

CapHaz-Net

Social Capacity Building
for Natural Hazards
Toward More Resilient
Societies

Risk Communication and Natural Hazards

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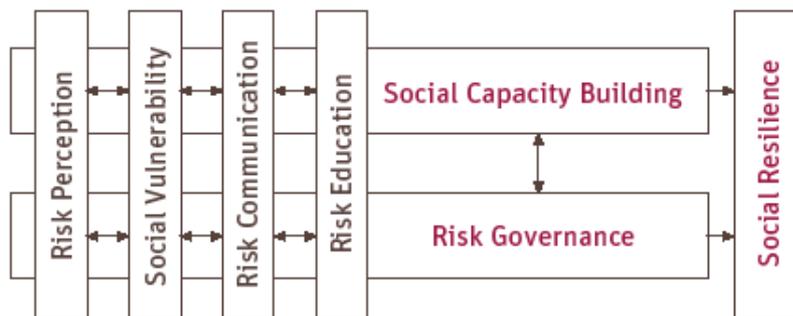
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Preamble

This report is a revised version of the Work Package (WP) 5 report on Risk Communication originally completed in May 2010. In the logic of the CapHaz-Net project it fulfils a specific function as one of the thematic work packages within the project, which directly relates to the other work packages, as shown in the figure below. Within the project, the central concepts of WP1 and 2 – social capacity building and risk governance – were identified prior to the project as the major framework concepts. These concepts directly relate to this WP5 on risk communication and all relate to the other thematic work packages on risk perception, social vulnerability, risk education and social resilience.



The original version of the report was presented at a workshop in Ljubljana, Slovenia, on the 7th and 8th June 2010 to a wider audience of around 40 participants. We have used the Ljubljana workshop to discuss the ideas presented in this report with a number of experts in this field and subsequently to improve the content of the report. Unlike the reports for WP1 and WP2, which are so-called 'living documents' that will be further enriched throughout the project, this document is the final version of the WP5 report.

The review of risk communication practices presented in this report has benefited from the expertise of many colleagues and communication practitioners in a number of European countries. In particular, we would like to thank Andreas Pichler, Teun Terpsta, Irina Stanciugelu, Alin Maghiar, Iuliana Armas, Nigel Watson, Edda Bergner, Christine Kehl, Gisela Wachinger, Simon McCarthy, Fiona Tweed, Blaž Komac, Christian Willi, Jelena Čalić, Marko V. Milošević, Wojciech Biernaki and Jarek Dzialek for contributing to the descriptions of communication practices (see Annex). We are grateful to experts in Austria, Germany, Switzerland, the UK, Italy, Spain, Norway, Finland, the Czech Republic, France and Spain for pointing us to insightful communication practices in the field of natural hazards. Finally, we are grateful to all participants of the Ljubljana workshop for their comments on the draft report and for sharing their experiences with us.

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Introduction to this report

In the logic of CapHaz-Net risk communication and risk education are two important means of social capacity building and hence crucial ingredients of resilient societies. Risk communication, as defined in this report, addresses the exchange of information, knowledge and attitudes between decision makers, experts, stakeholders, and the affected public and focuses on concrete risk situations. Risk education on the other hand refers to the transfer of more generalised (thematic, organisational or technical) knowledge on hazards and risks from professionals in teaching institutions (schools, providers of courses) to persons in schooling and training.

The first part of this report provides a state-of-the-art review on risk communication. In each section we first introduce literature on risk communication in general and then review the literature specifically on natural hazards. In the second part of the document we provide an overview of 60 natural hazard related risk communication practices in 16 countries in Northern and Western Europe, Central Europe, Eastern Europe and Southern Europe (full descriptions are provided in the Annex to this report). The goal is to provide an inventory of insightful practices with innovative and/or good qualities from which lessons and recommendations can be drawn. The review of communication practices considers all phases of the risk cycle (prevention/preparation, warning, emergency response, recovery/reorganization). However, the focus is clearly on communication to prevent/reduce severe impacts from natural hazards, to prepare people for natural hazards and to enable them to better cope with their consequences. From a risk management perspective, such communication mainly takes place in the prevention/preparation and the warning phase of the hazard cycle. Furthermore, this Work Package looks at communication between decision makers and stakeholders as well as between decision makers and the general public rather than between science and decision makers or among members of the general public. Both one-way and two-way communication processes are considered (e.g. maps, texts, discussions). To map the diversity of reviewed practices we introduce and apply a framework in the second part of the document.

Furthermore, we present empirical results of together three empirical examples of heat-related hazards, alpine hazards and plain floods to better understand the actual effects of risk communication in different contexts. These studies are:

- Heat-related hazards – The case of the 2007-2008 Barcelona Drought, Spain
- Alpine Hazards – Warning system in Vipiteno-Sterzing, Italy
- River Flooding – The River Elbe flood of 2002, Germany

Based on the inventory and the three empirical examples we give recommendations for future communication strategies. The report closes by outlining conclusions, open questions and research challenges.

1 Risk communication on natural hazards

Human communication has been studied in a diversity of disciplines, ranging from the early arts of rhetoric over psychology, sociology, anthropology, geography, organisation, management, and computer science to contemporary journalism and marketing.

Shannon's (1948, cited in Lindell and Perry 2004, p 21) traditional communication model has been the inspiration and basis for the bulk of the risk communication literature (Renn 2008). Basically, the model states that there is a source that sends a message through some channel to a receiver (see Figure 1). Whether this communication process should be one-way or allow an interactive exchange of information between those communicating has been the subject of long-standing contentions. Already Plato, favouring face-to-face dialogue, was suspicious of the public speakers of his day trying to persuade their audience of their positions. While recognising the goals of dialogue, his student Aristotle insisted that one-way communication could be ethical depending on the speaker's intention and character (Moser 2010).

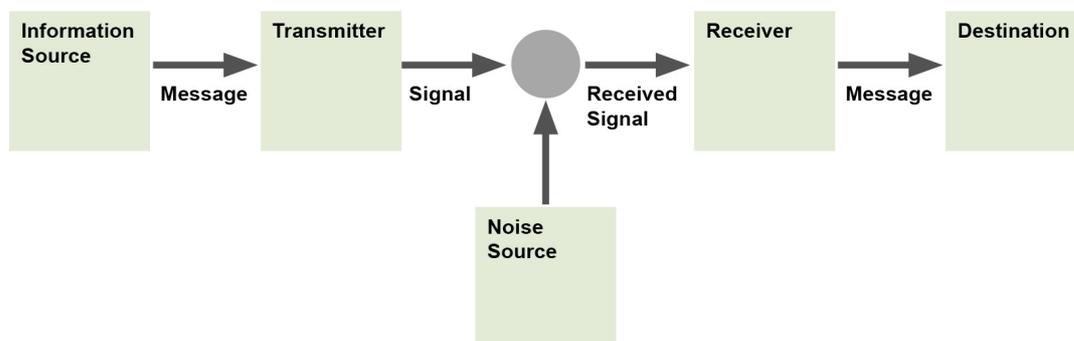


Figure 1: Sender and receiver model (adapted from Shannon 1948)

Applied to risk, communication might be defined broadly as a social process of information exchange between any entities in society on any form of risk (individual, social, political, environmental) that is purposeful or non-purposeful. In early risk management literature a narrower definition had become more widespread according to which risk communication 'usually focuses on an intentional transfer of information designed to respond to public concerns or public needs related to real or perceived hazards. Thus, risk communication incorporates tacit or explicit goals for targeted groups about specific events or processes' and it centres on the intentionality of the source of information and the quality of the information (Plough and Krinsky 1987, p 6). More recently, there has been a tendency to understand risk communication as an interactive *exchange* rather than a one-way transfer of information, knowledge and opinions among/between those responsible for managing risks and those who may be affected by hazard events (e.g. WHO definition <http://www.who.int/foodsafety/micro/riskcommunication/en/index.html>; De Marchi et al. 2006).

Box 1. How we define risk communication in this report

In this report we understand **risk communication** as both a one-way transfer of hazard and risk related information and their management, and as a two-way exchange of related information, knowledge, attitudes and/or values. We see risk communication as a preventive activity that prepares communicating actors for hazard events, that enables them to better cope with hazard events and which helps to reduce adverse impacts on people and social systems. Thus, we distinguish risk communication from **disaster, crisis** and **emergency communication** that tend to focus on communication activities during and in the immediate aftermath of hazard events.

Risk communication research has been extensive and substantial with respect to health, food safety, technological and chemical risks. The considerable body of literature that has grown from the 1970s onwards bears witness to the popularity and the significant changes that the concept of risk communication has undergone through the decades. It appears that at least in theory we can discern a move from simple to complex models (Walker in press). Such complex models attempt to embrace more thoroughly the complexity of hazard prone societies and the diversity of actors having a stake in or knowledge relevant to the management of risks and hazard impacts. In comparison, risk communication research in the field of natural hazards is arguably less developed and systematic to date.

Plough and Krinsky (1987) observe that while continuous academic interest in risk communication may be only a few decades old, the practice of embedding knowledge and memories of hazards in folk discourse and passing them on from generation to generation may be as old as the human culture itself (for more on risk and hazard communication in former times and the early role of the church as a dominant source of communication see e.g. Jakubowski-Thiessen 1992; Kempe 2007 and Rohr 2007). The nature of risk communication as a socio-cultural process of collective remembering and sense-making fundamentally changed with the rise of modern welfare states and institutions. Assessing, adapting to and communicating on risks increasingly became an expert-centred and professionalised task of emerging science and managing institutions. More recently, risk communication has been described as a vital activity that spans all successive phases of risk management. The IRGC Risk Governance Framework (Renn 2005) for instance stipulates communication as something that is needed from the framing of the risk situation to the implementation and monitoring of measures (see Figure 2). In the field of natural hazards, social scientists maintain that communication is vital before, during and after a hazard event (e.g. Lindell and Perry 2004; Steinführer et al. 2009). Or, from a managerial perspective, communication transcends and links the four main hazard cycle phases: prevention/preparation, warning, emergency response and recovery/reorganisation.

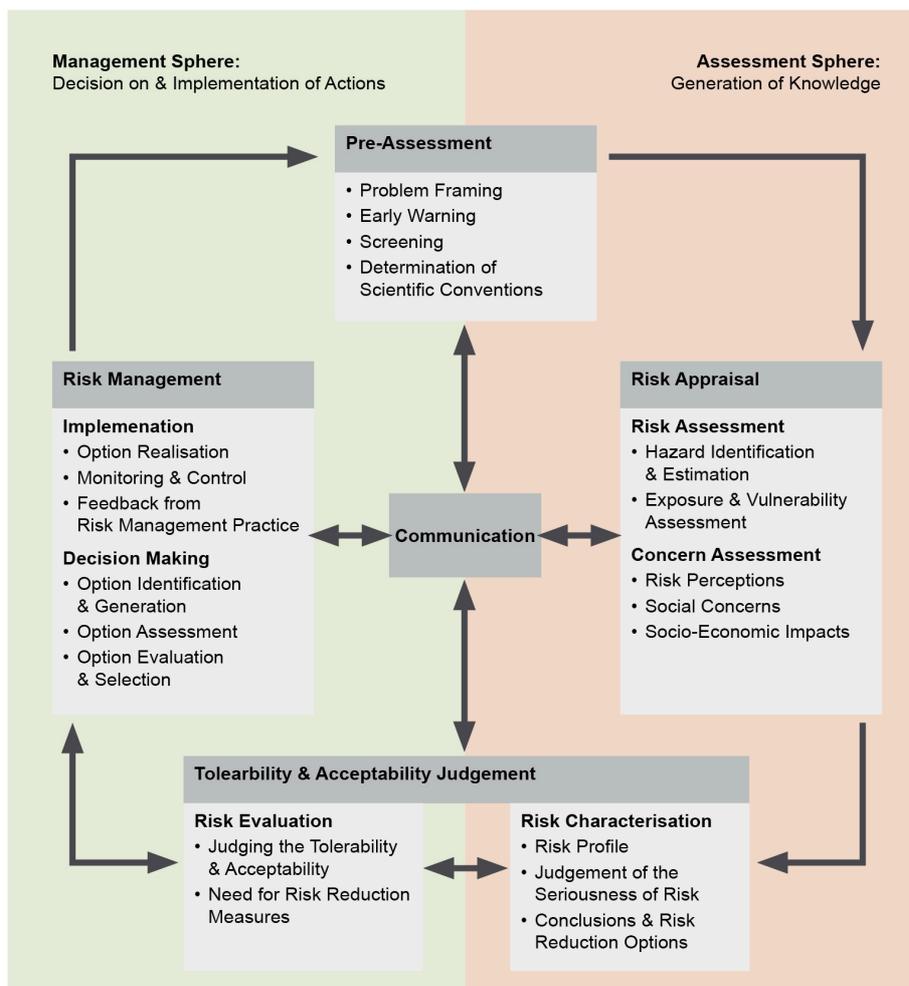


Figure 2: Communication and the five elements of risk governance (IRGC, 2009; p 65)

Indeed, communication on risks has been enshrined as a fiduciary responsibility of official bodies in a number of European and international policy documents (see box 2 overleaf), and has been translated into national law and regulation, though to varying extents across countries (see Wright et al. 2006). It is important to note that although guidelines on the communication of technological, chemical, food and health risks have emerged, there is hitherto no generic document that specifically sets out legal requirements or recommendations on the communication of natural hazard related risks at the European level.

Thus far, academic work has focussed on the management of risks by official bodies, whereas the ‘unmanaged’ or ‘unofficial’ side of risk communication has received not as nearly as much attention. It has only been recently that studies in a number of European countries, particularly on flood recovery, started to stress that when making their personal risk assessment people usually rely on information and advice that come from a number of sources, not only official ones (Parker et al. 2007; CapHaz-Net WP3 report on risk perception by Wachinger and Renn 2010). Particularly at the local community level, communication through interpersonal

networks and information disseminated by acquainted and trusted individuals parallels official risk communication (Tapsell et al. 2005; Steinführer and Kuhlicke 2006; Biernacki et al. 2008).

Box 2: Legal Requirements and recommendations at the European level

Policy papers relevant to risk communication in general:

- European White Paper on Governance 2001 (transparency in decision-making processes)
- IRGC White Paper on Risk Governance; OECD Guidance on Risk Communication for Chemical Risk Management (stakeholder participation, information)
- Seveso II directive (public information, involving the public)

Policy papers relevant to risk communication on natural hazards:

- Aarhus Convention (access to environmental information, public participation in decision-making)
- Sustainable Development Strategy (inform citizens and involve them in decision-making)
- Water Framework Directive (participation of stakeholders and the public in the management of resources)
- European Union Directive 2007/60/EC on the Assessment and Management of Floods (involving interested parties in the production, review and updating of flood risk management plans)

1.1 Evolution of risk communication

In this section we outline the most relevant developments that have engendered the move from simple to more complex understandings of risk communication.

A number of authors have traced the development of risk communication as a popular concern in theory and practice. Frewer (2004) suggests that there has been a refocusing of the official goals of communication from changing public views on risk in the 1970s, to gaining public acceptance for the sources of risk and their management, and more recently, to the building of trust in risk management bodies. Plough and Krinsky (1987) have argued that it was the need for risk managers to gain public acceptance for policies and technologies that significantly stimulated the study of risk communication in the first place. It is important to note that some authors have explicitly cautioned against an unbalanced re-emphasis on communication exercises that serve solely to increase public trust and consent, rather than on facilitating stakeholder and public dialogue as a contribution to mutual learning and innovation (Irwin 2006; Wynne 2006). Leiss (1996) has identified three phases of risk communication in the US:

- 1) One-way communication to primarily convey probabilistic information, to educate the public at-risk, and to gain consent over risk management practices and measures.
- 2) Persuasive communication to change people's risk related behaviours.
- 3) An emphasis on two-way communication and exchange in which all actors should engage with and learn from each other (Renn 2005).

One reason for the increasing interest in two-way communication has arguably been the failing of previous communication efforts to deliver the desired changes in risk related attitudes and behaviours (e.g. Kollmuss and Agyeman 2002).

This development has been associated with changes in the literature on risk in general. Bennett and Calman (2001, p 3) note that “there has been a progressive change in the literature on risk: from an emphasis on ‘public misperceptions’, with a tendency to treat all deviations from experts estimates as products of ignorance or stupidity, via empirical investigation of what actually concerns people and why, to approaches which stress that public reactions to risk often have a rationality of their own, and that ‘expert’ and ‘lay’ perspectives should inform each other as part of a two-way process.”

Below we give an overview of developments that, we assume, have concurrently influenced the thinking about risk communication in general and, more specifically, in the field of natural hazards:

- The technocratic approach to science, technology development and management became subject to social science critique from the late 1980s onwards. Critics argued that science and technologies themselves had become sources of risk as an increased production of knowledge correlated with greater gaps in knowledge and uncertainty about the impacts of innovations (Douglas and Wildavsky 1982; Beck 1986; CapHaz-Net WP2 report on risk governance by Walker et al. 2010). Consequently, risk communication was urged to move away from the back then dominant deficit-model (communication from a source of absolute authority to an audience that is assumed to be deficient in its understanding of risks) to a communication model in which both experts and non-experts openly acknowledge the limits of their knowledge and engage in a mutual dialogue on the benefits and on acceptable risks. The incorporation of a variety of values, knowledge and belief systems would accordingly broaden the societal basis of decisions on science and technology developments.
- Triggered by a number of regulatory scandals such as the BSE, GM food and dioxine crisis, academic studies found a decline of public trust in official bodies in European countries from the 1980s onwards (Lofstedt 2004). Indeed, public (mis)trust in authorities and science has been a key concern in the risk literature since then. To restore trust many authors call for greater stakeholder and public participation in risk management. Risk communication should therefore enable mutual exchange of opinions and provide information in a transparent and open way.
- Significant progress in the study of risk perception and information processing over the last decades has shown that while there is a relationship between knowledge and behaviour this link is neither simple nor straightforward. People select, interpret and evaluate information and uncertainty differently depending on their personal mental models, risk framings and situation (see WP2 and WP3 reports on risk governance and risk perception respectively). Also, the idea that ‘objective’ knowledge on the probability and dangerousness of hazards necessarily leads to specific protective behaviours has been proven too simplistic. Rather, an array of attitudinal and motivational resources, capacities and norms determine whether knowledge is transferred into action (see also the CapHaz-Net WP3 report on risk perception by Wachinger

and Renn 2010, and section 1.5 in this report). Hence, communication should not be limited to information on objective characteristics of hazards or the involved risk but needs to make efforts to influence the diversity of behaviour-relevant factors in concert.

