure (age, gender, special needs) of a municipality were considered.

Key questions were formulated by the chair and sent out to the members of PLANALP. All member-states gave feedback, and after a lively discussion with valuable inputs from all participating members, the following three pillars were proposed:

1. Collecting existing practices
2. Examining the collaboration between decision makers in contingency planning and natural hazard management through an online survey, and extend the validation of the results with national workshops
3. Grouping recommendations derived from these analyses to improve the cooperation between contingency planning and natural hazard management

To work through those pillars, the Chair commissioned a project consortium consisting out of the Austrian Central Institute for Meteorology and Geodynamics (ZAMG), the Austrian Research Centre for Forests (BFW) and the Leoben University (Montanuniversität) to collaborate on the study "contingency planning in the area of natural hazards". The consortium defined relevant natural hazards (avalanches/ice avalanches, forest fires, floods, soil slope failures) to keep a focus in the study. By summer of 2020 the consortium designed an online survey and the consortium & PLANALP members distributed it to the respective decision makers in contingency planning and natural hazard management in their countries. The results of this survey then provided the input for the national workshops. In these workshops, the so-called Rapid Risk Appraisal (RRA) was applied as a central method in an adapted form, tailored to the issues of the current project.

The RRA - based on ongoing research – has thereby been successfully integrated into the natural hazard contingency planning in the Alpine region in order to use the latest methods in the surveys and workshops. Based on the validation of the online survey in the national workshops, the consortium provided this report.

2 RESEARCH DESIGN

The starting point of this transdisciplinary project is a research question, based on the real-world problem¹¹ that was initially articulated and defined in the Seggau Workshop from 2019 in Austria given by the representatives of the PLANALP member states. A mismatch between contingency planning and disaster management was perceived and the necessity to better coordinate existing instruments, initiatives and the responsible teams. Based on the pre-defined problem and further 13 explorative interviews with natural hazard experts five main analytical categories revealed. The categories were described to be important and partly worth of improvement at the interface between management and planning. The five analytical categories are:

1. data availability (data collection and distribution)
2. risk communication (between experts (planners and managers), quality, trust, etc.)
3. structural quality (including bureaucratic obstacles, unregulated responsibility areas, etc.)
4. material resources (constructional, technical resources)
5. human resources (including the willingness to learn)

This analysis is based on empirical evidence from seven Alpine countries: Switzerland, Germany, France, Slovenia, Liechtenstein, Italy and Austria. As mentioned in the introduction, we consider pre-defined natural hazards, namely avalanches/ice avalanches, forest fires, floods and soil slope failures. A definition of each natural hazard is given in chapter “TERMS AND DEFINITIONS”, to be found on page 8f. Our target group are contingency planners and natural hazard management experts. While managers are rather located in the so-called response phase, planners are in the phase of prevention (see more in detail in the chapter “TERMS AND DEFINITIONS”).

The general objective is to converge theory (planning) and practice (management) or in other words, to adjust contingency planning on the practical needs of natural hazard management. To achieve this, we applied a mixed methods approach and combined a cross-national online survey in all seven countries and focus-group interviews in Switzerland, Germany, Slovenia, Italy and Austria. We aimed at providing an overview of the status quo through our online survey. Challenges, strengths and weaknesses at the interface between contingency planning and managing were questioned. The questionnaire was structured through our five analytical categories: data availability, risk communication, structural quality, material resources and human resources. Each analytical category offers groups of questions that are oriented towards the „Integrated Risk Management Model“¹² and its response, recovery and preparedness phase. In chapter 3 we present the outputs of the online survey by considering differences between natural hazards as well as the expert groups contingency planning and natural hazard management.

In addition to that, it was our objective to find out best practice examples and to understand by a qualitative approach the circumstances that support its development, and finally to derive

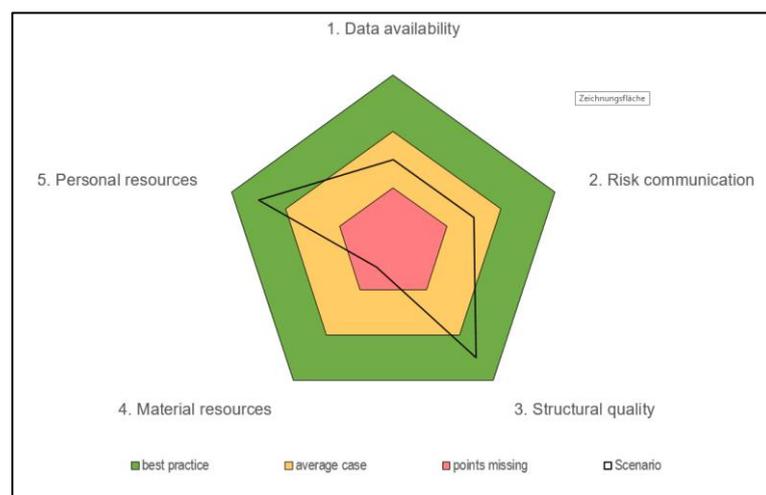


Figure 1: Example of the adapted RRA of a natural hazard

¹¹ Nowotny et al., 2001

¹² FOCP - Federal Office for Civil Protection, 2014

policy recommendations on that basis. Therefore, we applied focus group interviews and the so-called Rapid Risk Appraisal (RRA).¹³ The RRA was primarily developed within the Interreg Alpine Space Project “GreenRisk4Alps” and has been adapted to the purposes in this research. The adapted RRA considered the above mentioned five analytical categories and the evaluation schemes best practice (high expert satisfaction), average case (improvement desirable) and points missing (low expert satisfaction, improvement necessary). The subjective assessment of strengths and weaknesses by the workshop participants became visualized through a spider chart, which was the starting point for the focus-group discussion. The discussion focused on especially noticeable results and on the questions: What is understood as best practice? What are the reasons for developing strengths (best practice)? What are the suggested solutions for mastering weaknesses (points missing)? The workshop transcripts and interview notes were subjected to qualitative content analysis¹⁴ to identify categories and the main findings discussed in this article.

STAKEHOLDER ANALYSES FOR THE ONLINE SURVEY AND THE REGIONAL WORKSHOPS

Based on the fact that most countries are differently organised and structured in terms of contingency planning and management we adapted the categorization scheme, that was primarily developed for avalanches “Mitigation types”¹⁵ to our specific needs in order to capture stakeholder country specifics. The scheme differentiates between actors who intervene directly or indirectly in the long-term or short-term, e.g., only during a certain disaster event.