- As in the fields of health and science and technology, participatory and deliberative thinking gained ground in environmental policy and natural resource planning from the 1980s onwards. Arguably fuelled by the emerging sustainability paradigm and the rise of participatory critiques of purely technocratic approaches the field opened, in theory and practice, to innovative thinking about opening-up appraisal and decision-making to a wider range of actors (Fischer and Forester 1993; Healey 1993; Parkins and Mitchell 2005). Collaborative, interactive or communicative planning, consensus building and co-operative discourse (Fischer and Forester 1993; Healey 1993; Innes 1996; Margerum 2002; Sager 2002; Renn 2006) are all concepts and models that understand management and planning as processes that should be inclusive and provide meaningful spaces for interaction and deliberation. Communication and deliberation through dialogue, i.e. an open exchange of arguments (for more see for example Chambers 2003; Delli Carpini et al. 2004; Parkins and Mitchell 2005), are expected to impact favourably on participants' mutual relationships (e.g. trust, willingness and ability to work together), their mutual understanding, their ability to reflect critically on and discuss issues, and to facilitate high-quality agreements, new problem framings and options (e.g. Fiorino 1990; Buchecker et al. 2010). This development certainly has some relevance for risk communication on natural hazards since the planning of land-use and natural resources is increasingly considered as an important non-structural prevention measure. Conflicts between land-use policies and hazard mitigation agendas have been observed in a number of countries (see also WP4 report on social vulnerability by Tapsell et al. 2010).
- Related to the aforementioned developments is the changing nature of governance and the management of natural hazards from simply finding a technical solution and providing emergency recovery to more integrated models that also pay attention to prevention and preparation (see CapHaz-Net WP2 report on risk governance by Walker et al. 2010). As early as the 1990s, Mileti and his colleagues (Mileti 1999) promoted a more precautionary and sustainable hazard mitigation approach for affected communities. Fostering local sustainability in its widest sense (ecologic, economic, social and cultural) is seen as the best way to make communities more resilient to natural hazards, among other threats. This shift brings new challenges for communication which, as a consequence, needs to be tailored to a variety of purposes and communication needs (prevention, preparation, warning, emergency response and recovery), and to the characteristics and perceptions of actors (state and non-state agencies, organisations, groups, the public) at different levels.

Overall, the existing literature shows that the task of risk communication has become more challenging and more complex. The increasing number of actors that are perceived to have a legitimate stake or right to be involved in risk management and governance comes with multiplying expectations of how risk communication should be enacted and what it should ideally achieve.

Hence, sophisticated communication models are needed to do justice to the complexity, ambiguity, and multi-faceted nature of risks and their perception as well as to enable actors to implement normative principles of good risk governance and management.

1.2 The pillars of risk communication: actors, purposes, modes, tools and messages

This section briefly reviews key elements of risk communication. Key elements are the actors or communicators (or audience and messengers) and the purpose and content of messages, as well as communication modes, channels and tools.

Actors

Communication occurs between individuals, groups, private and public institutions, in small or mass communication settings. Communication may take place within and across local, regional, national or international levels and involved actors can be regarded as nodes in communication chains or networks between which information flows in one or many directions. The strength, stability, frequency and direction of the information flow, and the centrality of the actors (i.e. whether one actor/node is more central because it communicates with all other actors, whereas all others do only communicate with this central actor) are the defining characteristics of such networks. Gray et al. (1998) identify the following general categories of actors in risk communication:

- government (local and central) and regulatory agencies
- politicians
- scientists and experts
- industry
- trade unions
- non-governmental organizations and groups
- the exposed/concerned/affected public
- the general public
- the mass media such as local and national television, radio and newspapers (for more on the role of the media see box 3 overleaf).

While there is no consistent terminology throughout the risk literature, authors tend to speak of experts and decision-makers (e.g., scientists and experts, decision-makers and managers in government and regulatory agencies) on the one hand and stakeholders (e.g., nongovernmental organizations and groups, industry, trade unions) and the public at-risk, concerned or affected on the other hand (see box 4 for more on the identification of stakeholders).

Another broad distinction is between the source or messenger (e.g., scientific community, agencies, interest groups, eye-witnesses, media), transmitters (e.g., media, institutions, interest groups, opinion leaders) and receivers or audiences (e.g., general public, affected citizens,

groups members, experts, managers, institutions, media) of communication (e.g. Renn 2008). Needless to say that, in reality, one actor can have multiple roles in the communication process. The media, for instance, can be the receiver and transmitter of (scientific) communication as well as one source that generates risk related messages.

Box 3. The media as a vital actor in risk communication on natural hazards (see also CapHaz-Net WP6 report on risk education by Komac et al. 2010)

The media are key mediators of communication between the public, science and the political and management spheres on collective challenges such as natural hazards and climate change (Beck 1992). Mass media outlets such as television, the radio or the press make the same information available to various audiences, even across geographical and political borders. They hence act as 'social glue' with respect to the perception and interpretation of natural hazards in heterogeneous societies (Miles and Morse 2007).

Many scientists, particularly in the field of climate change, maintain that mass media portrayals can substantially influence their audiences' understanding of the issues at hand, related attitude formation and policy agendas (e.g. Boykoff 2007; Carvalho and Burgess 2005; Doultou and Brown 2009; Wilson 1995). Whitmarsh and colleagues (forthcoming 2010) suggest that, with respect to climate change, long-term media campaigns can generate and sustain awareness across large proportions of the public, while new interactive media can support the involvement of the public in decision-making. Regarding natural hazards recent research in Canada suggests that press coverage of flood events indeed affects readers' perception of risks and their preference for structural flood alleviation measures (Rashid 2010). Yet, it is not only the perception of risk and hazards that can be influenced by media representations but also the ways people evaluate other actors' (e.g. government, risk managers, scientists) handling of risks and the trustworthiness of their performance. Media coverage furthermore conveys different pictures of the people at-risk that can impact on their perception of their own responsibilities, their agency and their own capacities to manage risks and to cope with potentially hazardous events (Höppner 2010).

Whether the media actually set the agenda by constructing its own stories on hazards rather than reproducing the problem frames of other actors such as risk managers or scientists depends on many factors (Vasterman et al. 2005). Indeed, while in some cases the media disseminates official information to the public, in other cases it propagates its own problem definition, causal interpretations and recommendations for solving problems (Entman 1993; Lakoff 2010). Constructing problem frames involves a process of information selection and weighing which inevitably results in the amplification and attenuation of risks or other aspects of perceived reality. At times, the alternative frames of different actors stand in conflict. For instance, while risk managers are interested in emphasising prevention and reassurance, reporters are more likely to be drawn to sensation, conflict and drama (Vasterman et al. 2005). Journalistic norms such as newsworthiness and dramatisation, specific editorial practices and 'ideological cultures' of media outlets are important factors that shape how the media frames issues and related coverage (Boykoff 2007; Carvalho 2007). Scale seems to be another defining factor in this respect. Wilkins (2000) shows that national media in the US tended to de-contextualise flood events by focussing on the event rather than on its causes and mitigation measures. In comparison, local press coverage was more sustained and provided a more in-depth and context specific discussion.

There are therefore downsides to media communication on natural hazards. Particularly in situations of potential conflict (e.g. due to different preferences for prevention measures) or in the aftermath of a disastrous hazard event so-called media hypes produce a considerable amount of coverage. By using these 'windows of opportunity' such communication potentially gains the attention and interest of a large audience. However, the ways hazards and issues are reported within these windows are usually very narrow, focussing on 'a small number of mediagenic topics and information...that jam the media' (Miles and Morse 2007, p 367). This leaves little room for other actors (such as government, risk managers, scientists) to bring in their own messages. Furthermore, media attention tends to focus on events rather than on sustaining awareness for the topic in 'quiet times' of no immediate danger. Sociologists have pointed out that in our post-modern 'risk society' (Beck 1992) people feel threatened by a myriad of risks that exist only in terms of knowledge. The constant dissemination of related information through various media might make people feel cognitively saturated and reduce their willingness and ability to process further messages.

Finally, we should stress that the media is only one actor among others. It thus competes with other sources of information in the formation of people's perceptions (Wakefield and Elliot 2003).

The constellation of actors in the handling of risks and thus communication is usually described as being diverse and multi-scaled in nature (see CapHaz-Net WP2 report on risk governance by Walker et al. 2010). While these constellations are likely to differ between natural hazards and human-induced hazards, this has as yet to be discussed as an explicit subject in the risk literature. One might argue, however, that while the debate on the risks and benefits of science and technology is continuously advocated by actors with strong specific interests (e.g. consumer organisation, nuclear industry lobby, GM food association), this seems to be still less the case for natural hazard-related risks and their management. In the UK for instance, it has only been recently that the National Flood Forum started to support and campaign for residents affected by floods and that local Flood Action Groups formed to lobby local and central government for action on flood defences, better insurance rights etc.

In some cases, the constellation of actors might be even more complex in the field of natural hazards as actors with responsibility for, or with a stake in the handling of, natural hazards and risks differ not only between risk management or governance phases (pre-assessment, appraisal, characterisation/evaluation, management) but also across risk phases before, during and after a hazard event and across different spatial levels. Coulthard et al. (2007) present an example of the complex range and breadth of actors involved in flood risk management in the floods of June 2007 which affected the city of Hull, in the North East of England. New legislation, in the form of the Flood and Water Management Act 2010, attempts to rectify the problems of coordination that occurred when many different actors were involved in different aspects of flood risk management.

Box 4: Identification of stakeholders

The identification of actors is a perennial issue. Particularly for stakeholders there is no universal way to establish who has a stake in the handling of risks. In the environmental management literature, four criteria for selecting stakeholders have come to prominence, that is power, legitimacy, urgency and proximity (Mitchell et al. 1997 as adapted by Driscoll and Starik 2004 and Stanghellini and Collentine 2008).

Power refers to the extent to which a stakeholder had and has means to influence management and decision processes. **Legitimacy** is the degree to which the stakeholder's concerns and interests represent the values and beliefs within the wider social system. **Urgency** is defined as the immediacy or criticality of the stakeholders concerns and requests. And finally, **proximity** is 'the state, quality or fact of being near or close in space to the area affected' (Stanghellini and Collentine 2008; p 322). The latter criterion is most apparently related to the vulnerability assessment literature in that it grants people who are prone to hazards and their impacts to have a stake in the handling of these risks (see also WP4 report on social vulnerability by Tapsell et al. 2010).

However, as yet, research has not explicitly addressed whether the four-criteria approach of power, legitimacy, urgency and proximity would work for identifying stakeholders in the context of natural hazards.

There are hardly any attempts to map actors in communication before, during and after an event. Dobrot and Parker (2007) have undertaken to sketch the complex flow of information, data etc. within flash flood forecasting, warning and response (see Figure 3). Parker and Handmer (1998) have provided an insightful comparison of the communication flows between actors in a flood-warning situation from the perspective of official bodies, on the one hand and from the perspective of floodplain occupants, on the other (see Figures 4 and 5).

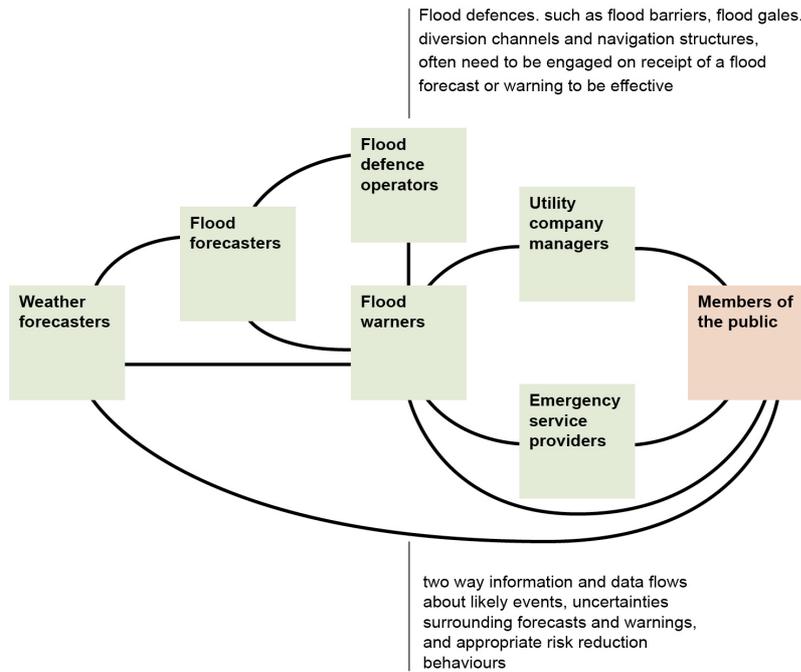


Figure 3: Communication between actors within flash flood forecasting, warning and response (Drobot and Parker, 2007)

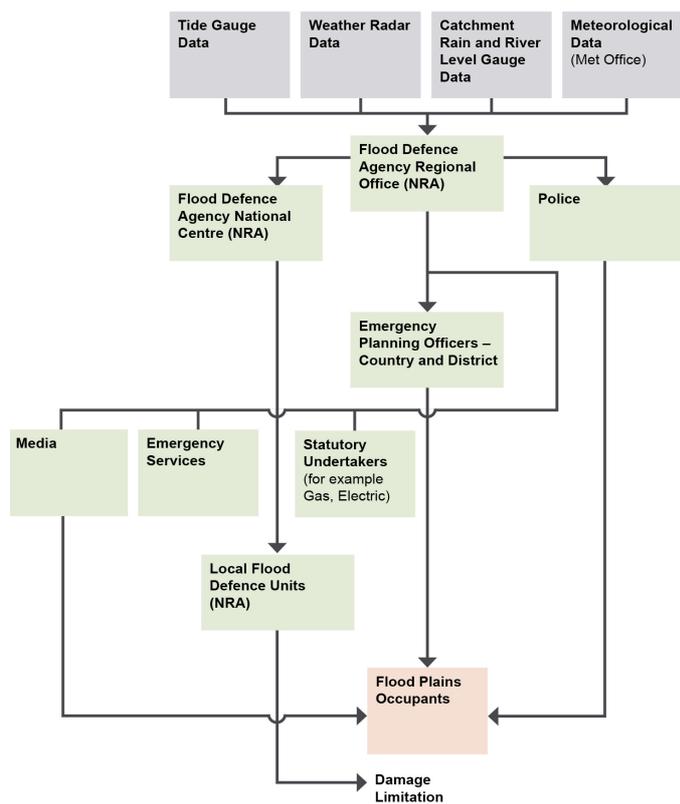


Figure 4: Communication between actors within flood warning from the perspective of official bodies – Risk communication within the management domain (Parker and Handmer 1998)

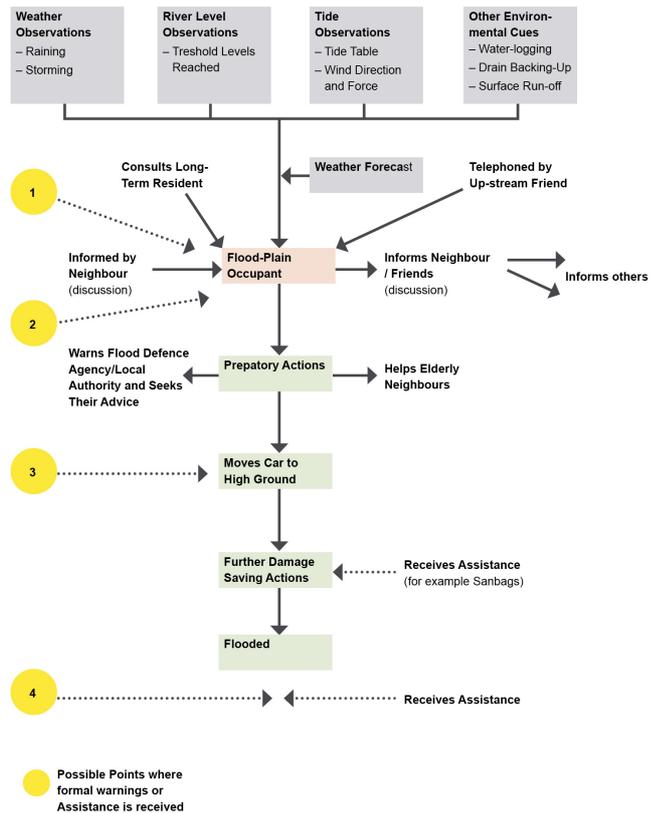


Figure 5: Communication between actors within flood warning from the perspective of floodplain occupants – Risk communication outside the management domain (Parker and Handmer 1998)

Purposes and functions

The literature on the purposes of risk communication generally takes a management perspective. Accordingly, risk communication may serve to:

- raise awareness;
- encourage protective behaviour;
- inform to build up knowledge on hazards and risks;
- inform to promote acceptance of risks and management measures;
- inform on how to behave during events;
- warn of and trigger action to impending and current events;
- reassure the audience (to reduce anxiety or 'manage' outrage);
- improve relationships (build trust, cooperation, networks);
- enable mutual dialogue and understanding;
- involve actors in decision making.

Clearly, not all communication seeks to convey information and knowledge only. It might also have a more social or – from the perspective of the communicating entity – a more symbolic function. Specifically, an institution or a company may use communication to display competence, control and confidence (Plough and Krinsky 1987). From the perspective of risk communication as a social practice embedded in a wider political and cultural context, communication is a process in which 'relations of responsibilities' (Bickerstaff et al. 2008) between individuals and institutions are constructed and issues are framed, assessed and evaluated. Communication might hence be less about specific risks per se than on assigning duty, authority, rights and blame, and on negotiating the ownership of risks. As mentioned before, communication is also the means through which memories and experiences are held alive and passed on.

In the logic of CapHaz-Net, then, communication is also one way to promote the development of social capacities that are needed to better prepare for and cope with natural hazards at the individual, group, community and organisation level. Table 1 gives examples of communication purposes and functions in different risk cycle phases (for more on communication purposes by hazard management phases see Lindell and Perry 2004).

A point to add is that communication efforts at the national or more local level do not necessarily serve all these purposes and functions to the same extent. There might be a bias towards for example communication to assure safety rather than communication to raise awareness or to assess and evaluate risk situations (e.g. Terpstra 2009). An emphasis might also lie on promoting trust in authorities and acceptance of mitigation measures rather than on facilitating mutual exchange and understanding among stakeholders (Irwin 2006, Wynne 2006). And finally, communication purposes can be seemingly conflicting, e.g. a public relations manager of potentially hazardous industries might want to reduce public concerns, whereas other actors might aim at increasing people's concern to trigger their preparedness and protective actions.