		Intervention "Avalanche and ice fall"	
		direct	indirect
Duration	short term	Austrian Armed Forces (assistance in preventive avalanche releases, civil protection, prompt assistance in case of an incident → recovery)	Disaster fund (co-financing of emergency equipment for fire brigades, the warning and alarm system and crop insurance premiums; additional funding for measures to prevent future damage and to repair damage caused by disasters) Police: maintenance of traffic safety and traffic flow even in exposed natural hazard situations
		Police / Ministry of the Interior: responsible ministry of the police as a traffic actor in natural hazard management and the Alpine Police as a documenter of avalanche accident; traffic actor in natural hazard management (road closure) and documenter of avalanche accidents	Municipalities (Building authority, Transport and Safety Committee - seasonal road closures, agricultural communities as municipal property, Avalanche Commission, forest/land owner - seasonal habitation of summer huts and pastures)
		Avalanche commissions (preventive avalanche releases/avalanche dispersion)	Avalanche prewarning service of the countries (avalanche warning; accident analysis)
		Mountain railways & ski resorts (construction of mitigation measures which at least safe ski areas and it's infrastructure)	National warning centre of the countries (triggering civil protection signals and informing the population as a core task; coordinating of alarm systems)
		Local municipal administrations (decision making for the community by the mayor based on expertise of the aval. commission; evacuation measures)	Civil Protection Unit (coordination and technical support in case of natural disaster)
	long term	District Office (commissioning of projects for technical protection measures)	Risk evaluation
		private companies like Wyssen avalanches, SYNALP ... (avalanche triggering towers, avalanche barriers, winddrift barriers)	Police / Ministry of the Interior: research into the causes of (avalanche) accidents, Alpine police: documentation of accidents in alpine terrain, reporting to courts and public prosecutors as well as administrative authorities; in particular accidents in winter in organised and non-organised ski areas (collisions, lift accidents, avalanche accidents)
		WLV (technical protection against avalanches)	WLV (hazard zone planning)
		Federal Forestry (reforestation, forest protection, forest management)	Municipalities (compliance of hazard zones, regulation of land use)
		Local Forest supervisor bodies (Forest ranger, district forest officer)	Local municipal administrations (decision making for the community)
Road construction of the countries (commissioning of projects for technical protection measures)	Road construction of the countries (planning, construction, management and maintenance of the state road network)		
ÖBB & Asfinag (construction of mitigation measures which primarily protect resort infrastructure but also effect the forest area; forest and biological measures as an important role in preventing erosion (near traffic lines))	BMLRT (Assignment of tasks / tenders and financing; Legal regulations) BOKU/BFW/ZAMG (research & education, development of mitigation measures) Alpine Clubs (education & forcing of awareness) National Warning Centre / Civil Protection Department of the Countries: (coordination, support and preparation of civil protection plans; monitoring of alarm systems)		

Figure 2: Stakeholder Analysis Example - Avalanches / Ice Avalanches Austria

Country representatives filled in a separate diagram for each investigated natural hazard (avalanches/ice avalanches, forest fires, floods, soil slope failures). This ensured a complete collection of relevant stakeholders that were taking part in the online survey. Like this, we selected regional participants (planners and managers) for our workshops.

¹³ Cocuccioni et al., 2020

¹⁴ Mayring P., 2010

¹⁵ CAA, 2016

CASE SELECTION

For the regional workshops we additionally defined the case selection criteria of a

- a) manageable region
 - b) region that is affected by at least two forms of the investigated natural hazards
 - c) region that is differently well prepared for disaster management, meaning it is known that there exist strengths and weaknesses.
-

3 CHALLENGES, STRENGTHS & WEAKNESSES - FINDINGS FROM ONLINE SURVEY

INTRODUCTION ONLINE SURVEY

An online survey was created to examine the interface between contingency planning and disaster management in the Alpine countries.

One wants to learn from the similarities and differences between those responsible, between countries and between different natural hazards. To this end, an agreement was reached on four natural hazards, which the participants could focus on in this survey: floods, avalanches/ice avalanches, soil slope failures and forest fires.

The participants should determine whether the range of their tasks lies primarily in disaster management or in contingency planning and then answer the question with focus on one of the above mentioned natural hazards.

Over 500 experts from the Alpine countries Austria, France, Germany, Italy, Liechtenstein, Slovenia and Switzerland took part in the survey, whereby the participants who had a response rate of less than 4.3% were sorted out in advance. Therefore, 484 completed surveys were taken into account.

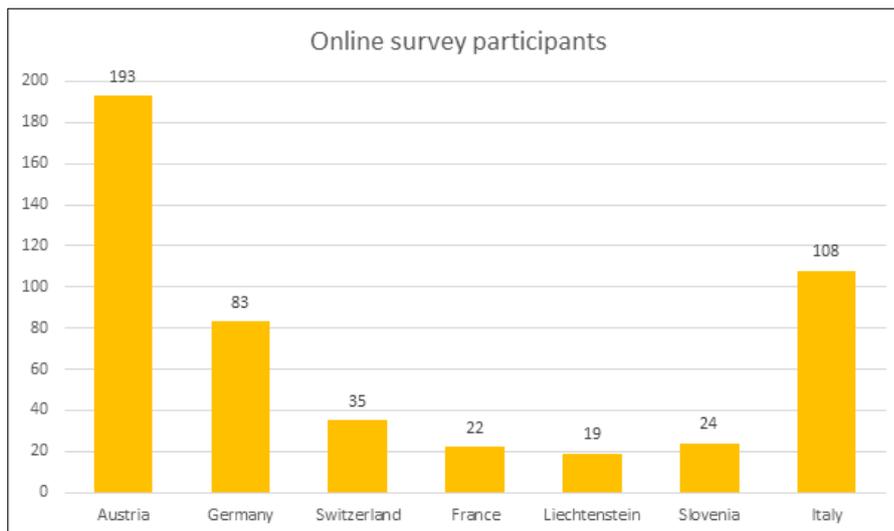


Figure 3: Participants in the online survey by countries.

COMPARISON OF RISK MANAGEMENT AND CONTINGENCY PLANNING

Looking at the similarities and differences between those responsible and between different natural hazards some interesting observations came up.

For all evaluated natural hazards, most participants of the online survey answered that their area of responsibilities is hardly or not affected by natural hazards. This result could indicate that the infrastructure of responsible persons is very good, but the disaster events occur fortunately quite rarely.

DATA AVAILABILITY

The results of the survey show a weakness in the documentation of damage events – historical and current. The amount and details of information about damage events should be increased for all natural hazards. In addition, the quality of early warning systems was identified as a weakness. There is a lot of potential for improvement and more research on that field.

Hazard susceptibility maps on the other hand got a quite positive feedback. They exist for all natural hazards, but should be extended, and were rated mostly positive. It is a strength to know which areas are more likely affected by natural hazards and where to put the focus in contingency planning and then disaster management for handling such natural hazard situations. However, the survey also shows a clear need for Web-GIS solutions that are available online and are also available as a one-stop-shop for managers and planners. The working process of contingency planners and disaster managers changed in the last years much more towards digital and mobile availability of the information.

RISK COMMUNICATION

The results of the survey indicate a good quality of the relation between contingency planner and disaster management for all four natural hazards, but the answers about information exchange between them indicates not such a pretty picture in most natural hazards. It seems that the personal relationships between planners and managers are good and strong, but there is no automatic transfer of necessary information and mutual expertise.

Looking at the structural quality within disaster management or contingency planning very often the quality was rated worse by the outside group of experts than by the concerning group of experts. This could indicate that structural problems within a group are often not viewed as such. The structural quality within both expert groups has weaknesses and potential for improvement especially within the natural hazards avalanches/ice avalanches and forest fires.

MATERIAL RESSOURCES

The need of material resources is specific for every natural hazard, but mainly helicopters, personal equipment (like protective clothing for forest fires or avalanche transceiver, shovel and probe for avalanches), special fire trucks and mobile flood barriers were mentioned as necessary.

Two significant disagreements between disaster management and contingency planning were striking:

In the natural hazard soil slope failures, the expert groups did absolutely not agree on the question, if retention spaces are sufficient. While 65% of the experts in disaster management thought that the retention spaces are sufficient, 67% of the experts in contingency planning answered that the retention spaces are not sufficient. This wide disagreement is surprising and raises the question why these two expert groups have such different opinions. Are their needs that different?

Regarding the natural hazard forest fires the opinions on the questions about the existence of special forest fire brigades and special protective equipment differ very much. Disaster management said that those things exist, while a significant part of the participants in contingency planning disagreed (56% and 67%). This wide disagreement on those two questions is surprising and raises the question why these two expert groups have such different opinions. Do the contingency planner not have the full knowledge about the available material or do these two expert groups have such different needs and expectations in their equipment?

HUMAN RESSOURCES

The results show a high willingness to learn at all natural hazards and countries, which should be used as strength and for more training of the experts. Additionally, more cross-border cooperation within the natural hazards is wanted. The desire for more exchange of data and information between contingency planning and disaster management as well as between the countries has emerged.

RECOMMENDATIONS FOR ACTION FROM THE ONLINE SURVEY

DATA AVAILABILITY

The documentation of damage events should be more standardized, defining the necessary parameters. Those documentations should be a digital available, continuous catalogue of local events with the possibility of traceability and the derivation of lessons learned protocols for coping capacities regarding future events.

A challenge in terms of documentation is that hazardous events (also within different countries) are often documented by different institutions according to their pursued goal or purpose. The depth of content for recording events therefore differs depending on the purpose of the documentation. A documentation scheme that allows to be filled by all actors with a uniform minimum input would be an advantage! In the sense of an international unification, standardized recording procedures should be available. For example, in the field of avalanche documentation, one could orientate oneself more on guidelines such as the UNESCO Avalanche Atlas or standards from the EAWS (European Avalanche Warning Services).

In terms of comprehensibility, availability and coordination with current, local features of the hazard warning maps, these were not assessed as positively by management as by planning. Therefore, the contingency planning in the future should evaluate the existing hazard warning maps in cooperation with natural hazard management.

Early warning systems are working, but the input data should be optimized and the network has to be updated, so that all current consumers will be reached. Additionally, the early warning systems should be available earlier, but with lengthening the forecast horizon the quality of accuracy will decrease. Such systems (e.g. regarding soil slope failures) are mostly based on precipitation information or weather forecasts. Local accurate forecasts for small Alpine catchment areas are still difficult. For local emergency managers, more specific weather information would be of great advantage. This is where the challenges lie in research, especially in times of climate change with changing weather patterns.

For natural hazards such as soil slope failures, floods and forest fires, more measuring points should be available for water withdrawal, precipitation measurement and river level measurement - especially in the preparedness phase for the risk manager.

RISK COMMUNICATION

For improving information exchange between contingency planning and natural hazard management and the relation between those experts a yearly meeting/training between planner and manager would be recommended to encourage the development of maps in close cooperation and to communicate lessons learned from practical experience.

An important tool for risk communication between planners and managers are among others the disaster control plans at local level. It is important that the responsible planners at the local level record all (future) relevant risks and that the procedures for deployment are clearly defined for local management. The mapping of certain event scenarios promotes risk awareness and contributes to a better understanding between planners and managers. A joint training on emergency cases would reveal gaps in communication as well as in the digital solutions used and can then be better implemented in existing disaster control plans.

Furthermore, a transformation of pure hazard maps into cross-disciplinary risk maps should also be aimed at (risk maps that include exposure and vulnerability are only available to a lesser extent in some countries).

MATERIAL RESOURCES

The main tasks regarding technical protection measures are to be assigned also to the spatial planners and political decision-makers. Local spatial planning must be well coordinated with existing hazard zone plans. It is important that damage potentials are already avoided during the planning phase. A retention area would often not have to be created if it was kept away from creating new infrastructure from the ground up. Infrastructure on questionable slopes (e.g. with regard to soil slope failures) or within flood plains must be critically examined in the future under the care of responsible spatial planning. Building sins from past decades must not be repeated - with political support. Under these circumstances, some structural measures or financial expenditures will not even be necessary.

HUMAN RESOURCES

More trainings for the natural hazard experts as well as more cross-border cooperation within the natural hazards are recommended.

In some countries, the participation of volunteers plays an extremely vital role in the field of natural hazard management. With increasing settlement pressure and intensifying weather extremes, this volunteer work will become even more important. It is of immense importance to maintain the level of volunteers (e.g. fire brigades) and to increase it in the light of a generally worsening situation due to climate change. In this context, consider volunteers are intrinsically motivated. People want to experience competence and group membership. If people feel self-determined and competent during their voluntary service intrinsic motivation increases. Consequently, invest in training for volunteers and in everything that increases identification with the group.

4 DEVELOPING STRENGTHS AND MASTERING WEAKNESSES - AN OVERVIEW OF THE WORKSHOP RESULTS

Reasons for developing strengths and mastering weaknesses were discussed more in detail in regional workshops in Austria, Germany, Slovenia, Italy and Switzerland. The participating countries decided to focus on country specific relevant natural hazards. In a rapid risk appraisal, each workshop group offered an initial assessment about their regional strengths and weaknesses by considering the five challenges (data availability, risk communication, structural quality, material resources and human resources) at the beginning of each workshop. Subsequently, the most striking results of the RRA became considered in a focus group discussion. The workshops followed a general guideline but were organized, analysed and summarized by the PLANALP representatives of each country. The following section gives an overview of the discussion results in form of summaries of the workshops.