Table 1: Examples of communication purposes and functions in the natural hazards risk cycle

Before event Prevention and Preparation	During event Warning and emergency response	After event Recovery and Reorganisation
Awareness raising	Warning of event, announcing emergencies	
Encouraging specific protective behaviours	Triggering behavioural response by people at-risk and those managing the risk, e.g. close flood barriers, begin to mobilize emergency resources	Encouraging specific behaviours
Information provision, where and how to get information, how to read information, on specific actions that can be taken	Information provision and coordination, what to do and whom to contact	Information provision and coordination of tasks
Reassurance, outrage management	Reassurance, outrage management	Reassurance, outrage management
Building authority and assigning responsibility, improving relationships and building trust	Stimulating compliance with those in authority	Building authority and (re-) assigning responsibility, improving relationships and building trust
Keeping memory alive		Keeping memory alive
Pre-assessing, appraising, and evaluating risk; planning and implementing measures, evaluating measures and communication		Assessing the situation, planning and implementing recovery measures, evaluating performance of measures and communication
Mutual understanding and learning (from different perspectives, types of knowledge and opinions)		Learning from past event

Modes, Channels and Tools

Ideally, the choice of communication modes, channels, and tools is guided by the purposes and functions of communication. Communication occurs in **written** (e.g. newspaper, letter, report), **verbal** (e.g. lecture, storytelling, conversation) and **non-verbal/visual** modes (e.g. gestures, body language, sign language, facial expression, graphics, movies). A further common distinction is between a **one-way communication** mode in which information is transferred in one direction, and a **two-way-communication** mode where information flows in both directions between the communicating actors. Two-way communication takes a non-dialogical form if one actor consults the other and a **dialogical** form if actors engage in an interactive exchange of information. Communication channels are either **face-to-face** (direct) or **mediated** (indirect). They target a specific or a diffuse audience that might consist of one, few or many actor/s. Considering a time dimension one might further distinguish between communication as one-off, repeated or more continuous activity. Figure 6 maps different modes of communication according to the direction of the information flow and the number of actors.

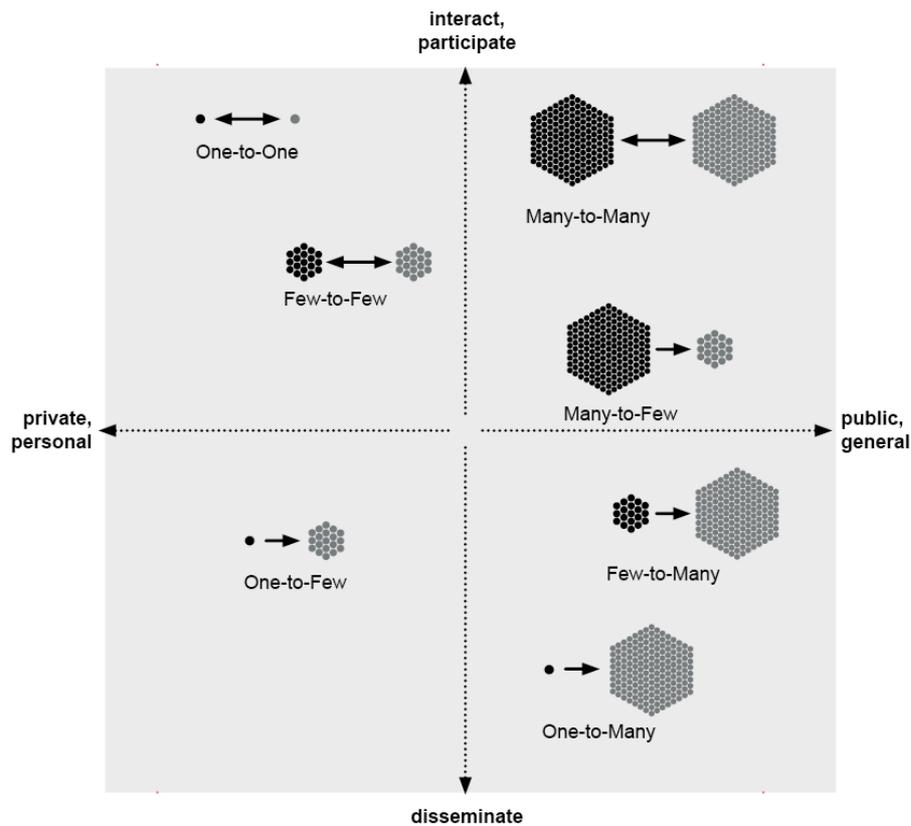


Figure 6: Modes of communication (adapted from Becker et al. 2009)

Communication modes and channels should match with appropriate communication tools (which might be technology-assisted tools or not). For example, face-to-face communication at individual or small group level can be realised through meetings, focus groups or lectures, whereas letters, reports, telephone and videoconferences are tools of mediated communication. To communicate with a larger audience, brochures, leaflets, booklets, mass media and social marketing tools might be particularly suitable. However, throughout the risk literature there are hardly any clear typologies of communication tools. Looking beyond this literature, specifically in works on the participatory planning and management of technologies and natural resources, tools are most commonly categorised by the direction and the purpose of communication (see Table 2 and for another extensive typology see Rowe and Frewer 2005).

As with risk communication studies in general, comprehensive overviews of communication tools are rare in the field of natural hazards too. Exceptions are Tapsell et al. (2005) who provide a summary of technology-assisted tools to disseminate flood warnings and McCarthy (2007) who lists intra- and inter-organisational communication tools in flood warning, prevention and response (see Tables 3 and 4). Hagemeyer (2007) gives an overview of communication tools organised by the spatial level at which they are usually applied in five European countries

(see Table 5). Such comprehensive reviews of existing and potential tools are, to our knowledge, still lacking for natural hazards other than floods.

Table 2: Examples of communication channels and tools according to the purpose and the direction of communication (adopted from Burgess and Chilvers 2006)

Purpose and direction of communication	Description	Tools
Information provision (also education) One-way communication	- At-a-distance/indirect communication of information with no feedback mechanism	- Leaflets, brochures, information packs, video, newsletters - Reports, documents, protocols - Exhibitions/displays (non-staffed) - Advertising - Media (TV, radio, newspapers) - Internet (information provision)
Information seeking/consulting, non-dialogical two-way communication	- Communication to receive feedback from all types of actors - Communication is either indirect or face-to-face	- Site visits - Exhibitions/displays (staffed) - Open house - Consultation document - Internet (information/feedback) - Free telephone line (automated and staffed) - Teleconferencing - Public meeting - Public inquiry/hearing - Deliberative opinion poll
Dialogue, two-way communication	- Enable mutual exchange and understanding - engage participants in interactive framing and appraisal processes and/or the evaluation and prioritisation of options - Identify areas of consensus and differences on issues	- Community Advisory Committees - 'Planning for real' - Meetings - Visioning - Deliberative Workshops - Internet Dialogue - Consensus building/conference and mediation - Deliberative mapping - Citizen panels - Citizen juries

Table 3: Technology-assisted communication tools for flood warning dissemination in the UK (Tapsell et al. 2005)

Well-trieed and in use	Comparatively new and in use	Near future, potential and/or advanced
- Standard analogue telephone - Door knocking - Mobile loudhailer - Written communication - Flood wardens - Flood sirens - Radio telephone/VHF - Radio - Facsimile	- Press-button digital Telephone - Mobile Telephone and voice mail - Pagers - Automatic voice messaging (AVM) using telephone - Teletext - Dial-and-listen services (e.g. Flood-line) - Television/radio broadcast - Signage e.g. flashing signs Intranet and internet websites with real-time warnings - Electronic mail	- Mobile telephone sms text messaging and sms cell broadcast - Digital TV and digital audio broadcast - Dedicated public address systems - Wireless application protocol telephones - Centrally activated in-home alert systems - Integrated dial-and-listen and AVM services - Real time flood data on web; including livecams - Third and fourth generation mobile telephones

Table 4: Flood risk communication tools at the national level in the UK (McCarthy 2007)

Phase in the risk cycle and actors	Communication tools
<p>Flood Forecasting, Warning and Response <u>Actors in communication:</u> - Government and regulatory agencies (Environment Agency (EA), Met Office, Department for Environment, Food and Rural Affairs (Defra), Emergency service bodies, Home Office) - Academics and consultants - Insurers Association of British Insurers (ABI) - Other stakeholders - Media (BBC, ITV)</p>	<ul style="list-style-type: none"> - Radar-based products - Nowcast, 6h deterministic forecasts - Soil moisture models - Monthly report - Heavy rainfall warnings - Post event maps or digital data - Project-focused meetings, e-mails and telephone conversations - Environmental Agency (EA) regional forecast modeling - EA warning codes by fax and telephone to professional partners - Preparation exercises and meetings - Research programmes - Conferences/seminar presentations
<p>Land use planning and development control <u>Actors in communication:</u> - Government and regulatory agencies (Communities and Local Government (CLG), Environment Agency (EA), Defra, Department of Trade and Industry (DTI), Department of Transport (DOT), Treasury) - Trade bodies: Local Government Association (LGA), Royal Town Planning Institute (RTPI), Chartered Institution of Water and Environmental Management (CI-WEM), Planning Officers, Royal Institution of Chartered Surveyors (RICS) and others - Insurers (ABI) - Academics and consultants</p>	<ul style="list-style-type: none"> - Policy documents and guidance - Consultation on draft policy documents - Stakeholder Forum - Regular meetings, emails and telephone interaction - Conference/seminar presentations - Website

Table 5: In use communication tools by spatial level of application (adapted from Hagemeyer 2007)

Local	Local-regional	Local-national	National-international
<ul style="list-style-type: none"> - Activities (festivals, charity events) - Presentations - Public discussions - Information events - Emergency training - Quiz - Public displays - Municipal gazette - Info letters - Flood columns and boards - Education trails - Citizen initiatives 	<ul style="list-style-type: none"> - Risk and hazard maps - Telephone Hotlines - SMS 	<ul style="list-style-type: none"> - Exhibitions - School days - Fairs (Flood fairs) - Leaflets, brochures, fact sheets - Articles in press media, radio and TV features - Blogs - Internet - Newsletters and mailing lists - WAP/i-mode 	<ul style="list-style-type: none"> - Thematic books - TV and video documentaries (e.g. 'Xynthia – Chronicles of a catastrophe') - Talk shows

A final observation at this point is that, at present, it seems to be common sense that risk communication needs to employ and combine a variety of communication channels and tools to be effective (e.g. Tapsell et al. 2005). For instance, Wagner's (2005) recommendation for hazard prone communities is to complement continuous/permanent communication through 'quiet wit-

nesses' such as high-water marks, or objects that indicate the areal extension of past hazard events and information boards located next to eye-catching structural measures, with occasional exercises by fire or civil protection services. While the first may help to keep memory and knowledge of past events alive, the latter might additionally stimulate people's interest in taking preventive actions.

Message

According to Sorensen (2000, p 121) the 'style and content of a message can have a dramatic effect on public response'. Developing and presenting a message is hence key for making communication effective. As a universal principle, the **content** has to fit the needs of the audience and the requirements of the risk communication situation. Sorensen (2000) for example holds that across the spectrum of natural hazards each public warning message should include the nature, the location, guidance, time and the source of the expected hazard event or risk.

Transparency (includes openness, honesty and comprehensiveness) in communication appears to be the single most called for principle of good communication not only with respect to natural hazards but with respect to environmental issues in general. It is said to have crucial implications for the trustworthiness of communicators and the credibility of their messages. This implies that the content of communication is not only on what is known but also on uncertainties and what is unknown (see also the section 1.4). Accordingly, it is best to 'acknowledge uncertainty; explain why it exists; describe what, if anything, can be done to get a better handle on it; and explain how the risk can be reduced in the meantime' (Lundgren and McMakin 2009, p 176).

Another well-established principle is that the **language** (as one aspect of style) and the terms used have to fit the audience rather than the other way around. For example, the meaning of expressions such as 'enhanced greenhouse effect' or '100-year flood' has been shown to differ between scientists and laypeople (Bell and Tobin 2007; Hassol 2008; Hagemeyer-Klose and Wagner 2009). Yet it is not only the meaning of words that defines the impact of language but also the connotations they evoke. For example, language can be positive and energetic or advocate fear, stress and powerlessness. In this way, communication can, over time, establish 'linguistic repertoires' (Ereaut and Segnit 2006) that people use to make sense of climate change or natural hazards and their role in it. The linguistic repertoire of alarmism that uses distress appeals to motivate attitude and behaviour change and that has been used in campaigns and in the media might have the opposite effect if ways to resolve the problem are not presented (Nerlich et al. 2010). Similarly, it is not yet fully understood how words like catastrophe, disaster or crisis, which are widely used to describe natural hazards and their impacts, influence people's perceptions of the same.

The use of metaphors, personal stories, non-expert icons, or art work to transport the message of climate change or natural hazards to wider audiences has recently received more attention from social scientists (Hassol 2008; O'Neill and Hulme 2009, see also section 1.5). More conventional means of presentation (the other aspect of style) include visualisations such

as illustrations, graphics, maps, charts, labels and time lines (for a comprehensive overview see Lundgren and McMakin 2009). A number of authors have emphasised that in risk communication using visual means is usually better than text only. However, if poorly designed, they are worse than no visual presentation at all (Hager and Scheiber 1997). Visual means are commonly used to personalise risks, to compare risks and to depict probabilities and/or uncertainties (see also section 1.5).

Finally, messages are always embedded in wider frames of meaning that 'include semantic roles, relationships between roles, and relations to other frames' (Lakoff 2010, p 71; see also box 3 on the media as an actor in communication). Carefully planning and actively reflecting on these frames when designing messages therefore seems to be key in good communication systems (Lakoff 2010). In the context of climate change, Spence and Pidgeon (in press) have recently shown that different framings (e.g. loss or fear frames versus gain frames) might be needed for promoting the acceptance of mitigation measures on one hand and triggering specific behaviours on the other hand. Lakoff (2010, p 79) argues further that good communicators need to combine frames and messages 'that are needed in the long run, as well as those needed to battle the right on issues of the day'. The lesson for risk communication on natural hazards is that -the effectiveness of short-term communication frames such as immediate warning may depend on the prior effectiveness of long-term frames such as risk communication to better prepare people for future events.

1.3 Conceptual approaches to risk communication

A burgeoning literature has advanced an array of approaches to risk communication, each stemming from somewhat different disciplinary backgrounds and highlighting different aspects of, and implications for, communication practice. The approaches mirror the different, above outlined, ideas about what the purposes of risk communication are.

General approaches

A selection of the most common approaches to risk communication according to Lundgren and McMakin (2009) is given below.

- **Communication process approach:** Proponents of this approach are interested in studying the single components of the risk communication process: sender, message, receiver, and their mutual relationships. These works are largely influenced by classical communication studies and depart from an understanding that ***each component of the model has to be taken into account when developing communication*** (Lundgren and McMakin 2009).
- **Mental model approach:** The analysis of characteristics, needs and existing beliefs of the audience and how it views risks and potential impacts is at the core of this cognitive psychology inspired approach. One explanation for the continuing popularity of this approach is the desire to better understand which information the audience needs to come to informed decisions. While better ***understanding the characteristics and needs of the audiences is ap-***

parently pivotal for tailoring effective communication, the mental model approach has been criticised as it does not necessarily overcome the ‘dichotomy between expert judgement and lay perception of risk and hence the view that risk communication is all about information transfer from experts to lay people’ (Plough and Krinsky 1987; Morgan et al. 2001), i.e. it is all about remedying a public deficit (see Lundgren and McMakin 2009 for a comprehensive discussion on how to assess the characteristics of the audience and its communication needs).

- **Culture and ethnicity approach:** Lindell and Perry (2004) elaborate the implications of culture and ethnicity for risk communication efforts. They argue that risk communicators need to understand the general characteristics of the ethnic subcultures in affected communities. Cultural norms, language mastery, household structures and role obligations can affect whether people receive information, their response time and as to how they interpret the situation (see also section 1.5). Ethnicity associated with characteristics such as income, education, housing quality and access to community resources and assistance has been shown to impact on the effectiveness of communication. There appears to be general differences between individualist and collectivist cultures too. Perry and Hirose (1991, cited in Lindell and Perry 2004, p 21) for example found that ‘Japanese are more likely to feel a sense of responsibility to a larger number and range of family and friends (the collective) when relaying warning information than are Americans’. Closely linked to this approach is the issue of transient populations and its implications for risk communication¹. Tourists or newcomers are likely to lack the same knowledge, experience and training as long-term residents and may hence have different communication needs. Increasing human mobility also comes with a leakage and a draining of knowledge from hazard prone communities which potentially erodes a vital basis for local risk communication practices.
- **Crisis communication approach:** According to this approach, the purpose of communication is to trigger appropriate behaviour in cases of emergency. The risk managing organisation ‘knows what is best for the audience’ and essentially gives them *only the information* they need *to quickly master the emergency situation*, e.g. to leave for a safe place. Theories of persuasion usually serve as the basis for crisis communication. The efficacy of one-way communication to stimulate a prescribed behaviour is a main concern from this perspective (Lundgren and McMakin 2009).
- **Hazard plus outrage approach:** This approach focuses on the handling of emotions as reactions to risk situations and management actions. From this perspective, *communication* has the function *to forestall or manage outrage or anxiety* by addressing the audience’s feelings.
- **Social network contagion approach:** Advocates suggest that, rather than targeting individuals, risk communicators should think and work through the social networks of communities. The underlying assumption is that people rely more on advice, opinions and behaviour from people that surround them in their daily lives. A promising way to get across messages and to

¹ We thank Fiona Tweed for this suggestion.

encourage specific actions in the face of risk might thus be to **team up with 'key social leaders'**.