Summary of the Austrian Workshop - Floods

On the basis of the evaluation of the questionnaire, the Rapid Risk Appraisal shows that improvements in all five analysis categories relating to flood events are desirable. During the discussion, many important statements concerning the individual analysis categories emerged.

Digital (online) disaster management work tools must be made easier and must be applicable nationwide, regionally and above all locally. This requires a mobilisation and digitisation of the (still analogue) existing system and a readiness for acceptance by the users by hands-on training.

Digital tools require a good data basis. To create this, the structured creation of a database is necessary, which is accompanied by a structured processing of the (digitally) available information. For this purpose, awareness and reference to the events must be created. Through the application and use of these digital (online) tools, important conclusions can be drawn about future events (dimensions and recurrence frequency).

To improve warning systems and the digital databases, additional costs for their expansion and proper training how to use the tools are necessary. If the technical possibilities are available, it is necessary that the users are willing to learn and properly trained

An increase in the number of extreme events which occur all over the region has shown how important it is to have a well-functioning risk communication with a focus on hazard awareness. Increased operations have a very large influence on the promotion of awareness. Above all, the awareness of decision-makers must be increased in order to give greater priority to the allocation of resources (human resources and financial resources) in the preparation phase of the risk management cycle.

A very important aspect is the commitment of many individuals, many things work very well in practice. However, this is due to a high level of commitment from individuals. Highly motivated and very committed individuals must be found. But more structure is needed, especially in the state and federal departments. Functionality in case of an incident is often only provided by individuals. A better connection and better, simpler cooperation between the institutions (State warning centre, fire brigade, etc.) is needed in the future, also with regard to data exchange.

Summary of the Austrian Workshop - Avalanches

The well-functioning situation in Austria is due to the large community of interests by many different institutions (federal state, ÖBB, tourism). Existing weather stations are continuously expanded, and new ones are set up. In recent years, a huge expansion has taken place, especially in the avalanche warning system, which is primarily due to the existence of tourism. In the future, better networking and data provision by digital means will be promoted in these areas. This influence of tourism is also directly reflected in the composition of the avalanche commissions and in the generation of new talent at all the institutions concerned. In tourist areas there are many interested people who are willing to get involved.

At present, primarily major events are recorded and documented, as they have a great impact on the existing infrastructure. Regionally, more and more attention is devoted to the documentation of small events. All avalanche events are to be recorded individually, regardless of their size and the extent of the event in terms of type and location. Problems arise from the fact that there is no uniform naming and description of avalanche types.

When building up avalanche databases that are as complete as possible with information from all the institutions concerned, it is necessary to issue a specific mandate to those who are affected. Furthermore, a very high level of commitment on the part of the processors is necessary to question and validate all the information. In order to guarantee the functioning of such a system, an appropriate financing must be available.

In order to keep such avalanche databases as complete as possible in the future, a legal basis for documentation is needed. In Eastern Austria all avalanche warning services use a uniform database for documentation and logging of events. But there is no uniform guideline or law on the obligation of documentation.

In general, data collection is working very well. The data transfer, which mainly takes place remotely via telephone and hardly digitally, works moderately. When data is passed on by telephone, the situation is quickly and clearly understood between experts. If information is passed on from expert to non-expert, obstacles arise - different interest groups prevent the development of strengths.

Information transfer via other channels shows a very good functionality using the example of a WhatsApp group. This system is constantly and easily available and easily accessible to everyone. Another aspect of the best practice example is the personal background. Photographs and short texts can be sent quickly, and feedback is given on the receipt and acknowledgement of the information. Thus, this system represents communication in both directions.

Natural hazard events always attract media attention. This interest has an influence on the work of the avalanche commission and the institutions concerned (municipalities, regions, road services, rescue, etc.). For these institutions, media training is desirable in order to be able to react in the right way to the media in such situations. This should also result in an improvement of the structures in the institutions (contact persons must be defined and trained). The media exercise a control function so to speak. On the other hand, there is also the possibility for the individual institutions to appear in the media in order to present their functioning working methods and thereby obtain funding and demonstrate the importance of their work.

Summary of the Germany Workshop – Floods and soil slope failures

The three participating municipalities in the district of Upper Allgäu are generally well-prepared for the challenges presented by natural hazards. Shortfalls are mostly linked to the cooperation with other authorities. Thanks to good teamwork based on good personal contacts between all persons involved, this is currently not a problem. Nonetheless, an organizational frame ensuring cooperation and exchange of relevant data in the future is missing. Such a legal frame further prevents the loss of information when generations of the persons involved change.

Emergency personnel as well as persons responsible in the municipal administrations would like to get more appreciation and support for their work from politics and society. The water authorities would like to see a growing acceptance for their measures especially from those who do not directly benefit from them.

As a possible approach to improve this, providing more information material was proposed. This would go hand in hand with rising the awareness of the public for the issues of flood and other natural hazards. Hopefully, a better acceptance of public measures will also lead to a higher willingness of the citizens to take measures themselves. In this context, the information campaign “[Hochwasser.Info.Bayern¹⁶](#)” (flood information Bavaria), which offers information material for municipalities, citizens and further players, was presented.

Currently contingency planning and hazard management on municipal level is mainly based on the emergency personnel’s experience and hardly uses theoretical foundation data. The available data are considered useful nonetheless. Data availability is seen as a problem by the municipalities for two reasons: Interfaces between the municipalities’ and the water authorities’ geoinformation systems are available only as web map services (wms), which cannot be implemented into some of the municipalities’s geoinformation systems. Additionally, the data should be available offline as well. Hence a specifically designed interface is considered desirable. Additionally, such an interface could also be used by the municipalities to submit event documentation to the water authorities. Political interests can also pose a problem as they can bar the way to making communally determined hazard maps public.

Documentation as well as systematic development of contingency plans is considered useful to share the existing knowledge. Nonetheless it is often disregarded due to other, more urgent tasks. Municipality representatives hence consider providing standardized procedures and documents for developing communal contingency plans helpful. The Bavarian State Ministry of the Interior already provides a practical working aid¹⁷ for this purpose.