- **Convergence communication approach:** This approach goes back to Everett Rogers (Rogers and Kincaid 1981) who thought of communication as an 'iterative long-term process in which values (culture, experiences and background) of the risk communication organisations and the audience affect the process of communication' (Lundgren and McMakin 2009, p 15). This acknowledges the importance of values for the process and outcomes of risk communication, meaning that communication must be able to facilitate the gradual elicitation and exchange of these values. Hence, **involving the audience in a lasting dialogue rather than through one-off and one-way communication** is the main implication for risk communicators adhering to this approach. In this way, communication might help to anticipate and mediate conflicts (arising from different values or interests) among organisations and people involved.
- **Social constructionist approach:** This approach challenges the widely held notion that objective knowledge and assessments of risk are exclusively provided by the scientific community and experts, while others (e.g. stakeholders, the public) contribute subjectivities such as values, beliefs and emotions. Proponents stress that, in fact, all actors contribute both knowledge and subjectivities and thus affect the assessment, evaluation and further management of risks. To understand that knowledge, values, perceptions etc. are shaped by the social and cultural context they are embedded in and that they may lead to alternative rather than either rational or irrational ways of perceiving and reacting to risk is therefore pivotal for the management and communication of risk. A main task of risk communicators should hence be to facilitate communication to mutually elicit, **understand, and learn from alternative rationalities** (for instance technical and experiential, scientific and social) and different forms of knowledge **in a two-way rather than a one-way process**.
- **Social trust approach:** Conceptualised and most prominently advocated by Cvetkovich and Earle (1995; Cvetkovich 2000), this approach rests upon the idea that people's trust in risk managing institutions is a major mediator of their risk related perceptions and behaviours (see also CapHaz-Net WP2 report on risk governance by Walker et al. 2010 and CapHaz-Net WP3 report on risk perception by Wachinger and Renn 2010). Trust, for instance, is regarded to be vital for public acceptance of risk management and its authority. In other words, people are more likely to follow the advice of risk managing bodies if they perceive them as trustworthy (Covello and Sandman 2001). Whether people place trust in authorities hinges on whether they deem institutional actions to be based on the same values as they hold themselves. It is on these terms that people grant institutions the responsibility to manage risks on their behalf. The main implication for risk **communication** is that it **should aim to build trust** in risk managing bodies. Open and honest communication that follows the principle of transparency is widely held to be key in promoting trust.
- **Social amplification of risk approach:** Introduced by Kasperson et al. (1988) this approach holds that, in societies, risks are communicated by different sources (e.g., government officials, non-state actors and NGOs, the mass media, members of the public) and transmitted by

a number of entities that deliberately or accidentally amplify or attenuate the risks and potential impacts of hazard events (especially the media and personal networks, see also CapHaz-Net WP3 report on risk perception by Wachinger and Renn 2010). Accordingly, risk-managing bodies inevitably compete with other sources that might take different stances on what is relevant and true. To keep risk related messages coherent is thus a challenge and official risk managers are advised to '**ensure that information is communicated early, often, and fully before others do**' (Lundgren and McMakin 2009, p 19). Importantly, at a society level, this approach helps to understand how discourses on risk (e.g. what the risks are and how they should be dealt with) evolve and take shape. At the level of risk management processes, it helps to understand that participants' communication about risk is inherently selective. In other words, without encouragement to do otherwise (by procedural rules on openness, transparency and settings that stimulate self-reflection), they disseminate and potentially magnify the information that is needed to support their views while attenuating or omitting others (Renn 2003).

Based on these approaches, handbooks and practical guides to risk communication have proliferated with a trend towards combining single approaches to benefit from their respective strengths and ultimately to increase the effectiveness of risk communication (see universal principles of risk communication in section 4.1 in this report and for extensive guidelines and recommendations see Renn 2008; Lundgren and McMakin 2009).

Fischhoff (2006 cited in Wardman and Lofstedt 2009, p 13) for instance has put forward a 'pragmatic scheme' that jointly promotes three principles: 1) create appropriate communication channels, 2) manage risks well and communication credibly, and 3) deliver relevant information in a concise and comprehensive way.

Gutteling and Wiegman (1996, p 42) propose a 'systematic planning approach to risk communication' which involves the 'systematic planning of information transfer, based on scientific research, to prevent, solve or mitigate the risk problem with adjusted and customized information (messages) for specific target groups.' At the same time, the authors emphasise that 'risk communication is a social process in which different types of communication (i.e. one-way, two-sided or multi-sided dialogues) will be applied depending on the circumstances and the phase of the planning process'.

Attempts to conceptualise different approaches (such as persuasion and dialogue) as complementary rather than mutually exclusive are remarkable given that the past has been rich in tensions between some of the outlined approaches. These tensions stem from seemingly fundamentally different assumptions regarding the nature of risk, human rationality and the purposes of risk communication.

Two main points of long-standing contention have been whether one-way communication is ethical and whether two-way, dialogical communication is practical (feasible, sensible) given time and financial constraints in management practice (see more on the 'ethics of communication' in Lundgren and McMakin 2009). For example, is it appropriate to use communication to

persuade people of what others think is right and, if so, on what conditions? How can the instrumental side of communication as a means to change behaviour and, in the extreme interpretation, to 'manipulate' opinions be reconciled with normative (the right to be involved on grounds such as democratic emancipation, equity, inclusion, fairness) and substantive rationales (to contribute values, perspective and knowledge to ideally influence the outcome) for communication? Or, in other words, in which situations can communication be limited to a one-way mode and in which situations throughout the risk cycle should risk managing bodies encourage participatory processes? A troublesome question in practice is also who decides on what and how much information should be released, and to whom (see also section 1.4). Authors have cautioned against a focus on managing public emotions as the main goal of communication as this might portray people as irrational and driven by fears rather than as reasoning subjects (Warman and Lofstedt 2009). One main drawback could be that risk-managing agencies choose to withhold information that might, in their view, cause worries, a practice that could be criticised as patronising from a participatory governance point of view.

Some authors maintain that becoming aware of these issues is a first vital responsibility of those communicating. Bennett and Calman (2001) argue that using one-way communication is legitimate as long as risk managers do not presume that it is only the public that might have a certain bias in their perceptions. Rowan (1994) pleads not to outlaw valuable communication goals such as stimulating behavioural change and protective measures, and issuing emergency instructions. While indeed directive by nature, they contribute to the building up of crucial knowledge capacities. Gutteling and Wiegman (1996, p 40) add that to not issue disaster warning messages because they are one-way and could be perceived as manipulative 'seems throwing out the baby with the bathwater.' However, the use of persuasive techniques to influence values and risk framings should not be accepted.

Inferring from Renn (2005, 2008) one might argue that the questions about whether one-way or two-way communication is more appropriate and about who should be involved might also depend on the type of risk and potential conflict at hand (see box 5 overleaf). Accordingly, there might be 'simple' risks that are so obvious that everyone would perceive them similarly and the answers to which are just as obvious. Hence, they could be handled within the risk management sphere only and require communication between agency staff. In such a situation it may suffice to inform other actors of the outcomes by one-way communication. However, one might hold against this that, in the field of natural hazards, there are no simple risks if we view them in their wider socio-political context rather than their physical characteristics alone (e.g. Jurt Vicuña Muñoz 2009). In complex, uncertain or ambiguous risk settings that might be perceived differently across the spectrum of actors (e.g., agency, stakeholders, actors, scientists etc.) two-way communication, particularly dialogical forms, becomes more central. According to Renn (2005, 2008), complex risks would require the exchange of knowledge between risk managers and other experts. Uncertainty in a risk situation would call for the involvement of concerns and perspectives of additional stakeholders (e.g. affected groups, private companies etc.).

For situations of high ambiguity and hence of potential controversy the participation of the widest range of actors through deliberation is recommended.

Box 5: Communication in different risk settings according to Renn (2005)

Simple risk problems

“For making judgements about simple risk problems, a sophisticated approach to involve all potentially affected parties is not necessary. Most actors would not even seek to participate since the expected results are more or less obvious. In terms of cooperative strategies, an ‘instrumental discourse’ among agency staff, directly affected groups (such as product or activity providers and immediately exposed individuals) as well as enforcement personnel is advisable. One should be aware, however, that often risks that appear simple turn out to be more complex, uncertain or ambiguous as originally assessed. It is therefore essential to revisit these risks regularly and monitor the outcomes carefully...simple risks should not be equated with small or negligible risks. The major issues here are that the potential negative consequences are obvious, the values that are applied are non-controversial and the remaining uncertainties low. Examples are car accidents, known food and health risks, regularly reoccurring natural disasters or safety devices for high buildings.” (p 45 and 51).

Complex risk problems

Resolving complexity necessitates a discursive procedure during the appraisal phase with a direct link to the tolerability and acceptability judgement and risk management. Input for handling complexity could be provided by an ‘epistemological discourse’ aimed at finding the best estimates for characterising the risks under consideration. This discourse should be inspired by different science camps and the participation of experts and knowledge carriers. They may come from academia, government, industry or civil society but their legitimacy to participate is their claim to bring new or additional knowledge to the negotiating table. The goal is to resolve cognitive conflicts. Exercises such as Delphi, Group Delphi and consensus workshops would be most advisable...” (p 51/52).

Risks problems due to uncertainty

“Characterising risks, evaluating risks and designing options for risk reduction pose special challenges in situations of high uncertainty about the risk estimates... risk managers are well advised to include the main stakeholders in the evaluation process and ask them to find a consensus on the extra margin of safety in which they would be willing to invest in exchange for avoiding potentially catastrophic consequences. This type of deliberation called ‘reflective discourse’ relies on a collective reflection about balancing the possibilities for over- and under-protection... It is recommended that policy makers, representatives of major stakeholder groups, and scientists take part in this type of discourse ... round tables, open space forums, negotiated rule-making exercises, mediation or mixed advisory committees including scientists and stakeholders“ (p 52).

Risk problems due to ambiguity

“If major ambiguities are associated with a risk problem, it is not enough to demonstrate that risk regulators are open to public concerns and address the issues that many people wish to take care of...the process of risk evaluation needs to be open to public input and new forms of deliberation... High ambiguities require the most inclusive strategy for participation since not only directly affected groups but also those indirectly affected have something to contribute to this debate. Resolving ambiguities in risk debates requires a ‘participative discourse’, a platform where competing arguments, beliefs and values are openly discussed. Advisable sets of deliberative processes include citizen panels, citizen juries, consensus conferences, ombudspersons, citizen advisory commissions...” (p 52).

Approaches used in the communication on natural hazards

Reviewing the literature it appears that there are hardly any communication frameworks and tools specifically developed for the field of natural hazards. Interestingly, the term risk communication frequently appears in risk literature and more recently in risk management frameworks such as the OECD framework on ‘Critical Components for Managing Catastrophic Risks’ (Kleindorfer et al. 2009) or the ‘Cycle of integrated risk management’ by the Swiss National Platform for Natural Hazards (PLANAT). What becomes clear though is that while these frameworks acknowledge the importance of communication, precisely what communication might look like (in terms of actors, purposes, tools, content) is left largely to the imagination.

In the following we briefly illustrate how approaches are combined to serve different purposes or functions of communication in the natural hazard literature. Following the overall focus of CapHaz-Net, we also discuss their potential contribution to social capacity building. To structure social capacities we mainly take inspiration from the CapHaz-Net WP1 report on social capacity building by Kuhlicke and Steinführer (2010), and from Powell and Colin (2009). Accordingly, we distinguish between knowledge capacities (e.g. on hazards, on how to act), attitudinal/motivational capacities (awareness, motivation to act), social/organisational capacities (e.g. trust, relationships) and psychological capacities (e.g. to cope with stress, anxiety) at individual, community and organisation level (see Table 6 for further information on levels).

Table 6: Levels at which social capacity building can occur (taken from Kuhlicke and Steinführer 2010)

Organizational level	Individual level	Community level
<p>The defining characteristic of this level is that actors belong to some kind of “cooperation structures within formal-institutional structures and systemic functions, with clearly defined strategic goals, explicit benchmarking processes (milestones) and [...] with a defined end (death of network)” (Matthiesen 2005, 10). Such formal organization structures may exist in different sectors: the public, the private and the voluntary sectors.</p>	<p>This level includes individuals or a collective body of individuals (e.g. households, schools etc). The defining characteristic of this level is that actors are formally not organised with respect to hazard and risk management efforts.</p>	<p>This level focuses on local communities and summarises the actors from the organizational level (public, private & voluntary sectors) as well as individuals. It concentrates, above all, on the interaction and forms of cooperation between the different actors in a specific locality (e.g. village or an urban neighbourhood).</p>
<p>Organizations from the public sector, which are directly or indirectly involved in disaster and risk management. They may include governments, ministries, administrations, planning agencies, local authorities, public services, fire brigades, etc.</p>	<p>Companies in the private sector. They may be insurance companies but also other companies formally or informally involved in risk and disaster management e.g. privately owned utility or infrastructure companies. It may also include companies exposed to natural hazards.</p>	<p>Non-governmental organizations from civil society (voluntary sector) involved directly or indirectly in disaster and risk management. They may include NGOs, foundations, community groups, activist groups, Union and interest groups.</p>

Communication to raise awareness and to change risk related behaviours

How to influence risk related attitudes and behaviours through communication appears to be a main concern in the natural hazard related literature. An integrated communication framework has recently been presented by O'Neill (2004) in the context of flooding at the community level (see Figure 7).

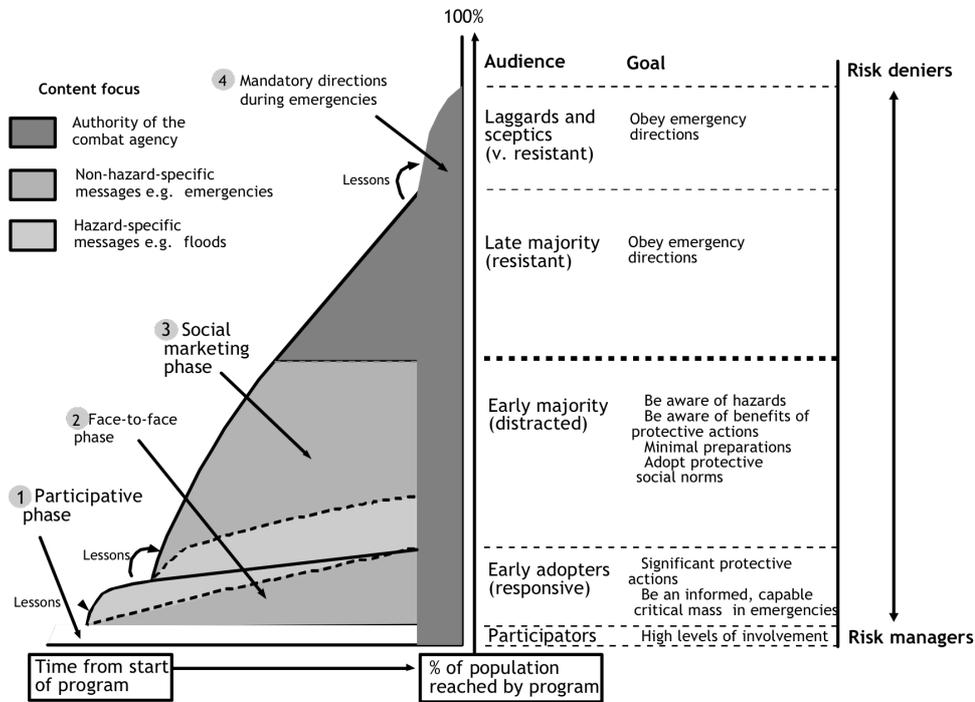


Figure 7: Integrated model of risk communication (O'Neill 2004)

O'Neill (2004) suggests that according to the characteristics of the audience different communication tools are needed and the goals of communication vary. Accordingly, people differ in their willingness to actively manage rather than denying risks and to adopt or change behaviours. The propensity to proactively engage with risks affects the time people need to adopt protective behaviours. O'Neill advises that the relatively small number of people in a community with a high willingness to invest time and energy in adopting actions should be involved from the very start of a communication programme and in a more participatory, face-to-face way to benefit from their local knowledge, creativity and time when developing community approaches. These very engaged individuals might act as 'local champions' or 'peer educators' to fellow residents. To encourage protective behaviour amongst those in denial about natural hazard risks or those resistant to change their behaviours other communication tools, particularly social marketing techniques, are more appropriate to get the message across about how to behave in particular situations. Although O'Neill developed the model for Australian communities, there is no reason why this could not be transferred to a European context.

The model combines a number of the aforementioned general approaches to risk communication, particularly the mental model approach with its focus on perceptions/characteristics

of audiences and resulting communication needs, and the social network contagion approach. The model's potential for **social capacity building** appears to be at the individual and community level. For a small group of individuals their involvement in a participatory process and face-to-face interaction might lead to capacity building at the:

Individual level:

- *Knowledge capacities:* build individual knowledge on risks and ways to act and the ability to find and understand information
- *Attitudinal/motivational capacities:* develop attitudinal/motivational resources such as self-confidence in knowledge and personal abilities to critically analyse information and to creatively engage in finding solutions to a problem; build a personal sense of responsibility
- *Social/organisational capacities:* develop communication, organisation and leadership skills; planning and outreach skills
- *Psychological capacities:* develop capacities and resources needed to better cope with the psychologically adverse effects of hazard events

Community level:

- *Social/organisational capacities:* develop local ownership of the communication programme; build networks between community individuals, groups and organisations.

For most people targeted by social marketing techniques the potential for **social capacity building** appears to be limited to the:

Individual level

- *Knowledge capacities:* building up knowledge on ways to act; ability to find and understand information
- *Attitudinal/motivational capacities:* raised awareness; interest and motivation to act; build a personal sense of responsibility

Theoretically, the approach suggests that the small group of people who are involved through a participatory process at the beginning of the communication programme may co-define what capacities are needed in a community and by which means they should be developed. However, whether this would be the case or whether the face-to-face interaction would be merely serving to train 'peer educators' who spread the scripted word depends on the way such a participatory process would be enacted. Also, the scope of co-definition is bound to the overall aim of triggering specific behaviours in the case of an event. It is not in fact an aim to involve residents and their knowledge in the assessment, evaluation and planning for risks.

Communication to enable mutual understanding and dialogue

Other authors have worked on improving communication to elicit mental models and enable mutual understanding. Translated back to the field of natural hazards, such communication may

ultimately serve different ends, for instance socially robust decision-making, participatory problem framing, option appraisal and scoping or consensus building.

Kolkman et al. (2005; 2007) for instance advocate a frame reflection and mental model mapping technique to enable mutual understanding between decision-makers, experts and stakeholders (in this case representatives of special interest groups) in the context of integrated environmental assessment (EIA) and flood defence planning. In this way the facilitated mutual learning process about alternative risk frames, the perspectives on possible responses and underlying assumptions, preferences and interests should ultimately help decision-makers to identify and address controversies at early stages of the planning process. Similarly, Burgess and colleagues (2007) propose a deliberative mapping methodology to engage experts and citizens in an interactive dialogue on problem framing and option definition that might be adopted for the appraisal of natural hazard risks. Kenyon (2007) and Scolobig et al. (2008) have recently presented participant-led multi criteria approaches for evaluating flood mitigation measures in Scotland and Italy respectively. Stanghellini and Collentine (2008) have put forward a model for facilitating stakeholder participation in the management of catchment areas (CATCH model). Again, the focus is on structuring dialogue and deliberation among managers and stakeholders to ultimately enable mutual understanding and to resolve areas of conflict. The model distinguishes between three degrees of involvement, i.e. co-operating/co-working stakeholders who participate in dialogue and face-to-face interaction, co-thinking stakeholders who are consulted on their knowledge, ideas and perceptions, and finally co-knowing stakeholders who are kept informed on progress. In the U.S., focus groups and participatory mapping techniques have recently been trialled to enable mutual understanding on risks and alternative strategies to adapt to natural hazards between different domain-centred stakeholder groups in local land-use planning. The project succeeded in initiating a dialogue between these groups and in establishing shared goals such as increasing local resilience through sustainable community development (Frazier et al. 2010).

These communication models draw strongly on social convergence, social constructionist, and mental models approaches. Mostly, they focus on dialogical two-way communication between experts, decision-makers and key stakeholders, while the deliberate mapping approach makes explicit efforts to also involve citizens or the wider public in interactive communication processes. The main potential for **social capacity building** arguably is at the:

Individual level

- *Knowledge capacities*: learning about other actors with a stake in the handling of risks, what they know, what they think and why; knowledge on risks, hazards and prevention measures
- *Social/organisational capacities*: communication skills; ability to reflect critically and to 'deal' with different frames and perspectives; learn to locate areas of agreement and disagreement

Community level

- *Social/organisational capacities*: finding and pursuing shared/collective goals; forming communities of interest and/or identity

Communication to improve relationships and coordination

Another interesting way to approach risk communication on natural hazards has been put forward by McCarthy (2007). Drawing on intra- and inter-organisational communication approaches he shows that communication on risks between and across the spectrum of risk managing entities before, during and after flooding events (in his study the author examines risk communication on floods between management bodies at the national level in the UK) is as much about defining and improving relationships as it is about conveying information and direction. Accordingly, the management of natural hazards by public and private organisations can be understood as merging classical task-oriented approaches to communication with approaches that focus on strengthening relationships and human resources within and between organisations. These relationships and resources build the foundations for the effective cooperation between departments, agencies and organisations with high task interdependencies (Bouwen and Taillieu 2004). To this end organisations involved in the management of natural hazards need to apply a range of communication channels, modes and tools (see Table 7).

Table 7: Organisational communication (Miller 2003)

Communication	Classical approach	Human relations approach	Human resources approach
Content	Task	Task, social	Task, social, innovation
Direction	Vertical (downward)	Vertical and horizontal	All directions team based
Channel	Usually written	Often face to face	All channels
Style	Formal	Informal	Both esp. informal

This approach probably has the most obvious links to social capacity building. Building up human resources and relationships within and between organisations is central to this approach. Developing these resources and relationships is therefore vital to better and more efficiently use information/knowledge and to coordinate/structure actions. **Social capacity building** potentially occurs at the:

Individual level:

- *Knowledge*: learn where to get data, how to use it and whom to contact
- *Social/organisational*: communication and organisation skills, improved relationships (establishing and stabilising relationships based on trust and experience)

Organisation level:

- *Knowledge*: learn to work together to achieve shared goals
- *Social/organisational capacities*: ability to manage/share information and to coordinate tasks, establishing and multiplying formal and informal communication channels within and between organisations

Having briefly reviewed these approaches, it would appear that authors have addressed the challenge of risk communication rather differently. Overall it seems that the theoretical and political trend towards precaution and prevention in the handling of risk has, as yet, not led to a refinement of risk communication in these phases. While there are apparent links to social ca-

capacity building they are often not explicitly discussed as such in the literature. In section 2 we follow up these inter-linkages.

1.4 Challenges of risk communication (by Corina Höppner with contributions by Chiara Bianchizza, Bruna De Marchi, Luigi Pellizzoni and Anna Scolobig)

There are manifold challenges to risk communication in practice. Some major ones are briefly discussed below.

Characteristics of natural hazards

Challenges due to the characteristics or ‘etiology’ of natural hazards are among the most discussed issues in the relevant literature (see CapHaz-Net WP4 report on social vulnerability by Tapsell et al. 2010). Tables 8 and 9 show characteristics of natural hazards that are commonly regarded to impact on the needs for, and constraints to, risk communication.

Table 8: Characteristics of natural hazards and main challenges for risk communication

Characteristics of natural hazards	Main challenge for risk communication
Occurrence of hazard event:	
- Speed of onset: sudden, slow/creeping	Perception of hazard or risks; spatial and temporal specificity of forecasts/communication; warning
- Frequency or return period	Perception of risks, awareness; memory
- Size	Perception of hazards and risks; spatial and temporal specificity of forecasts/communication; warning
- Novelty/Change	Perception of hazards and risks; awareness; experiences
Impact of hazard event:	
- Area: focused or diffuse	Perception of hazards, impacts and risks; awareness, warning
- Intensity	Perception of hazards, impacts, consequences and vulnerability
- Immediacy and duration of impacts	Perception of impacts, consequences and vulnerability; awareness

Usually, it is a combination of these characteristics that is deemed to impact on risk communication practice. Faulkner and Ball (2007, p 73) argue that ‘effective (context-optimised) communication must necessarily change in nature, content, and uncertainty across the spectrum’ of natural hazards. For instance, rapid-onset hazards such as flash floods, hurricanes or bushfires also tend to vary in their spatiality and temporal intensity. They are hence hard to predict and the resulting communication will be less specific in terms of location and time (Faulkner and Ball 2007). These characteristics also determine the possibility and lead time of warning and alarming people. In the case of hazards characterized by a high speed of onset, warnings need to show quick effect and need to simultaneously target very different receivers. At the same time, additional preparatory communication to build up people’s knowledge about how to behave in

the case of an event and their willingness to act accordingly becomes vital as rapid-onset hazards are hard to predict and leave little time to issue behaviour advice with immediate warnings². To make such warnings a success trust between the senders and the receivers is believed to be key and needs to be built up through communication and performance beforehand, during and after a hazard event³. Although effective one-way communication is most vital in warning and emergency situations this does not necessarily mean that there is no role for two-way communication. Indeed, face-to-face communication with, for instance, community wardens or the opportunity to ask a real person further questions rather than only receiving a recorded message are believed to positively influence the effectiveness of warnings (Parker et al. 2009). When designing warning and alarming systems for rapid-onset hazards, two-way communication with people at-risk has been argued to result in more robust and effective warning procedures (Parker and Handmer 1998).

Importantly, the characteristics of hazards also shape the perceptibility of risks and events (visibility) and the ways they are actually perceived. For instance, the risk and the event of a drought and its impacts may not be as easily perceived as the risk and immediate impacts of rock avalanches. Hence the need for raising awareness and the ways to sustain it through communication will differ. Another challenge for risk communication particularly with respect to droughts is that different audiences may require different warning lead times to prevent losses. More specifically, to protect farmers from the negative consequences of a drought they should be warned several months in advance to be able to adapt their crops. In contrast, the fishing or the tourism sectors might need shorter lead times to take preparatory actions. Heat waves are also comparatively hard to perceive and their impacts tend to be temporally and spatially diffuse which poses a challenge for official emergency services. Thus an important task of communication is arguably to build awareness and support networks within neighbourhoods. Emerging or changing characteristics of hazards arguably require different communication strategies to make up for lacking experiences or to deal with existing ones. While droughts in Southern Europe are normal yet currently changing (frequency, severity, extreme changes from water scarcity to water abundance), they are a comparatively new phenomenon in the minds of people living in Central and Northern Europe.

The invisibility of risks and hazard events, their variability and the time lag of effects (see also CapHaz-Net WP3 report on risk perception by Wachinger and Renn 2010) may not only be a problem for communication aimed at awareness raising but also a challenge for communicating the need for, or the benefit of, new and existing structural and non-structural prevention measures. Reducing the frequency of hazard events by mitigation measures is likely to reduce their perceptibility too and it might also generate a false sense of security among, for instance, the inhabitants of a floodplain. The latter has been discussed as the 'levee effect' in the risk literature (Tobin 1995). As a consequence of the invisibility of events, people's vulnerability might increase as they may dismiss mitigation measures (sustaining existing ones and funding new ones) and preparedness as unnecessary.

² We thank Fiona Tweed for this suggestion.

³ This was a common view among the participants of the Ljubljana workshop.

Finally, chain effects and the impacts of secondary hazards might require different communication efforts than the trigger hazard event. For instance, the recent eruption of the Eyjafjalajökull volcano in Iceland (April 2010) was quite small as a trigger event but unusual weather conditions lofted the ash over Europe resulting in a range of trans-boundary impacts and communication needs⁴.

Table 9: Characteristics of natural hazard events and main implications for risk communication

Characteristics of events relevant for risk communication	Alpine Hazards					Heat-related Hazards			Plain Floods
	Mass movements				Snow avalanches	Flash floods	Droughts	Forest Fires	
	Landslides	Slope-type debris and mudflow	Rock fall	Rock avalanches					
Speed of onset	low-high	high	high	low-medium	high	high	low	high	medium
Return period	medium-long	medium-long	short	medium-long	medium (periodic)	medium-long	medium-long	medium-long	medium-long
Areal extent	small-medium	small-medium	small	medium-large	small-medium	small-medium	large	small-large	small-large
Predictability of location	low-medium	medium-high	low	medium-high	high	medium-high	high	low	high-medium
Resulting Challenges and need for risk communication									
Perceptibility of risk of event	medium-low	low-medium	medium-high	medium	medium	low	low	low-medium	low
Specificity of forecasts and communication: - Location	medium-low	medium-high	low	medium-high	high	medium-high	high	low	high-medium
- Time	low-medium	low	low	low-medium	medium-high	low-medium	high	medium	medium-high
Warnings (possibility, available time)	low-medium	low	low	medium-high	low-medium	low-medium	high	low	medium-high

Note. This table is only supposed to give a rough idea about the relative differences between the natural hazards CapHaz-Net is dealing with. There are more characteristics such as for instance the variability of the intensity of impacts that pose challenges to risk communication.

Perception of risks and coping measures

As already discussed in the Caphaz-Net WP3 report (Wachinger and Renn 2010), perceptions of risk vary across natural hazards but also across individuals and groups of individuals due to a number of individual internal and contextual factors. Hence, complexity is not only inherent to the ecological system but also a feature of the societal systems that are affected by natural hazards. The implications for risk communication are manifold and besides the already men-

⁴ We thank Fiona Tweed for this input.

tioned 'levee effect' we only highlight two major ones. Firstly, researchers have shown that perception does influence people's willingness/motivation to receive information. Beretta (2005) observes that the higher the perception of risk, the stronger the desire to receive information and to engage in discussion on the prevention and mitigation of natural hazards. Hence, the first challenge is to stimulate people's interest in related information and then to deliver it in a way that is understood (see section 1.5).

Secondly, different perceptions of risk may lead to different judgements of the situation (or to diverging views on the relevance of natural hazard risks compared to other risks) and of the need to act. Even a similar perception of risks across actors does not necessarily mean that they will all support the same prevention measures. Rather, underlying interests, conflicts, beliefs about the ownership of risks, the perceived fairness of measures and their wider socio-economic implications, or differing levels of risk tolerance, can lead to different viewpoints. A resulting challenge for communication is thus to elicit these issues, to foster mutual understanding and to mediate between different views. It is, as already mentioned, two-way dialogical communication that is commonly regarded to be most appropriate for meeting these challenges. A failure to address diverging perceptions and viewpoints can have serious consequences. Wolsink and Baumeister (2003) for example have shown that residents' distrust and disapproval of floodplain protection measures grew as they felt that the way planners redistributed risks and benefits over the three affected villages was unjust.

Uncertainty in communication and the principle of transparency

Many researchers maintain that uncertainty in prediction and risk communication is a problem for effective risk communication not only between science and decision makers but also between them, and stakeholders and the public. Others argue that uncertainty is no problem as long as it is discussed openly as part of a transparent communication process (see also sections 1.2, 1.3 and 1.5). They claim that communicating uncertainty and being open about the pros and cons of mitigation options builds trust in the communicators and increases the credibility of the message. Of course, in real life, if hazard mappers want to persuade a landlord to leave his/her property, uncertainty about the actual boundaries of risk zones might not contribute to approval. Similarly, immediate warnings may be less effective in triggering protective behaviour, though there is hardly any systematic evidence for this. O'Neil (2002, cited in Wardman and Lofstedt 2009, p 10) argues that the full disclosure of information might actually lead to an amplification of risk, public confusion and outrage, decreasing trust in science and further uncertainty 'unless that information is sorted and assessed, but unless those institutions responsible for sorting and assessing information are already trusted there is little reason to suppose that transparency and openness are going to increase trust'. Indeed, there is evidence that 'if a dis-trusted source provides information that appears to promote its own vested interests, the information will influence people's attitudes in the opposite direction to that being promoted in the first place (Frewer 2004, p 393). Another critical point is that an increasing amount of information potentially makes communication materials lengthy and tiresome.

However, transparency and the communication of uncertainty are commonly considered as vital for building and maintaining trust. Trust is considered a crucial element because it determines the credibility of a message and its source and because it might affect the receiver's willingness to engage in communication (see also section 1.5). Open and full communication and the acknowledgement of uncertainties may be particularly useful for stimulating the development of 'critical trust' (Walls et al. 2004) rather than strong reliance (or high uncritical trust) in risk managers. Such 'critical trust' promises that people are cognitively engaged with issues and it might contribute to people's capacity of critical reflection and lead to more self-responsibility (such empowerment is one of the principles of risk and environmental governance, see also CapHaz-Net WP2 report on risk governance by Walker et al. 2010).

Having said this, it seems that applying the principles of transparency and uncertainty communication in practice will always involve some kind of trade-off. Risk managers are thus challenged with finding a balance between these communication principles and the requirements of a specific situation, time constraints, people's motivation to receive information, their resources and their own ability to work efficiently.

Participation

Communication to facilitate participation is prone to the same pitfalls as participatory approaches and processes in other fields too (see also the CapHaz-Net WP 2 report on risk governance by Walker et al. 2010 and the WP3 report on risk perception by Wachinger and Renn 2010). Indeed, there seems nothing unique about the natural hazard context that makes it immune from the self-selection of participants, tokenism, a limited room for negotiation, interest-based manipulation, the exercise of power or poorly designed and implemented tools. If the quality of communication tools and procedures is poor and contextual conditions unfavourable, participation might even have the opposite effect to that originally intended (e.g. Cooke and Kothari 2001).

Naturally, two-way communication and participation in the context of natural hazards are exposed to all these challenges too. However, reviewing the literature it seems that there is, as yet, not much discussion on which participatory communication techniques are appropriate in which risk management situations, beyond the conclusion that such techniques should be applied in situations where a diversity of interests and viewpoints exist. For instance, the goals of interactive workshops can vary from eliciting visions, interests, knowledge, or values to assessing specific mitigation options. A question bothering practitioners is in which situation does it make sense to apply one or the other.

Risk governance/management

Communication happens at different management or governance stages, characterized by different aims and priorities (see section 1.2). The need for a clear distribution of responsibility among actors is key in order to have one stream of information both among responsible bodies and towards the population, to avoid repetition and contradictory information, and to have an

effective chain of delivery. This is true for immediate warnings and long-term communication that aims at building up a culture of risk within a community/society. Particularly in emergency situations, the challenge with communication is to a) have defined and functioning channels of communication, b) to make the flow of information work between operators, c) to have clearly assigned responsibilities and competencies (e.g. who informs in which situation), and d) to make sure that the receivers of the message know they can trust the information and that they are prepared to act (Lombardi 2005). Using the example of the region of Piedmont Pellizzoni and Ungaro (2000) showed that organisational and technical (tools and channels of communication) details crucially determine the success of warning and alarming messages. On a Sunday morning, warning messages about imminent major floods were sent via fax to the offices of the municipalities at-risk. As nobody worked in these offices at that time, the warning was not received and great damage followed. The case stresses the point made earlier and which has become general wisdom among communication researchers that risk communication is only as effective as the reliability of the nodes in the chain.

Again, the fragmentation of responsibilities and competencies as well as administrative divisions pose serious challenges for the improvement of information flows, the efficiency of warning, the planning of prevention measures and recovery (e.g. McCarthy et al. 2007). Another point to make in this respect is that building up trust in the source of communication is a challenge in itself as it needs considerable time and effort to do so. On the other hand, trust is destroyed quickly and it does not depend only on the quality of the communication process but also on the general performance of those who want to be trusted (e.g. De Marchi et al 2006, Höppner et al. 2007). This is not the place to discuss the point in all its breath and depth, we just note here that trust is indeed relevant but as risk management increasingly intersects with land-use planning the issue of trust becomes more complex. Trust in risk managers does not entirely consist of the same dimensions as does trust in land-use planning committees (Höppner 2009). While risk managers are expected to fulfill their fiduciary duty to protect all people from harm, some people see land-use planning committees as trustworthy if their representatives are prepared to take their particular interests into account. In practice, it might be difficult to reconcile particular interests and protection for all. Hence, the trust of some people might decrease even though risk managers try to fulfill their fiduciary duty.

Finally, diverging 'epistemic cultures' or attitudes to risk and uncertainty among risk managing institutions can pose challenges to the effective use of risk communication tools. In a cross-European study, Demeritt et al. (2007) have shown that flood forecasters often struggled to make the best use of new technologies such as ensemble prediction systems (EPS), a technology that was originally developed for meteorological forecasts. They found that while meteorological forecasters traditionally adopt a precautionary approach and issue warnings early even if there is a considerable likelihood that the event will not occur, flood forecasters operate in an institutional context that favours a 'wait and see' approach in the face of uncertainty⁵. Such

⁵ This has also been discussed as the 'duality of error' in the literature (Hammond 1996). Accordingly, for any given forecasting situation there is a trade-off to be made between two kinds of mistakes: issuing a warning that does not actually occur (a false positive warning or prediction) and not issuing a warning for an event that does occur (a false negative warning or prediction).

a cautious approach to warnings stems from concerns about institutional reputations and credibility, which may weigh heavier than in other institutional cultures. In practice, actors involved in forecasting and warning might, thus, hold different and, at times, conflicting stances on when to alert people and on the value of new technologies (see practice #1 in the Annex).