¹⁶ Hochwasser.Info.Bayern, 2020

¹⁷ LFU, 2020

Summary of the Italian Workshop - Avalanche

As highlighted by the Rapid Risk Appraisal, data availability was unanimously considered as a strength by the experts of the focus group. Data regarding avalanche damage causing events are continuously collected on the field by foresters using a systematic approach, following a standard set up by the Interregional Association for Coordination and Documentation of Snow and Avalanche problems (AINEVA). Data is then made available to contingency planners through web-browsers. Among these, the Civil Protection Browser, managed by the Provincial Agency for the Civil Protection, gathers different data from various sources in order to link risk prevention, land use planning and emergency management information.

Although the data field was undoubtedly considered as a strength, the Provincial Agency for Civil Protection aims to further improve its accessibility. In this regard, in the coming year, the Agency is planning to publish data (which currently requires to be requested) openly online in the framework of an EU Interreg V, I-A project they are leading, called RiKoST. Moreover, data about historical events will be gradually expanded by the private consultants who are currently responsible for the development of the Hazard Zone Plans (HZPs). All the municipalities of the Autonomous Province of Bolzano are indeed required by law to develop such plans. Some municipalities already possess approved, while others are still in the process, leading to a heterogeneity of available data. The focus group agreed on the general high quality of the HZPs: once approved, they become part of the legal binding and integrative part of the land use plan; moreover, they become accessible to users through the online browsers previously mentioned.

Nevertheless, there is still a need for the valorisation of such plans, especially regarding their integration with other instruments such as the Municipal Civil Protection Plan. The responsibility for drawing up both the HZP and the MCPP falls on the municipalities; however, the MCPPs were often developed earlier than the HZPs. Through an update of the MCPPs, the two instruments have the potential to operate in an interactive manner and reach their potential in application.

The current work on the HZPs was also considered as a good trigger to further implement another tool, the local Intervention Maps. This is an experimental local tool in which a map accompanied by practical indications on the actions to be performed in case of the occurrence of an event. Other measures such as protective structures or spatial planning require more time to be implemented; intervention maps instead can be produced in a relatively short time.

Finally, the participants demonstrated a general willingness to learn from foreign practises and practical exercises. There have been many exercises at local level, but the objectives of these exercises are not clearly defined nor coordinated. A proposed solution would be to develop specific strategies for the territory together (e.g. during an expert workshop).

Summary of the Italian Workshop - Soil slope failures

Data availability for recent and historical damage causing events is quite unanimously acknowledged as one of the major strengths, being data on recent events collected in a systematic, digital and continuous way; moreover, data related to historic events is mostly collected in a digital way. The accessibility of such data has been improving to make data more usable to all categories of experts and contingency planners.

Another major strength acknowledged is the high and qualified experience and competence in emergency management of local practitioners in the whole Province (namely the numerous associations of volunteer fire brigades and the Provincial body). Local knowledge is however partially integrated in risk prevention and emergency planning, as this is not systematically part of official risk prevention or emergency plans, like the Municipal Civil Protection Plan (MCCP). This was pinpointed as an aspect to address to boost coordination in contingency planning and to optimize the use of plans as a dynamic governance tool.

Alternatively, the Hazard Zone Plan (HZP) is generally acknowledged as a relevant tool in terms of risk prevention, also thanks to the collaboration with external experts for its elaboration. In terms of planning, a better coordination between the MCCP and the HZP, both at local level, should be fostered. As relevant non-structural prevention and emergency management tools, they should be made more operational, intertwined and dynamic. The current work on the HZPs was also considered as a good trigger to further implement another tool, the local Intervention Maps, in order to improve the cooperation between risk prevention experts and emergency management experts/practitioners.

Concerning structural quality, the awareness that different kinds of structural measures have been sufficiently adopted goes hand in hand with the extent to which non-structural ones are necessary, too: a risk culture seems to be equally spread among the different experts/practitioners, who, contrarily, complain the reassurance that structural, visible and big measures provide to local communities.

In terms of risk communication, it emerged first that risk prevention experts and emergency management experts/practitioners generally trust each other and do generally recognize their reciprocal value. There is considerable respect, trust and dialogue among experts of different fields and a strong willingness both to learn and incorporate best practice and to learn by practical experience. What can be improved is the coordination among risk prevention and emergency management experts and practitioners at different governance level, and the assessment of their joint/non-joint collaboration.

Weakest points reported in the discussion resulted in the lack of simulations/operational exercises and extra-training courses for both kind of experts/practitioners, and the partial transfer of practical lessons from experience to risk prevention experts. Operational experience is usually passed on within the volunteer fire brigades through direct experience, but exercises are not clearly defined nor coordinated at Provincial level, with previously defined shared targets and scenarios. Furthermore, there is little chance to experience larger coordination efforts at different scales, because greater disastrous events – which would need a joint provincial-local effort – have not occurred in recent times.

Summary of the Slovenian Workshop – Floods

One of the major strengths in emergency planning in Slovenia is the systematic approach in this field, in accordance with the legislation, which clearly defines the planning process, obligations of different stakeholders, scope and levels of plans, their regular update, checks through exercises, and also through regular inspection. The disaster management system in Slovenia functions effectively also because there is high coverage of disaster protection and rescue plans, harmonized at the national, regional and local levels.

Based on the evaluation of the questionnaire and during the discussion at the workshop, additional findings and proposals for improvements in the individual five analysed categories through the Rapid Risk Appraisal emerged.

The key basis for good disaster protection and rescue plans are the risk assessments, which in Slovenia are elaborated for all major risks in close cooperation with the responsible ministries and other stakeholders, and regularly updated in line with the EU legislation, taking into account new data and the achievements of the profession and technology.

There is a need for consideration of development; how to further adapt the results of the officially regulated flood hazard/risk analysis (mainly for the purpose of spatial planning) to the needs of disaster protection and rescue planning, and how to integrate them more systematically into the regular updating process. With regard to the design of protection and rescue plans, users wish a more user-friendly design and tools and modern digital solutions in terms of, for example, more manageable digital support and simplified field personal reminders (checklists).

The planning process is as important as the final “product”, the disaster protection and rescue plan. In Slovenia the process is led by civil protection planning experts, and in smaller communities with the assistance of external experts while ensuring the participation of all stakeholders. Incorporating local knowledge and experience is crucial. Higher quality and more useful disaster protection and rescue plans are generally achieved when the majority of the response and other organizations are actively involved. Additional attention needs to be paid to the incident commander’s role and their involvement in the development of the protection and rescue plans. There is also the challenge of the dispersion of stakeholders with different responsibilities in the field of water and flood management at different governance levels, and there is a need to improve their cooperation.

In terms of risk communication, planning experts and emergency management experts/practitioners generally know and trust each other. There are lessons learned opportunities through analysis and meetings after disasters. What can be improved is to ensure a process of systematic integration of recognized “lessons learned” into further planning, training and response activities.

Application-oriented information about the situation from the normal to the level of alarm and disaster are the keys for operational use of disaster protection and rescue plans. A reliable, timely and useful overview of the current situation is crucial for effective response management and efficient use of disaster protection and rescue plans. We have, therefore, further support and develop monitoring and prognostic capabilities.

Summary of the Switzerland Workshops – Floods and soil slope failures

Key factors for success:

Good cooperation between cantonal and municipal level.

Clear procedural guidelines determined by the canton, which are the same for all processes (natural hazards or technical hazards, for example) to ensure structured procedures for contingency planning.

Contingency planners and natural hazard/emergency managers have to be one “team”.

The selection of the group composition is crucial: technical experts, local knowledge of the natural hazard situation and local specialties, mix of administrative levels (cantonal and municipal) and fields of responsibilities (financial, natural hazards, emergency management), including political representation.

Today it is a kind of prestige to be part of the team. Therefore, the motivation and the commitment of many individuals is very high, what leads also to a continuing consistency of the group. However, this is due to a high level of commitment from individuals. Highly motivated and very committed individuals must be found also for the future generation.

Participation (everybody is heard, and brings something valuable to the table) helps to maintaining the motivation of the group and of the active individuals.

Regular/frequent trainings are necessary and ensure that also new people achieve the level of knowledge which is needed.

Digitisation must be used more often and application should be simplified.

5 WORKSHOPS: CROSS-COUNTRY COMPARISON

In the regional workshops, not all five categories were always discussed, but rather those categories that showed striking results in the RRA, meaning they were rated particularly good or bad. With an average RRA score, workshop members decided which category they wanted to discuss. Thus, the discussion focused more on characteristics of best practice examples and the possibility for optimisation in case of missing points. Italy and Austria addressed the topic of avalanche. Soil slope failures were discussed by Italy and Switzerland and experiences in the field of floods were recorded in Austria, Switzerland, Slovenia and Germany. In the following section, a transnational but natural hazard-specific analysis is presented.

WORKSHOPS AVALANCHES

In the avalanche workshops held in Austria and Italy, data availability was considered as a best practice. The following characteristics underlie the good data availability in both countries.

- Continuous expansion of weather stations although data availability is already good.
- The availability of and demand for data increases with tourism. In winter it is ski tourers and in summer paragliders who transmit local snow and/or weather data to experts. At the same time, tourist areas are pushing the expansion of the data network to increase security in ski resorts.
- Major incidents result in risk prevention measures that provide increased protection for local transport infrastructure.
- Event recording and documentation is carried out in complete form, regardless of the size of the event and the extent of damage. This makes the data more heterogeneous, but the overall picture is more varied. This makes it easier to assess upcoming events.
- Avalanche damage events are documented by people who are already working in this area (e.g. foresters or hut keepers).
- Interregional agreement standards help to systematically collect data and make it comparable.
- Data distribution is fast (e.g. via online access).
- The data sources and types of data are diverse: planners and forecasters receive local data and information from many sources. Thus, situation assessment and the preparation of prevention measures are underpinned by a variety of data and sources. In Austria, for example, a constant weather and avalanche warning team transmits local data for a small financial compensation. These transmitters are experienced local experts. However, numerous ski tourers also transmit their local observations. In this case, the data is provided by laypersons; experts first have to verify the data.

Although this point of analysis is already regarded as best practice, the competent authorities are still striving to improve data availability at the interface between planning and management. To this end, the following measures are considered necessary by the workshop participants in both countries:

Data distribution and clarification of who should have free access to which data must be optimised.

The collection of **historical data** should be accelerated.

The **recording of small events** should be accelerated. In Italy this aspect is already much more strongly promoted than in Austria. Austrian experts want to improve this point.

Experts from both countries advocate a **legal obligation** to document avalanche events and to draw up hazard zone plans. This legal basis already exists in Italy. Experience shows an increase in data

availability. The hazard zone plans will also become part of the legally binding land-use plan and are also available online.

Updating and linking of hazard zone and civil protection plans: There is a further need to upgrade hazard zone plans by using them with other instruments of the civil protection plan. Civil protection plans were often planned before hazard zone plans were prepared. By updating disaster control plans and hazard zone plans, the two systems should work together. The revision of the Hazard Zone Plans triggered the adaptation of local emergency plans in Italy. Local intervention maps have been drawn up, considering all current data. The maps were provided with local indications and necessary actions to be taken in case of an incident. Corresponding intervention maps were not very time-consuming, especially in their preparation.

One obstacle to further improving data availability is the transfer of information, or more precisely the **problem of risk communication**. Information is often exchanged by telephone between local and national experts. Communication between experts works very well and situations are quickly and clearly understood. Experts speak the same language. Obstacles arise when data is passed on from laypersons to experts. Experience shows that photos/pictures of local conditions or events can help to overcome this language barrier.

An example from Austria shows how modern communication systems can be successfully used to transfer local data, especially between experts and laypersons. Laypersons transmit local snow and weather data or information on avalanche events to forecasters and planners via WhatsApp. Bidirectional communication systems are particularly advantageous here, as experts can confirm the arrival of the data, ask questions and express their gratitude for contributions. This feedback has a motivating effect on laypersons, with the consequence of further data transfer.

WORKSHOPS SOIL SLOPE FAILURES

In the Italian and Swiss workshop on the natural hazard "soil slope failures, channelized debris flows and soil slides", as well as from the results of the floods and avalanches workshops, it became apparent that best practice scenarios exist above all in the area of "data availability" and the associated "risk communication".

The increase in the number of soil slope failure events has made the population and, above all, professional staff aware of the hazards. Over the years, a wealth of experience has been gained in dealing with this natural hazard. Furthermore, local knowledge is respected and included in discussions, guidelines and planning.