Generic vs. context specific communication models

The question as to the advantages and disadvantages of generic vs. context specific communication models is a perennial one. The tenor in the risk literature though seems to be that a single best practice guide to risk communication is neither appropriate nor achievable (Burton et al. 1993). Rather, communication has to be adapted to the characteristics of the hazard (Faulkner 2007), the expected intensity and impacts of a particular event, the context of the communities at-risk, the characteristics of the receiver, and the objectives of communication (and hence stage in the risk management cycle). In the case of warning for instance, Sorensen concludes that ‘a single warning concept will not equally serve the requirements of all hazards... An all-hazard warning system is inappropriate unless the specific needs imposed by each different hazard type are also considered’ (Sorensen 2000, p 120). However, while there seems to be widespread agreement that communication models should be flexible and adaptive, there is hardly any discussion on which good practice criteria could be applicable across hazards or spatial levels and which could not. Indeed, it is likely that some criteria might be included in a generic framework that would help developing and executing communication in practice, whereas other aspects might be more contingent on the specific context and thus require more flexibility.

1.5 Research on the effects of risk communication (by Rebecca Whittle, Gordon Walker, Matthias Buchecker and Corina Höppner)

This report started from the premise that risk communication involves tacit or explicit goals (see sections 1.1 and 1.2). The extent to which these goals are being achieved is a key topic of research and debate within academia and the public sector more generally. As discussed in Section 1.2 there are many different modes and tools of risk communication, just as there are many studies debating the relative merits of these and trying to establish which formats of risk communication may be most effective (Bier 2001; Faulkner and Ball 2007; Fernández-Bilbao and Twigger-Ross 2009; Kashefi and Walker 2009). Such studies reflect a growing anxiety among risk communicators that their messages may not be having the desired effect on the public at large. For example, in relation to natural hazards, McCarthy (2007, p 133) points to a fear that ‘advances in forecast technological sophistication are moving well ahead of end users’ abilities to take advantage of them’, while O’Neill and Hulme (2009) highlight the damage that poorly conceived risk communications can have in causing: ‘an active disengagement with the issue’. However, as Bier (2001) points out, determining what constitutes a success in relation to risk communication is not straightforward. Using the example of a well-known public health campaign, Bier asks whether a risk communication campaign can be said to be successful if it man-

ages to make teenagers aware of the risks of unsafe sex but does not actually persuade them to take any action in relation to these risks.

Equally, Parker et al. (2007) argue that attempts to evaluate the economic benefits of flood warnings by measuring damage costs at the level of the individual household do not account for some of the substantial advantages offered by flood warnings, such as saving lives and collective social benefits. Their study showed that, when measured at the scale of the individual household, the economic benefits of flood warnings are low for the simple reason that inventory items only amount for 52 per cent of the total potential damage costs of a flood (much of which comes from damage to the fabric of the building itself). Furthermore, moveable items only constitute 41 per cent of the inventory value, meaning that potential savings are low in relation to total damage costs.

For this reason, any attempt to evaluate the success of risk communication efforts must take place with reference to the diverse goals of these communication efforts (see section 1.2). In the discussion that follows, we have divided these goals into five broad categories in accordance with their relationship to social capacity building and main purposes of risk communication: knowledge related effects, attitude/motivation related effects (e.g. awareness raising, interest in further information), behaviour related effects, social/organisational effects (e.g. trust, democratic learning, relationships), and psychological effects (e.g. the reduction of anxiety and stress). Of course, these categories are not mutually exclusive – as the examples we discuss will demonstrate, risk communication campaigns will often have more than one goal – for example, to raise awareness *and* change behaviour, or to improve people's knowledge *and* change their attitudes to risks. During this discussion we are primarily concerned with risk communications which take place between professionals, stakeholders and the general public. However, it is important to acknowledge that risk communication also takes place between professional partners (Kashefi and Walker 2009). This is an under-researched topic which, nevertheless, has major impacts on the risk management decisions that are made by both public and private sector institutions. Given that comparatively little research has been done in the field of natural hazards, this section also includes literature from related fields such as natural resource management and planning, health, food, chemical and technological hazards/risks. Before we review empirical findings on the impacts of risk communication we briefly introduce some theoretical background on the factors generally influencing human behaviour.

Knowledge-attitude-behaviour models and the role of information processing

In the literature it is now widely agreed that the relationship between knowledge, attitudes and actual behavior is complex and shaped by a myriad of cross-related factors rather than being linear. Early linear models that tended to attribute the gap between knowledge and action to an information deficit were soon proven too simplistic (Kollmuss and Agyeman 2002). In the following decades they were replaced by models conceptualising human behaviour as a product of not only knowledge but also of other individual-internal factors (e.g. attitudes, values, perception of norms, personal capacities, personal characteristics) and individual-external or situ-

ational/contextual factors (e.g. time, economic conditions and resources, cultural factors, infrastructure, institutional settings, social and political structures, household characteristics). In their widely applied *theory of planned behaviour*, Ajzen and Fishbein (e.g. 1980) acknowledge the vital role of various attitudes, salient social and subjective norms, feelings of self-agency and control and people's willingness or intention to act. Researchers explain the discrepancies between people's intention to act and their behaviour by the influence of situational or contextual factors (e.g. Hines et al. 1986), the prevalence of old behaviour patterns and by further internal factors such as the feeling of responsibility, self-identity and experiences from past behaviours or emotions (e.g. Kollmuss and Agyeman 2002, Conner and Armitage 1998).

Other authors have worked to conceptualise the dynamic formation of attitudes through communication. The well-known *elaboration-likelihood model* by Petty and Cacioppo (e.g. 1986) distinguishes a central and peripheral route of information processing. People are likely to take the peripheral route if they a) are only marginally interested in the issue at hand (and hence less motivated to elaborate the related message), b) trust the source of information, c) think that hazards are under societal control, rather than personal, and/ or d) are constrained with respect to their cognitive resources and level of knowledge needed to carefully scrutinise the content of the message. Which of the two routes is taken thus also depends on the prior framing of the issue by communicating actors (e.g., the media) as they can influence the aforementioned conditions (Miles and Morse 2010). Levine and Renn (1991, see also Renn 2008) have adapted this idea for the context of risk communication. Internal attention and selection filters (such as the ability to receive a message, the detection of attractive symbols and clues in the message, personal interest in the topic and source credibility) reduce and alter the original message, which is then evaluated against a set of criteria that differs for the central and peripheral route of information processing. Following the central route, people evaluate whether the message meets their personal interests and is socially desirable, whether the arguments are credible (plausibility, impartiality and fairness of arguments) and whether it is congruent with their own values, attitudes and the opinions of reference groups. People taking the peripheral route judge the message against their personal interests, the credibility of the source, the message format (length, number of arguments etc.), the attractiveness of cues and symbols, the opinions of reference groups and the message's social desirability. Based on these evaluation processes, people form and rationalise their attitudes. An important implication for effective one-way risk communication is that it should be able to meet the needs of both those who elaborate a risk message via the central route and those who process it via the peripheral route. Hence, attractive symbols, graphics and interesting stories or cues should be used to gain people's attention for messages that are clear and simple without appearing superficial or simplistic (Renn 2008).

However, as discussed earlier a positive attitude towards a specific behaviour does not necessarily mean that people perform accordingly as many other individual-internal and external factors also come into play.

Effects on knowledge and on attitudes/motivation

Many risk communication efforts seek to increase or alter our knowledge about the various hazards that we face. For example, in the UK, the Environment Agency is looking to raise public awareness of the impacts of flood recovery and, in the related field of technological risks, communication campaigns have always existed to try and improve people's understanding of issues such as nuclear power or genetically modified foods (Frewer et al. 2003; Pidgeon et al. 2003). Of course, few campaigns have knowledge building as their only goal. Implicit in these examples is the additional aim of changing attitudes or behaviour, such as getting people to take action to protect and prepare their homes against the risks of flooding or increasing acceptance of technologies that may be generally perceived as 'risky'.

The popularity of risk communication campaigns aiming to build social capacity by increasing people's knowledge of risks could be said to have a direct link to the 'deficit model' of risk communication alluded to previously (see section 1.1), whereby the goal is to align the views of the public with those of the 'experts' (Hilgartner 1990; Frewer 2004). However, we have already seen how contemporary risk communication campaigns are increasingly eschewing this 'top down' approach to communication in favour of a two-way, more participatory approach to risk management which is thought to be more effective. A focus on improving knowledge also reflects a change in emphasis in the governance of natural hazards from a reactive approach designed to deal with the consequences of disasters as they happen, to a more pro-active, preventative approach based upon resilience and preparedness (Lindell and Perry 2000) and where the individual has a greater role to play in ensuring his or her safety (such trends are very much in line with the kinds of new governance process described in CapHaz-Net's WP2 report on risk governance by Walker et al. 2010). Consequently there has been much research on which forms of communication are 'best' at building up knowledge (Fernández-Bilbao and Twigger-Ross 2009a, Kashefi and Walker 2009, Bier 2001, Faulkner and Ball 2007). However, it does not necessarily follow that the better understood communication formats are also better at changing behaviour (Kashefi and Walker 2009) as what represents the 'best' format will vary depending on the precise goal of the communication campaign, the audience and the risk situation at hand.

It is also important to think about the link between the kinds of knowledge-oriented risk communication campaigns, which tend to operate continuously over longer timescales, and the much shorter-term warning messages released in the event of a disaster which are oriented specifically at changing behaviour (see below for discussion). Although most researchers would agree that both kinds of campaigns have a role to play, Mileti et al. (2004) have argued that it is important to be aware of the differences between these: 'Although many of the principles known about how to effectively communicate hazard to the public apply to both education and warning, they are different... There is only a limited relationship between them. Public response to warnings is much more the result of the information that people have access to during the warning period than anything else, including pre-event public education'. They do, however, concede

that 'Prior public education can 'prime' people for response in some future warning, for example, by educating people about the location of evacuation shelters'.

In addition to the goal of building knowledge, many risk communication efforts seek to change people's attitudes to the kinds of hazards that they may encounter. The examples of GM foods and nuclear power provide good examples of these kinds of campaigns in relation to technological risks, while public health campaigns have also been focussed around these kinds of messages. For example, when HIV/AIDS first came to prominence, risk communication campaigns sought to reduce the fear and stigma surrounding the disease by making it clear that you couldn't catch the virus by hugging, kissing or shaking hands with someone who was HIV positive. In relation to natural hazards, one of the best examples is climate change, where current risk communication campaigns are trying to counter the sense of (information) fatigue, apathy and fatalism that many people feel. For example, Futerra's 'sell the sizzle' campaign argues that people are turned off by the kind of negative portrayals of global destruction that have characterised many climate change campaigns (Futerra 2010). Rather than focusing exclusively on 'climate change hell', they argue that it is important to attract people by creating an attractive alternative of a 'low carbon heaven' that people can visualise and desire (see also section 1.3). More recently, Spence and Pidgeon (in press) could provide empirical evidence that gain framed rather than fear framed communication (i.e. focus on the positive and negative consequences of events or actions respectively) tends to be more effective in promoting acceptance of climate change mitigation measures. However, their findings also suggest that loss or fear frames can be more effective in motivating people to seek further information on their personal vulnerability, e.g. whether their homes are at-risk from flooding. There is also some evidence that such loss frames are more successful in generating a better recall of the information provided. Hence, these frames might be useful if communication aims at providing people with information on how they should behave during a natural hazard event.

Equally, research by Lorenzoni et al. (2007) and O'Neill and Hulme (2009) shows how important it is for risk communications to engage people through the three co-dependent spheres of cognition, affect and behaviour. It is therefore important for risk communications to have meaning and relevance for the target audience. O'Neill's and Hulme's (2009) research on the use of icons to communicate messages about climate change shows that 'scientific' icons (for example, explanations and diagrams of changes to the thermohaline circulation in the oceans) did not hold as much interest for people as images showing how climate change would affect their local area.

Indeed, giving people something interesting that they can relate to and think about with their friends may be one of the most effective forms of risk communication. For Mileti et al. (2004) good risk communication 'gives people something to mull over and to discuss with friends, family and colleagues. It sparks interest enough that people generate questions, and then seek more information to answer their questions...'

With respect to risk communication that aims at promoting acceptance of mitigation measures, research in the field of natural resource management has shown that neither one-

way nor dialogical one-off communication is a guarantee for the acceptance of planning measures (Höppner et al. 2005). In fact, one-off dialogical communication can lay open latent conflicts or accentuate overt ones in a community (Buchecker et al. 2010). If quick agreement on measures is the aim rather than mutual understanding on the roots of conflicts and disagreement, initiating dialogical forms of communication might, thus, not be the most effective way. In the context of natural hazards it is still largely unclear to what extent high acceptance levels of, for instance, structural measures in some communities and low levels in others result from related communication efforts (e.g. Hagemeyer-Klose 2009).

Finally, little is known about the long-term impacts of risk communication. In one of the rare quasi-longitudinal studies of the long-term impacts of chemical industries in two at-risk towns in the U.S. Heath and Palenchar (2000) showed that years of proactive emergency communication efforts had increased people's general level of concern, their motivation to receive and process information, and their knowledge of what to do in the case of an emergency. The study thus disproves the claim that continuous communication may lull people into information fatigue or a false sense of security.

Effects on behaviour

Risk communications that attempt to change people's behaviour are probably the most prominent kind of communication in relation to hazards. Such campaigns cover everything from attempts to encourage people to stop smoking ([www.http://smokefree.nhs.uk/](http://smokefree.nhs.uk/)) and eat more fruit and vegetables (www.5aday.nhs.uk) in the public health sphere, through to government advice on what to do in the event of an emergency (see, for example, the 'Go In, Stay In, Tune In' campaign practice #37 in the Annex) and specific communications designed to encourage householders to make modifications to their home to make them safe in the event of floods, earthquakes and other kinds of natural hazards (Lindell and Perry 2000; Parker et al. 2007; Defra 2008; Fernández-Bilbao and Twigger-Ross 2009).

However, while these campaigns have varied in terms of their impact on the public, none of them have been universally successful in that there are many people who still smoke, eat unhealthy diets and do not prepare themselves for emergencies or modify their homes to make them more hazard-proof. While there is empirical evidence for the success or failure of public awareness raising and information campaigns on risks to human health, the impacts of such campaigns, brochures, educational trails, maps and other communication tools are hardly studied in the field of natural hazards (Wagner 2005). Some work has been done on earthquakes, though mainly outside of Europe. Based on a household survey in three U.S. communities Mileti and Fitzpatrick (1992) have suggested a causal sequence of risk communication effects. Accordingly, risk information only had an indirect affect on people's behaviour in that it triggered further information searching. The motivation to do so was reinforced either through some kind of additional information or social cues. The search for further information or confirmation applies not only to earthquakes but across the spectrum of hazards. Parker et al. (2009) thus con-

clude that access to such information should be provided as part of all good communication strategies.

Such research has also shown that these risk communications do not necessarily lead the public to take the desired actions as people are not simply passive recipients who receive risk communication messages and act on them. Instead, risk communications involve complex interactions that do not take place in a vacuum. For example, Mileti and Sorensen (1990) argue that six steps are involved in the receipt of a warning message:

1. Hearing the warning
2. Understanding the contents of the warning message
3. Believing the warning is credible and accurate
4. Personalizing the warning to oneself
5. Confirming that the warning is true and others are taking heed
6. Responding by taking a protective action.

Mileti and Sorensen's list thus shows how central the risk communication context is in influencing how the message is received (Mileti and Sorensen 1990; Fernández-Bilbao and Twigger-Ross 2009b). Similarly, Parker et al. (2009 p 108) maintain that risk communications 'are filtered, interpreted and evaluated in (1) a social context, and, (2) in the context of experience' and may not therefore result in the expected response. Risk communication must therefore be understood as a social process which is dependent on the characteristics of the message, the sender, the audience, the social context of communication, the characteristics of the hazard itself and also on the mode/channel in which it is delivered.

With respect to the communication mode Moser (2010, p 41) summarises that 'face-to-face communication tends to be more persuasive and impactful on personal behavior than mass-media(ted) communication. One-way, written or verbal communications tend to enable learning and active engagement less well than dialogic and interactive forms of communication.' In the context of flood warnings, two-way and in particular face-to-face communication have been shown to be more effective in some cases. More specifically, older people in the U.K. reacted more positively to a knock on their door by flood wardens than to some flood warning technologies (e.g. dial-and listen flood warning services), which they found less user-friendly (Parker 2009). People receiving a warning also tend to discuss it face-to-face with members of their immediate social network family (Drabek 2000). The results of such discussions are likely to influence the way they actually respond to such communication (see also the empirical example of the warning system in Vipiteno-Sterzing, Italy in section 4.2 of this report).

For many researchers, the format used for risk communications is an important explanatory factor (Handmer and Proudley 2007, O'Neill and Hulme 2009, Bier 2001). For example, Fielding et al. (2006) found that the severity of the flood warning has an impact on the kinds of actions that people will take, while another important, and related, issue concerns the potential contribution of providing people with probabilistic or uncertainty information in relation to hazard communications (Kashefi and Walker 2009). Indeed, the focus of risk communication research (in food and technology) has hitherto been on communication of scientific uncertainty and prob-

abilities (Wardman and Lofstedt 2009, p 7). Studies outside of Europe and on health related risks, have been undertaken on how probabilities and the scientific uncertainties that come with them are understood by the public (e.g. Johnson and Slovic 1994). In the field of natural hazards, communications involving probabilistic information have been trialled in relation to a range of hazards including hurricanes (Baker 1995), floods (Morss et al. 2005; Bell and Tobin 2007), earthquakes (Bostrom et al. 2008) and weather forecasts (Gigerenzer et al. 2005; Handmer and Proudly 2007).

Gutteling and Wiegman (1996) argue that there is empirical evidence that both rational (e.g. probabilities) and emotional appeals (e.g. personal consequences of hazard events) in risk communication influence people, although emotional appeals seem to be more effective than rational ones. Similarly, there is no clear answer to the question as to whether presenting information through statistics and numbers is more effective than through a narrative style, e.g. personal accounts. With respect to probabilistic information in warning messages, research suggests that rather than following the rules of probability theory when judging uncertain events people tend to use heuristics (Slovic 2000) and reduce options to a binary behaviour choice (e.g. stay or leave). This decision-making process is influenced by emotions, personal experience and other factors.

Using probabilities makes communication more complex and hence potentially less comprehensible. However, it might also make the content of the communication more credible and not presenting them might raise suspicion that some information has been omitted. While some authors have found evidence for these concerns, others have not. Hence, it seems important to still present probabilities, yet more clearly. Risk comparisons as an alternative way to communicate risk probabilities have shown mixed if not adverse impacts (e.g. more outrage or opposition as a result of inappropriate comparisons). Risk ladders and visual presentations of probabilities (pie or bar-charts) have been shown to be more effective in influencing perceptions and risk-mitigating actions than numbers (e.g., percentages, proportions) (Harding et al. 1982; Gutteling and Wiegman 1996). The verbal and written communication of probabilities is also challenging as there seems to be 'limited shared meaning between forecasters and the public on verbal forecast expressions' (Handmer and Proudly 2007, p 79) and what probabilistic statements such as the 100 year flood actually mean (Bell and Tobin 2007). However, it has been found that the inclusion of probabilistic information can be particularly beneficial when the target audience already has a certain degree of knowledge of – and interest in – a particular topic (Frick and Hegg under review). Research also suggests that the inclusion of uncertainty information in risk communications between decision-makers can lead to these actors making better decisions about the management of hazards (Kashefi and Walker 2009) and that they feel more confident about the decisions (Rotach et al. 2009). As mentioned earlier, other actors have found that such information, for example in the form of ensemble forecasts, are not always used in the way they are intended due to different 'epistemic cultures' within the responsible institutions (Demeritt et al. 2007).