The following points are also mentioned as precondition for developing a best practice situation:

- Good cooperation with the regional authorities
- **Political support at all levels (local, regional and national)**
- Direct communication
- Support by authorities when implementing local protection measures
- Special equipment is urgently needed in the event of an emergency, there is a high level of commitment from local building contractors to provide support in the event of an incident
- **High data availability for current and historical damage-causing events**
- Accessibility of data has improved greatly, with data of all categories available for experts and emergency planners
- Local knowledge is integrated into risk prevention and emergency plans

In order to reduce the remaining weaknesses, the strengths will be used and the experience and knowledge gained will be integrated into the measures to be taken

- Improving coordination in emergency planning and optimising the use of plans as a dynamic control instrument - Integration of local knowledge
-

- Improving communication with external authorities - **The results of the Italian workshop showed that the experts trust each other and mutually recognise each other's information. There is respect, trust and dialogue between the planning and management experts.** But what needs to be improved is the communication between risk prevention and emergency management experts at different levels of government. This includes coordination between risk communication and emergency management experts and practitioners at different levels and the assessment of joint and non-joint cooperation. Furthermore, an improvement of the personal contact with responsible government officials is to be promoted. The Swiss workshop showed that communication with cantonal authorities works very well; communication with external authorities is difficult. Therefore, personal contact should be improved, e.g. through staff meetings or excursions.
- Group leaders are well trained and communication between them is well established. However, the people on site (volunteer fire brigade) should be involved and informed and should be **specifically trained for this natural hazard**
- The Hazard Zone Plan is recognised as an instrument of risk prevention, thanks to cooperation with external experts. In terms of planning, better local **coordination between the municipal civil protection plan and the hazard zone plan** should be encouraged
- **Modern digital solutions and strict protocols should support the development and adaptation of the emergency plans.** A control system should monitor all changes and be approved by certain persons in authority
- The revision of contingency plans should be designed within the team to ensure that knowledge is refreshed or the team is trained.

As in the avalanches and floods workshops, important obstacles were identified regarding data availability and transfer, which hinder the development of strengths. These include:

- Infrastructure and equipment of the institutions concerned are not on the same level
- **Use of the documentation facilities is not user-friendly**
- Possibilities for easy adaptation of documents are to be generated (cloud solutions)
- **Knowledge transfer and knowledge of the tools is not available at all levels**
- More practice in handling digital databases to create a routine

Training: A very important aspect of the measures needed for strengthening the local risk prevention is the local risk prevention. There is a lack of simulations or operational exercises and training for the experts (managers, planners) and practitioners (fire brigade, etc.). There is also a lack in the transfer of practical lessons from the experience of dealing with local mudflows.

WORKSHOPS FLOODS

The results of the floods workshops in Austria, Switzerland, Slovenia and Germany have shown that improvement is desirable in all five categories of analysis despite best practice scenarios.

Best practice scenarios are found above all in the area of data availability. However, important examples and reasons for best practice scenarios can also be found in the other analysis points.

- **There are very advanced and well-functioning systems of protection against floods** (e.g. the VNDN system in Slovenia - system of protection against natural and other hazards)
 - **Experience gained in the event of an incident has so far been well integrated into further emergency planning**
 - **Disaster and rescue plans are drawn up comprehensively.** Slovenia, for example, has a very high percentage of coverage of the danger zones with these plans, which are also constantly updated. Floods represent a very high risk in Slovenia.
 - Good data exchange is based on **good personal/informal contacts**
-

- **Frequent flooding events increase the attention and concern of the local population.** Awareness of the impact of such events is high.

Despite this very good situation, there are, of course, improvements that are urgently desirable:

- Digital tools for data collection and distribution need to be made simpler and to be applicable nationally, regionally and above all locally - users want a more user-friendly design and tool solutions. In order to integrate local data into the system in a timely manner, the systems must be made mobile (mobile phone compatible). Different databases should become compatible and digital checklists should become available for local emergency management. Corresponding checklists only make sense if they have integrated current knowledge, i.e. are continuously updated.
- Experience shows that the platform must be stable, i.e. available offline, for example. This is urgently required in order to be able to obtain and import all data during the event of an incident.
- Previous tools also remain partly unused because the respective technical development lacks acceptance by the users.

Improve interaction: The results of the officially regulated flood hazard/risk analysis must be adapted more closely to the needs of contingency planning. In addition, the hazard and risk analyses must be integrated more quickly and systematically into the regular process of updating local contingency plans.

Involve the local population more closely in the prevention process: Collective responsibility as a basic attitude. Decision-making and assumption of responsibility for risk prevention is the responsibility of the group, not of individuals: Increasingly frequent extreme events can **increase risk awareness**, but it is particularly important to raise the awareness of decision-makers so that they also make resources (personnel / financial resources) available for flood risk prevention.

The **willingness to learn** how to use digital tools from local users must be encouraged

Systematic inclusion of more local observers and local information in the process of planning and response management for future events

Integration of the younger local community in risk prevention (e.g. contribution to the collection and documentation of local data, etc.) and emergency management in order to pass on knowledge across generations and to ensure the availability of competent local people.

The process of emergency planning should increasingly **involve local managers and supraregional disaster control planners**. Coordinated action by all actors is important for a successful response.

Experience has shown that the planning process is almost more important than the resulting emergency plans. This joint (emergency) planning process between local knowledge carriers and emergency managers on the one hand and supra-regional experts/planners on the other, leads to

- a) a common language, the contact persons in the respective groups are known to each other,
- b) a common understanding of the local challenges regarding natural hazards,
- c) to develop new knowledge, by bringing together local knowledge and supra-regional expertise.

The above points lead to better coordination in case of emergency.

Training: The practical experience of local flood experts should be incorporated into training courses for all new people and for the further training of already trained personnel (fire brigade, etc.).

The next table presents a quick overview of the most important reasons for developing best practices in terms of data availability. Support or supporter, completeness and good communication are categories that are mentioned to be important for developing best practices in all forms of natural hazards.

REASONS FOR BEST PRACTICE - Data availability			
REASONS	AVALANCHES	SOIL SLOPE FAILURES	FLOOD
CONTINUITY	continuous expansion of weather stations		
SUPPORT	tourism as both, data collector and data requester	good cooperation with regional authorities	frequent flooding events increase attention and concern of the local population
	major incidents	political support at all levels	
	data transfer and documentation by locals	local construction companies support in case of an event with heavy equipment	
COMPLETENESS	complete event documentation, regardless of the size of the event	data of current and historical damage causing events are documented	well-functioning protection systems are existing in most vulnerable zones
		local knowledge is integrated in risk prevention and contingency plans	disaster and rescue plans are drawn up comprehensively
STANDARDS	systematic documentation/ standards exist		
TEMPO	fast data distribution (online access)		
DIVERSITY	a variety of data and sources are collected		
COMMUNICATION		direct	successful integration of experience gained from former events in future contingency planning
			personal and informal contacts

Figure 4: Reasons for developing best practices - data availability

As above visualized workshop participants assessed data availability as best practice example. Per definition, this means that there is a high expert satisfaction. Nevertheless, interviewees also mentioned remaining weak points: incomplete data collection, a lack of communication, a lack of knowledge transfer and missing implementation of modern technical tools. The following table summarizes actions for further optimization, recommended by the workshop participants.