However, although probabilistic information appears to be widely accepted and a common format, research also indicates that it may not have much of an influence on the decisions that people make and the ways in which they act in the event of a natural hazard occurring (Kashefi and Walker 2009). Indeed, Mileti et al. (2004) argue that probability estimates are not very important when persuading people to take action as a result of the ways in which people make decisions: 'The end result is binary: is this something to worry about/do something about or not?'

Regardless of whether probabilistic information is included, more fundamental issues about the communication process itself may also explain why risk communications do not always have the desired effect. The characteristics of the sender are important here. As discussed in the following section on social/organisational effects, trust has been shown to be a major issue in risk communication (Renn and Levine 1991; Fischhoff 1998; Williams and Noyes 2007) with contemporary risk communications taking place against a backdrop of increased mistrust in science and the organisations responsible for managing risks. This has led researchers to argue that, when targeting hard to reach groups – such as ethnic minorities, for example – it may be more effective for risk communicators to make contact with community leaders, faith groups etc. and spread the message this way so that people receive the information from a trusted 'inside' source (Eisenman et al. 2007, see also 'social network contagion approach' to risk communication in section 1.3).

The characteristics of the audience are also important. In the first instance, Mileti and Peek (2000) point out that a warning may not lead to action if people do not know what actions they should take, while Palm (1981) argues that people's behaviour in relation to earthquake hazards in California must be seen in the context of the other "constraints and utilities" affecting their household and ultimately their decision to act in certain ways – for example, the need to acquire safe and affordable housing in a very expensive part of the USA. Viewed in this way, the risk of an earthquake is only one factor among many in terms of the decisions involved in purchasing a home. 'In short, what is observed and labelled as risk-taking behaviour for a portion of the decision, would actually be perceived by the decision-maker as risk-averse behaviour given all of the elements which made up the final decision.'

A further crucial point is that 'the public' is not a single, uniform entity – instead, there are many different 'publics', all with different experiences, interests and needs, meaning that risk communication approaches must be tailored to their requirements (Fernández-Bilbao and Twigger-Ross 2009). Such ideas pose a challenge to the ideal of a 'one size fits all' model of risk communication which can cater for everyone. In particular, research has identified a number of factors that can make a difference to how someone responds to a risk communication. Firstly, those who have experienced previous disasters may be more inclined to heed warnings and take effective actions to reduce the damage to their property (Fernández-Bilbao and Twigger-Ross 2009a, Parker et al. 2009), while studies in Germany have also shown a difference between owner occupiers and tenants (nearly 50 per cent of renters left their homes without taking any actions to secure their property and possession, as opposed to only 18 per cent of

owner occupiers, see Steinführer and Kuhlicke 2006; Tapsell 2009). As we might expect, specific vulnerabilities – such as old age or the presence of a disability – can also affect a person's likelihood of receiving a warning (due to possible social isolation) and their ability to do something about it. Consequently, it is often argued that risk communicators should target separate strategies at vulnerable groups (Fernández-Bilbao and Twigger-Ross 2009b). At the opposite end of the spectrum is what researchers have termed the 'white male effect'. According to Slovic (1997) this describes well-educated, relatively wealthy men with conservative political views who have a tendency to downplay risks in comparison with women or those of other ethnic backgrounds. Further socio-economic household characteristics may also play a part in how people respond to hazard related communication. For example, research has shown that families with children may be more inclined to evacuate (Peek and Fothergill 2006). However, extended family networks may also act as a hindrance to evacuation as people may wait until the whole family – including pets or farm animals – can be assembled together before leaving (Rodriguez et al. 2006). In some cases, a family member – usually a man – will also remain behind to safeguard the home and possessions. Gender seems to have a less straightforward effect: while some empirical studies suggest females respond more readily than males, other studies have shown the reverse (Parker et al. 2009).

There is also a time dimension to the effects of communication, which is not well researched. A study on community response to a chemical hazard information campaign in Australia showed that distributing information through brochures in a one-shot campaign did not mean that people actually read and used this information (Jaensch 1995 cited in Rohrman 1998). The main conclusion is that one-off campaigns based on printed information are far from sufficient for building up knowledge or for triggering changes in attitudes and behaviours.

Social/organisational effects

Research literature suggests that risk communication or communication with stakeholders and the public in general yields not only effects at the individual level but also social and organisational effects. In particular two-way communication is expected to increase trust in governing bodies (Kasperson et al. 1992; Slovic 1993), build social capital (Abelson et al. 2003; Butterfoss 2006), improve relationships, achieve wide acceptance or consensus and minimise conflicts (Bouwen and Taillieu 2004; Joseph et al. 2008), enhance local ownership and increase a local sense of responsibility (Butterfoss 2006), activate social and democratic learning processes (Mosert et al. 2008), and improve inter-organisational collaboration (Heeb and Hindenlang 2008)

Achieving these social effects is widely considered as crucial for long-term capacity building (Ishizaka and Tanaka 2003; Parker et al. 2007). In risk communication practice, however, social effects or the building of social/organisational capacities are seldom pursued as explicit goals (see also section 1.2). Only very few systematic evaluations of the social or organisational effects of risk communication can be found in the risk literature and the situation is not much

better in other fields of public communication. In the field of natural hazards, such evaluations stand at a very early stage.

The majority of existing studies focus on short-term effects, so that there is considerable uncertainty as to the stability of these effects (Buchecker et al. 2010). Measuring the social effects of interventions is complicated by the fact that they are influenced by many factors and that these effects often develop with a considerable time lag (Innes and Booher 1999; Bier 2001). Even more complex is the comparison of different forms of communication due to the wide diversity of designs and contexts (Bier 2001).

Across research fields it is widely held that communication influences people's trust, though empirical evidence for this is scarce. However, it is also often assumed that one-way communication cannot achieve trust building or, at least only to a limited degree (Parker et al. 2007). In an experimental study on hospital risks Conchie and Burns (2008) found that less trust was built up through full information provision (transparent communication) than was eroded by withholding information. Furthermore they could show that full information increased people's trust in institutions only if they had already a high level of trust.

In a quasi-experimental field study in the context of natural resource planning Höppner and colleagues (2007) showed that an information event and an interactive workshop had different effects on participants' trust in other participants, the responsible planning committee and the planning project itself. However, not all dimensions of trust developed in the same direction or within the same time frame. While one-off events seem to have an effect on some dimensions of trust, others are likely to need more continuous communication efforts to show any changes.

Quasi-experimental studies in the context of landscape planning suggest that also in short-term two-way communications, trust in the organising institutions only increases if the processes are high quality and well legitimised (Höppner et al. 2007; Buchecker et al. 2010). The evaluation of a long-term consensus-building process in the context of a river restoration project, however, showed a considerable increase in the participants' trust in the organising authorities although the quality of the process was generally assessed as only moderately positive (Buchecker 2008).

There is also some evidence that two-way communication contributes to other aspects of social capital and relationships. Stakeholders included in watershed partnerships in the U.S. assessed the mutual understanding and the quality of relationships among the stakeholders as significantly lower in the first phases of the partnership than in later stages (Leach et al. 2002). Again, good relationships only appeared to develop fully after a period of 4 years. An ex-post evaluation of landscape development concepts in Switzerland among project leaders found that projects with stronger participatory components contributed to a higher mutual trust and a higher mutual understanding among the participants as well as to better collaboration (Höppner et al. 2005).

There are some empirical studies suggesting that two-way communication has positive effects on social learning processes. The evaluation of the above mentioned consensus-building

process in the context of a river restoration project revealed that the process not just resulted in a stronger support of the negotiated project, but also of other (future) river restoration projects of the region (Buchecker 2008). A representative study on river restorations in Switzerland confirmed that people who had been involved in river management in the past generally showed a stronger support for future river restoration projects (Junker et al. submitted). Other studies indicate that even one-off consensus-building processes yield positive effects in terms of perceived regional self-direction and the support of participatory planning (Buchecker et al. 2010) and that avoiding conflicts is one major value added of long-term two-way communication (Menzel and Buchecker in print).

There is considerable evidence that two-way communication contributes to a higher level of consensus on planning measures. In the context of nuclear risks, an experimental study confirmed that non-participants assessed decision processes and their outcomes as significantly more positive if they were told that stakeholders had been involved in the decision (Arvai 2003). Evaluations of one-off consensus-building processes in landscape planning projects showed a systematic convergence of participants' attitudes and an improved mutual understanding of positions among groups (Buchecker et al. 2010). Long-term stakeholder partnerships in watershed management resulted in lower assessment of the existing conflicts among the stakeholders (Leach et al. 2002). An experimental study in the context of the risks of mobile communication found that the population expected two-way communications (unlike one-way communications) to considerably reduce conflicts (Wiedemann and Schutz 2008). The first results of an ongoing study on the long-term effects of participatory river management in Switzerland also indicate positive effects on local ownership and local sense of responsibility (Menzel and Buchecker in print).

Having reviewed the relevant literature, there is limited but consistent evidence that two-way formats of risk communication have social effects relevant for social capacity building. More systematic long-term evaluations are needed to achieve a comprehensive understanding of the interaction between different forms of risk communication and their benefits.

Psychological effects

Empirical research on the psychological impacts of risk communication is still an exception, especially with respect to natural hazards. Recent studies in the field of flood warning have started to shed light on the effects of warning on people's psychological well-being (Parker et al. 2007). They found that receiving a warning alone did not yield any effect on psychological distress and symptoms of shock. Instead, the length of the warning lead time was associated with less reported stress, reduced 'worst time' feelings and trauma (Parker et al. 2007). The authors conclude that a longer lead time for warnings is crucial for reducing the adverse psychological effects of flooding.

We conclude this section with a comment on empirical research methods to measure the effects of communication. The bulk of empirical research has been done ex-post. There are only a few

studies that used pretest-posttest designs or longitudinal research designs. The latter two would be vital to actually measure effects (Rohrmann 1998), however, they are also the most challenging to achieve.

2 From theory to practice – What is good risk communication?

From the above discussed approaches to and challenges of risk communication we can derive a number of recommendations or principles for good risk communication practice. In the following we list general principles that apply for all types of hazards including natural hazards.

General principles of good risk communication:

- There is a communication scheme, strategy or programme in place.
- The purposes and objectives of communication efforts are clear.
- The roles, responsibilities and resources of the involved actors are clear.
- It is clear who the 'audience' is. Communicators have analysed key characteristics, perceptions, concerns, knowledge, and whether and how the audience wants to be involved in the handling of the risk.
- The information on the audience is used to tailor the communication content.
- The communication modes, channels and tools match with the purposes and the needs of the audience (see box 6 overleaf).
- The communication process and the outcomes are evaluated.

While these principles apply across the spectrum of communication purposes it was stressed earlier in this report that a single good practice checklist is not appropriate. Rather, these checklists differ according to the type of hazard at hand, the purposes of communication and the context of the communities and people at risk. Suggested good practice checklists for a) informing a local public at-risk and to raise its awareness, and b) for involving stakeholders in the risk management process are shown below.

a) Principles of communication to inform and to raise awareness (based on Mileti et al. 2004, the state-of-the-art review and the results of the CapHaz-Net expert workshop in Ljubljana in June 2010):

- Communicate repeatedly. It is an ongoing activity rather than a one-off event.
- Be clear, use simple language and do not use purely technical or statistical terms and probabilities.
- Use varied sources and use different tools, modes and channels to communicate which are tailored to the goals of communication, the requirements of a situation and the specific needs of the audience. Don't rely on one communication channel only.
- Render the information consistent and repeat it.
- Tell people what to do to improve their safety.
- Support people in their search for more information. Use words and great graphics plus a good mix of the verbal, the written and the visual. Include attractive symbols, graphics, interesting stories or cues to gain people's attention for messages that are clear and simple without appearing superficial or simplistic.

- Position additional information in the community. Use local people to disseminate and champion information
- Tailor information for special groups.
- Use multiple languages.
- Package information for the media. Work proactively with the media.
- Embrace and openly communicate uncertainty. Find a balance between transparency communication and the practical requirements of a situation and the available resources.
- Use 'windows of opportunity' after a hazard event that might increase the general openness for information.
- Have a long-term strategy that changes as the risks and needs of the audience evolve.
- Allocate adequate resources to professionally design and conduct communication.

b) Principles of communication to enable mutual dialogue between stakeholders and involve them in the risk management process (based Lungren and McMakin 2009, Renn 2008 and this state-of-the-art review):

- Allocate adequate financial resources and time to the process.
- Develop a written interaction/participation plan.
- Involvement should start early and run throughout the risk management process.
- Organising bodies should be committed to listening to, and acting on the issues raised. They should actively communicate how the stakeholders' or the public's contributions influence their work and decisions.
- Relevant stakeholders should be carefully identified and equally represented in the process.
- All relevant information and decisions should be openly communicated and made available to the participants.
- All stakeholders should have equal access and capacity to participate.
- The tools and aims of dialogue and participation should meet decision-makers' and participants' needs.
- Dialogic communication tools should be led by a neutral and professional moderator or mediator.

Box 6: Lundgren and McMakin's (2009) general recommendation for matching modes, channels and tools with different purposes of communication

Purpose	Suggested modes, channels and tools include:
Raising awareness	Visual presentation of risk Face-to-face communication Technology-assisted communication
Informing	Information materials Face-to-face communication Technology-assisted communication
Changing behaviour	Information materials Face-to-face communication Visual presentation of risk
Mutual understanding, knowledge exchange, consensus building	Stakeholder and/or citizen dialogue

3 Risk Communication on Natural Hazards – Practices in Europe

Given that the literature provides general guidelines for good risk communication the question arises as to whether these guidelines are actually being applied to communicate floods, alpine hazards and heat-related hazards. In this section we present an inventory of risk communication practices in Europe and inquire whether we can find the above mentioned principles translated into practice and whether we can discern further good or innovative practice criteria.

First, we outline how we identified risk communication practices for the inventory. Subsequently, we give an overview of the reviewed practices, summarise main insights and highlight good practices for the varying purposes of communication. Again, the idea behind this inventory is to indicate the different ways in which risk communication on floods, alpine hazards and heat-related hazards is enacted in Europe rather than providing a representative summary of all risk communication practices across all European countries.

3.1 Identifying and mapping communication practices

There are many situations in which risk communication can occur (e.g. assessment of risks, preparation and implementation of hazard maps, warning) and communication practices can serve different purposes and functions (e.g. to inform about risks, to inform about what to do, to raise awareness, to exchange knowledge and perspectives). Our inventory should reflect this diversity. Thus, WP partners needed a common framework to structure and to map the array of heterogeneous communication practices. Such a framework furthermore allowed us to develop a common understanding of what we mean by 'risk communication practices' and to standardise the WP partners' descriptions of the practices.

To **identify practices** WP partners were encouraged to ask experts (preferably authorities with a national overview) from their own and at least one other country to point us to specific practices. We suggested the following guiding questions for interviewing these experts:

- Can you think of any good or interesting practical examples of information provision and awareness raising with respect to natural hazards (specific hazards/risks)?
- Can you think of any good or interesting practical examples where local stakeholders or residents have been involved in the planning/implementation of structural measures, of non-structural measures (risk maps, land use planning) or the assessment of risks?
- Can you think of any good or interesting examples for warning procedures, tools?
- Why do you consider them as good or interesting?
- How do they differ from mainstream practice?
- Are there any legal tools/legal requirements with respect to communication?

To describe and to map each practice we...

- 1) ...specified the location and, if applicable, the time frame of the practice.
- 2) ...specified the type of hazard and the risks involved.

3) ...specified the position of the communication practice within the risk cycle. WP5 considered communication practices to prepare for, warn of and recover from hazards/impacts since we are interested in communication as an ongoing activity that transcends single phases of the hazard and risk handling process. However, partners in WP5 agreed to focus on communication to prepare for, prevent and warn of natural hazards as these are the phases in which capacities and resources needed to better prepare for and cope with hazards can be build. Of course, if the practice transcended to the recovery/reorganisation phase this has been noted too. To position the practices more precisely within the risk cycle we suggested using the following 'situations' where communication might occur.

Prevention/Preparation			Warning	
Pre-assessment /appraisal	Development of measures	Implementation of measures	Development of warning strategies/tools	Implementation of warning strategies/tools

If communication occurred during the development or implementation of prevention/preparation measures we further determined the type of measures. The following categories served as a guide.

Structural measures		Non-structural measures			
Small-scale (e.g. avalanche barriers, debris catcher)	Large-scale (e.g. flood retention measures in large river basins)	Land-use planning	Hazard and Risk maps	Risk information/ Forecasting	Emergency training

4) ...specified the purposes/functions of the communication practice. Based on the literature review we suggested the following categories:

- Informing (to build up knowledge on hazards and risks; informing to promote acceptance of risks and management measures; to inform on how to behave during events);
- Triggering awareness/ behaviours;
- Consulting on information, perceptions of risk, needs, knowledge;
- Facilitating mutual exchange/understanding (mutual exchange of knowledge, perception of risks and mutual learning from different perspectives through dialogue);
- Facilitating participation in decision-making;
- Reassuring (reduce anxiety, 'manage' outrage, build confidence);
- Improving relationships and coordination (build mutual trust, cooperation, networks to coordinate and share tasks more efficiently).

If possible, we also specified the content of communication and the main challenges we identified.

5) ...identified the actors between which communication occurs and through which channels and tools the communication took place. WP5 partners agreed to review risk communication

practices between decision makers (managers, official bodies), stakeholders and members of the public rather than between scientists and decision-makers or among members of the public. We have also paid attention to the time dimension of communication in terms of whether it is an ongoing, repeated or one-off activity.