MASTERING WEAKNESSES / Actions for continuing in the best practice category - Data availability			
WEAKNESSES	AVALANCHES	SOIL SLOPE FAILURES	FLOOD
INCOMPLETE DATA COLLECTION	recording of small events also	make documentation facilities user-friendly, thus improve data collection	make the data collection platform stable. This is important to obtain and import all data during the event of an incident
	legal obligation for documentation of events		make data collection tools user friendly and applicable at all levels
LACK OF COMMUNICATION	using photos to overcome language barriers between laypersons and experts	staff meetings or excursions could help to improve communication between emergency management experts and external authorities	
LACK OF KNOWLEDGE TRANSFER	updating and linking hazard zone and civil protection plans	special trainings for preventing and managing soil slope failures for people on site (e.g. volunteer fire brigade)	integrate the younger local community in risk prevention (e.g. for data collection) in order to pass on knowledge across generations
		revise contingency plans within the team to ensure that knowledge is refreshed and the team is updated	integrate different forms of knowledge and increase trust between different actors. Therefore, involve local managers and supraregional disaster control planners for contingency planning
		increase coordination between civil protection plan and hazard zone plan	
MISSING IMPLEMENTATION OF MODERN TECHNICAL TOOLS	data distribution must be optimized. Define who should receive what kind of data and apply new digital solutions	contingency plans need always an adaption. Use digital solutions and strict protocols that monitor all changes	integrate hazard and risk analysis systematically in the updating process of contingency plans
			encourage local users to use digital tools

Figure 5: Weaknesses and how to master them - data availability

6 RECOMMENDATIONS

a) General investment in digitization and the creation of a central natural hazard database

would be desirable. The qualitative workshops as well as the quantitative survey showed that the demands on a central database for the collection of floods / avalanches / soil slope failures relevant data and their distribution are diverse. A central database must be:

- usable for all levels (local, regional, national).
- easy and user-friendly to handle. Current solutions sometimes overwhelm the target groups. The challenge here is that the user groups are very heterogeneous in the case of a central solution.
- available online. Data must be available and importable on the move (e.g. via mobile phone).
- available offline in order to be able to access data independently from the internet in the case of an incident and also to be able to feed in local event data.
- have good logistics behind it, where it is controlled, which target group gets access to which data, providing the availability for analyses that serve political or scientific purposes.
- filled with both current and historical data. The database should have historical data entered, filled in as completely as possible (see legal recommendation) and, in the case of avalanches, also record small events. These points make the overall picture more complete and optimize the possibilities for preventive measures
- a merge of several already existing databases, provided by different institutions all over the countries, could be a first step to create a central solution
- follow international standards and best practices for the documentation of different natural hazards

A technical system that records data must be centrally coordinated and systematically structured. It is advisable to pursue transdisciplinary approaches in technical development, where users are involved in the development process. Only in this way a central database can be designed to be user-friendly and achieve a high level of acceptance.

Another challenge in terms of documentation is that hazardous events are often documented by different institutions according to their pursued goal or purpose. The depth of content for recording events therefore differs depending on the purpose of the documentation. A documentation scheme that allows to be filled by all actors with a uniform minimum input would be an advantage! In the sense of an international unification, standardized recording procedures should be available.

Experience has shown that a legal obligation to document events also significantly improves the data situation. Therefore, a corresponding change in the legal situation is recommended regardless of natural hazards. MORE data requires MORE data validation by experts. The latter requires a lot of commitment and time, which must be paid for.

b) Interface management – Knowledge transfer

Planner supraregional – local

In all workshops (soil slope failures, avalanches and floods) and the online survey, the necessity for closer cooperation between those who draw up a local emergency plan and those who work on higher-level hazard zone plans became apparent. Italy has presented a best practice example on how, after the hazard zone plans have been revised, further local emergency plans could be adapted. One can orientate oneself on their experience.

Planner – Manager

The next interface, namely the emergency planner and those who carry out an emergency response at the local level, requires an improved coordination. More local knowledge must be integrated into the

emergency plans and the natural hazard warning maps. Plans can become a dynamic control tool if they are kept well updated and local field experience is integrated. Modern digital solutions and strict protocols should support the development and adaptation of emergency plans. A control system can monitor changes, which can then be approved by certain persons in authority. Local emergency plans should be continuously renewed and always drawn up in a team between local knowledge carriers, emergency managers and supraregional experts (e.g. planners). It turned out that the coordination process itself is central. It promotes relationships of trust as well as the quality and accuracy of the contingency plans at the local level. Good data exchange is based on personal contacts.

Authorities – civilian population

Focus on the aspect of regional risk governance. That means, promote local self-responsibility and participation in risk prevention and at the same time ensure the quality and the external framework conditions. Create a basis for solidarity risk prevention between civil society and the state.

Promote risk awareness among the population as well as personal responsibility and self-efficacy. Civil society groups, not individuals, who share responsibility for local risk prevention and crisis management, distinguish best practice examples. Comprehensive training courses are required for this, both data collection and the use of data systems, as well as of professional training taking into account practical experience.

Intergenerational

The interface to the next generation must also be continuously renewed at the local level. The young local population must be integrated into prevention and emergency management at an early stage. It is important to train, inspire and intrinsically motivate the local population, especially the young, such that they can and want to make their social contribution to risk prevention and crisis management.

c) Risk communication

For improving information exchange between contingency planning and disaster management as well as the relation between those experts a yearly meeting/training between planner and manager would be recommended to encourage the development of maps in close cooperation and to communicate lessons learned from practical experience. A joint training on emergency cases would reveal gaps in communication as well as in the digital solutions used and can then be better implemented in existing disaster control plans. More exchange of data and information is not just wanted between contingency planning and disaster management, but also between the Alpine countries.

Risk communication between laypeople and experts

If local data is transmitted from laypeople to the subject matter experts, validation is required. There is not only a certain language barrier, but also a difference in specialist knowledge, which is why some methods have proven themselves here. Since local data can only be collected comprehensively with the help of local lay observer, it is advisable to pay attention to a few points:

- A stable lay network transmits local data to experts (planners, forecasters, etc.). These experts are able to assess the competence of the transmitter and thus the transmitted data well. (e.g. best practice example: avalanche Austria so-called weather and avalanche observer)
 - Unknown laypeople transmit additionally visual material for the linguistic description so that the experts can check the local dangerous situation more comprehensively.
 - A bilateral communication channel should be used, where further local information can be requested and misunderstandings can be clarified. In addition to data transfer, such channels can also be used to convey recognition, which ultimately has a motivating effect. Volunteers are intrinsically motivated, i.e. they want to feel they belong and know that their data matters.
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