- 6) ...specified in what respects and why we consider the practice as good or poor. What worked well and why?
- 7) ...specified, if possible, whether the practice has contributed to the building of knowledge, attitudinal/motivational, social/organisational capacities or psychological capacities. Alternatively, we outlined its potential contribution.
- 8) ...specified whether anything can be said about the relationship between communication and social vulnerability (e.g. Is risk communication tailored to the needs of vulnerable groups? Are the social and economic risks of management measures considered? Did communication facilitate an equal distribution of benefits/disadvantages?)
- 9) ...added a brief description of the national setting of the practice and a general reflection that was guided by the following questions:

- *National setting*

What types of hazard is the country facing?

Are there any legal tools/legal requirements with respect to communication?

What is mainstream risk communication in the country (risks, management phases, actors, tools)? What is regarded as innovative practice and why? Are there any discernible trends?

Does the described practice differ from the mainstream in the country?

- *General reflection*

Does an evaluation of the communication process take place and, if so, how?

What were the difficulties with reviewing the practice?

3.2 Inventory of communication practices

First, a note of caution is necessary: as this is a review project, we relied on existing information and descriptions of the practices as well as expert views. Hence, the appraisal of good/poor practices is not exhaustive, i.e. we could only note aspects on which we had information, and therefore these are not necessarily the only good or poor aspects of the practices. Also the notion of ‘evaluation’ differs among practices which means that, in some cases an evaluation consisted of consulting a few expert views only (or the views of those who designed communication), while in other cases a qualitative or quantitative survey among receivers was conducted. A full description of practices is given in the Annex to this report. Tables 10 and 11 give an overview of the reviewed practices.

Table 10. Summary of communication practices

Number of practices:	60
Countries:	16
Hazards:	40 Floods, 8 debris flow, 7 landslides, 6 storms, 5 heatwaves, 4 snow avalanches, 4 storm surges, 3 rockfall, 3 droughts, 3 earthquakes, 2 rock avalanches, 2 forest fires
Spatial level:	24 local, 13 national, 8 national-regional, 6 regional-local, 4 national-regional-local, 3 regional
Communication mainly serves to:	46 provide information, 22 warn of events, 12 train emergencies, 11 forecast events, 10 implement non-structural measure (6 land-use planning, 4 risk/hazard maps), 8 develop non-structural measures (7 land-use planning, 1 risk/hazard map), 7 implement structural measures, 7 develop structural measures, 2 develop warning systems

Table 11: Information on the 49 risk communication practices

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Austria									
#1 Severe weather warning*	International, national, regional	Hurricanes, gales, flooding, fog, storms, heat, cold	- Prevention/preparation: Information/forecasting - Warning	- Informing the public - Triggering protective actions	- Website (including risk maps) - SMS, e-mail. Telephone, radio, TV, teletext	- Diversity of channels - Behaviour advice - Continuity - Up-to-date - Design (Europe-wide harmonised icons)	Challenge: - False alarms - Multiple warning services	- Knowledge - Motivation/interest to learn more	1
#2 Campaign 'Kraft des Wassers**'	National	Floods	- Prevention/preparation: Information	- Informing the public - Awareness raising - Allocating ownership of risks	- Brochure	- Part of a series - Specific advice on personal mitigation measures	Challenge: - Outreach	- Awareness - Motivation to act - Knowledge	1
#3 Snow avalanche bulletin	National, regional	Snow avalanche	Prevention/preparation: risk information/forecasting - Warning	- Knowledge transfer - Awareness raising - Influence behavior	- Website - Risk maps - Mass media	- Daily update - Diversity of channels - International norms	Challenge: - Too much warning might undermine credibility	- Knowledge capacities - Guides for risk and emergency behaviour	2
#4 Flood risk zoning HORA*	National, regional	Floods, earthquakes	-Prevention/preparation: Risk maps	- Informing authorities and the public - Awareness raising	Internet Platform	- Continuity - Up-to-date - Single point of access		- Knowledge - Awareness	1
#5 Peak discharge information system	Regional	Floods	- Prevention/preparation: Information/forecasting - Warning	- Informing the public - Triggering preparatory/protective behaviour	- Website (including risk maps) - Radio, TV, teletext	- Continuity - Up-to-date - Design (understandability of info icons)	Poor: - Language/terms (no translation into foreign languages)	- Knowledge - Awareness	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Czech Republic									
#6 Flood Forecasting System	National, regional, local	Flooding, drought (i.e. low water levels); part of a system also covering heavy rain, wind, frost, snow	- Prevention/preparation: Information/forecasting - Warning	- Informing authorities and the public	- Website (including maps with gauge information)	- Up-to-date (hourly updates) - Design (starting from the national scale: easy access to regional and river-basin information)	Challenge: - Only internet-based Poor: - Majority of information only available in Czech	- Knowledge (information)	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Finland									
#7 Kokkola Island	Local	Storm Surges, Storms, Heat waves	- Prevention/preparation: Land use planning	- Informing the public about projects/decisions	- One-way communica- tion	- Preventive approach to climate change - Flexible decisions that are adaptable to new and more valid scientific knowledge on the impacts of climate change		- Knowledge - Awareness	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
France									
#8 National communication about Natural Hazards	National	Floods, forest fires, storms, cyclones, land slides	- Prevention/preparation: Information	- Informing the public - Awareness raising - Triggering protective behaviour	- Website structured in 7 sections	- Content (Information is clear, concise, very complete) - Specific behaviour advice - Up-to-date - Design (Website is easy to navigate)	Poor: - Outreach/availability (only available via Internet)	- Knowledge - Awareness	1
#9 Vulnerability reduction Loire basin	Regional, national	Riverine floods, flash floods	Prevention/preparedness: risk information, prevention plans for buildings	- Sensibilisation for risks - Risk /vulnerability assessment - Triggering private prevention measures	- Vulnerability reports - Questionnaires - Photomontages - Media - Articles	- Vulnerability assessment for specific buildings motivates owners to take prevention measures	- Focus mainly on owners of (larger) enterprises	- Awareness - Prevention behavior	2
#10 Plan Vidourle	Regional, local	Riverine floods, flash floods	- Prevention /preparation: Planning of large scale structural measures, risk information, emergency plans	-Sensibilisation for risks, - Keep memories alive	- Travel exhibition - 3-D model of river basin - Book - Video	- Diversity of tools and channels - Instrument: Targets the needs of the wider population and of children.		- Awareness - Knowledge - Trust building	1
#11 Damage reduction Communauté du Pay d'Aix	Regional, local	Forest fire, earthquakes, floods, technological risks	Prevention/preparation: emergency plans, emergency training	- Risk preparedness - Risk behaviour	- Guidelines - Media - Emergency plans - Alert system	- Make damage reduction a regional issue - Reflection of regional vulnerability		- Awareness - Coordination of emergency measures	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Germany									
#12 IÜG Bayern*	Regional, local	Floods	- Prevention/preparation: Implementation of hazard/risk map	- Informing the public - Raising awareness	- Hazard/risk maps in print and in web services	- Tools fit the objectives - Continuity	Poor: - Design (Understandability, readability, usability) - Presentation/outreach (lack of promotion in prominent public places) - Lacking link to other tools	- Knowledge - Awareness	2
#13 Spree Forest watercourse margin project	Regional, local	Floods	- Prevention/preparation: Development of structural and non-structural measures, information	- Facilitating mutual exchange between authorities, stakeholders and the public - Facilitating participation of stakeholders and the public in decision-making - Informing the public	- Strategy group, working groups - Moderation plenary with all participants; 43 meetings with 1600 participants from the region - Information events, exhibition, media work	- Communication and participation scheme from the outset - Participatory approach - Professional design - Diversity of modes, channels and tools - Active media work - Continuity - Integrated approach (conversation and natural hazards) - Continuity over the duration of planning and implementation process		- Knowledge - Awareness - Trust building - Mutual understanding and learning	1
#14 'Blauer Plan' Regensburg	Local	Floods	- Prevention/preparation: Planning and implementation of structural and non-structural measures, Information	- Informing the public to increase knowledge, trigger interest, promote acceptance - Awareness raising	- Maps, info tables, flood marks, flood columns, infobox, brochures, public events/festivals, Website, 3-D videos - Press conferences - Round Tables	- Diversity of modes, channels, tools - One-off, episodic and permanent tools - Tools fit the objectives	Poor: - Design (design of flood columns was open to improvement) - Language/terms (Understandability, Communication of a false sense of security) Challenge: - Gap between information provision and information intake	- Knowledge - Awareness	2

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Germany									
#15 Flood Partnerships in Baden-Württemberg	Regional Local	Floods	- Prevention/preparation: Information, structural and non-structural measures	- Raising awareness among the public in catchment areas - Informing the public about risks - Triggering protective actions among the public - Improving the communication and coordination between the authorities and of the public in the affected communities - Network building	- Communication between authorities: Formal and informal exchange of experiences and joint elaboration of flood maps, alarm and application planning, preventive planning - Communication to the public: Materials (e.g. films, exhibitions) on flood prevention - Internet webpage with e.g. a flood lexicon, flood maps and contact persons	- Time, i.e. long-term strategy running since 2003 - Goes beyond the municipality level to the catchment level - Two-fold strategy which combines interaction between authorities and information for the public		- Awareness - Knowledge - Social/organisational capacities, i.e. abilities to work together and to share tasks; trust-building	1
#16 Flood animation centre, Hamburg	Local	Storm surges, flood	- Prevention / preparation: Information, motivation to reflect risk situation	- Awareness raising - Motivating - Training	- Flood animation box - Visual tools such as flood cylinders and videos - Virtual flood maps	- Enhances awareness through emotional experiences - Motivates to reflect personal risk situation	- Limited outreach	- Awareness raising - Participation in capacity building processes	2
#17 Flood Art, Moosburg *	Local	Floods	- Prevention/preparation: Information	- Awareness raising - Memorising	- Sculptures and other art objects	- Innovative, unique to local contexts - Language (expert-independent)		- Awareness - Motivation/interest - Positive emotions	1
#18 Flooding Köln	Local	Flood	- Prevention/preparation: Risk information - Warning	- Information - Awareness raising	- Permanent: Alert lights/Tide Gauge Tower, Website, bulletins with behaviour advice, risk maps - During event: telephone, radio, internet - Communication between authorities through FLIWAS Flood Warning and Information System	- Intuitive alert system - Integrative approach: permanent, episodic and event related communication to the public and communication between authorities - Design (Website is easy to understand, good graphics; innovative lighting of pumping station)	- Website not accessible to whole public	- Awareness raising - Knowledge	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Iceland									
#19 Evacuation simulation	Local	Volcano	- Prevention/preparation: Information, emergency training - Warning	- Information - Triggering protective action (evacuation)	- Information meetings to inform residents - Evacuation warning by text message to mobile phones or recorded messages dialed to landline	- Learned from failure - Content simulated evacuation (informative, raised awareness)	- Strong reliance on mobile phone technology is problematic as they may easily fail and residents don't carry them around all the time - Residents had not been consulted in the development of the evacuation plan - Residents felt disempowered	- Knowledge - Awareness - Mutual learning between public and authorities - Social/organisational capacities: empowerment of residents through direct involvement (town meetings) in a risk communication and evacuation strategy	2

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Italy									
#20 Information flow between meteorological centers*	National, regional, local	Floods, snow avalanches, debris flow, landslides	- Prevention/preparation: Information/forecasting - Warning	- Informing to improve decisions at national and local levels - Informing the public	- Bulletins		Poor: - Language/terms (Understandability to public) Challenge: - Fragmented and overlapping competences - False alarms due to standardised interpretation (mistrust of the sources)	- Knowledge	1
#21 Etsch-Dialog	Regional	Floods, debris flow	- Prevention/preparation: Planning and implementation of structural and non-structural measures, Information	- Facilitating mutual exchange/dialogue between authorities, stakeholders, experts - Facilitating participation of stakeholders in decision-making - Informing to increase knowledge and to promote acceptance among stakeholders and public - Awareness raising	- Eight Flussraumforen (Riverfora), field trips - Info folder, info events, website, info station with documentary video, River-Bus, Festival, touring exhibition - Press releases and meetings	- Communication plan from the outset - Participatory approach - Participatory assessment with documentary - Diversity of modes, channels, tools - Professional design - Responsibilities are clear - Language fits user needs - Cooperation of 6 municipalities - Active media work - Integrated information approach (hazards, management, planning, ecology etc.) - Continuity over the duration of the planning process		- Knowledge - Awareness - Motivation/Interest - Mutual learning - Relationships and Cooperation - Communication abilities of stakeholders	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Italy									
#22 Alba	Local	Floods	- Prevention/preparation: Planning and implementation of non-structural measures (land use/environmental planning), Information, Training	- Informing to facilitate better decisions by civil protection units - Facilitating participation of students in decision-making - Raising awareness - Triggering protective/emergency behaviours (citizens, schools)	- Meteorological bulletins - Invitation letter, evacuation simulation - School involvement in hydro-geologic study	- Integrated approach	Poor: - Emergency training only one-off event Challenge: - High costs, need for time and energy	- Knowledge - Awareness - Mutual learning - Creation of social nets	2
#23 Malborghetto-Valbruna	Local	Flash floods and debris flow	- Prevention/preparation: Implementation of structural and non-structural measures	- Informing stakeholders - Consulting information, data, images, video - Keeping memory of past events alive	- Public hearings and meetings - Documentary DVD, video-interviews, images and text	- Active reflection and memorising of past events		- Knowledge - Awareness - Mutual learning	1
#24 Vipiteno-Sterzing and Val di Vizze	Local	Floods	- Prevention/preparation: Planning of structural and non-structural measures	- Awareness raising - Consulting opinions and observations - Facilitating mutual exchange/understanding between authorities and public - Improving relationships/coordination through trust and cooperation - Facilitating participation in decision-making (choose an alternative for risk mitigation which is accepted by residents)	- Public meetings, face-to-face information of stakeholders, written information	- Participatory approach (opinions, visions)		- Knowledge - Awareness - Mutual learning - Relationships - Trust in authorities	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Netherlands									
#25 'The Netherlands lives with Water' and 'Think Ahead' campaigns	National	Floods	- Prevention/preparation: Information	- Informing the public - Awareness raising	- Radio, TV, Internet - Information booklets and events	- Continuity, most intense during flood season - Diversity of channels	Poor: - Effectiveness (hardly any change of attitudes/behaviour) - Detached from local situations	- Awareness	2

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Norway									
#26 Aknes rock slope	Regional	Rock fall, rock avalanche	- Prevention/preparation: Non-structural measures - Warning	- To warn local public - Facilitating participation of stakeholders in the development of an early warning system - Facilitating stakeholder participation in the development of mitigation measures	- Website - Public meetings, newspapers, TV, radio, training exercises - Workshops with stakeholders - Warning through 26 sirens, automatic phone calls	- Training exercises revealed weak points which were addressed as a consequence			1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Poland									
#27 MGW forecast and warning system	National, regional	16 different natural hazards, e.g. storms, heavy rain and snowfall, heat, frost	- Prevention/preparation: Forecasting - Warning	- Mainly to warn responsible services and people at-risk of the risk and possible consequences.	- Website - Mass media	- Design (warning system is well designed)	Poor: - Instruments, i.e. no nation-wide information campaign about the website Challenges: - Design and Content, i.e. using the same scale for various hazards with different consequences might not be appropriate. - Time, i.e. frequent high alert warnings may have reduced vigilance - Outreach (Internet is available to only 42 per cent of Polish population)	- Knowledge on risks - Awareness	1
#28 Flood Prevention Coordination and Information Centre	National	Floods, drought	- Prevention/preparation: Risk information	- Informing the general public about risks and how to behave during events	- Internet website	- Content, i.e. information is useful; behaviour advice - Up-to-date and around the clock availability	Poor: - Outreach, i.e. information is not distributed actively Challenge: - Outreach, i.e. Internet is not available to all	- Knowledge - Awareness	1
#29 Local Flood Protection System in Kłodzko valley	Local	(Flash) floods	- Prevention/preparation: Forecasting - Warning	- Informing and warning local authorities, fire-fighters and people in flood-prone areas about flood risks	- Website - Alerts to county and community authorities, and firefighters	- Improvement as local systems had not been available before - In some cases accompanied by the development of local evacuation plans.	Poor: - Content and language, i.e. still seems to be too scientific and difficult to understand	- Knowledge on risks - Awareness	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Poland									
#30 Flood Damage Mitigation Plan in Gorzanów	Local	Floods	- Prevention/preparation: Planning of evacuation and education plan	- Involving the local public in designing the local evacuation and education plan - Building up knowledge among local public	- Questionnaires to consult citizens' knowledge and preferred communication channels - Maps, local website and leaflets - Special lectures and competitions in local schools	- Content and instruments: Evacuation and communication were formulated on the basis of social consultations	Challenge: - Number of citizens that actively took part in the process of designing the plans was rather low	- Knowledge - Awareness - Ownership - Trust	1
#31 Flood prevention plan Racibórz	Local	Floods	- Prevention/preparation: Information - Warning	- Informing services and the people at-risk about the risks and possible consequences	- 11 electronic warning horns - Local media (radio and TV) complement horns in case of an emergency - Evacuation maps and first-aid kits for residents - Illustrated cartoons were distributed among local pupils - Films about property protection and evacuation - Website	- Time, i.e. continuous practice - Diversity of tools	Poor: - Citizen's preferences for communication channels were not consulted	- Knowledge - Awareness	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Romania									
#32 'Be prepared. We are' campaign	National	Floods	- Prevention/preparation: Information, Emergency training	- Informing students and the public at large - Trigger protective actions Raising Awareness	- Website, TV spot, leaflets, stickers, brochures, bracelets - Training events at high schools	- Combination information and training - Outreach (students to peers and families) - Diversity of channels and tools	Challenge: - Lack of funding	- Knowledge - Motivation - Awareness	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Serbia									
#33 Jagodina municipality	Local	Landslides	- Prevention/preparation: Information	- Passing on knowledge on risk prone areas among the local population and from residents to decision-makers and ge-engineers	- Verbal communication among the local population - Written communication via topographical maps that show the location of landslide prone areas	- Time, i.e. it is a continuous practice that is more than a century old - Available information dates back longer than any institutional data - Spontaneous and unplanned communication can, at times, be more efficient than institutional measures and communication	Challenge: - Incoming experts and planners are sometimes unaware of the local knowledge, the available information and functioning communication between residents	- Awareness - Knowledge - Trust - Mutual Understanding and learning - Ownership	1
#34 Trgoviste municipality	Local	Landslides	- Prevention/preparation: Implementation of structural and non-structural measures - Warning	- Informing about the hazard, risks and measures taken - Behaviour advice to trigger actions accordingly	- Sector on Emergency Management (highest national body in the field) and local authorities contact inhabitants and provide leaflets and an evacuation plan	- Priority is put on prevention - Improvement to previous practices in Serbia which were chaotic and limited to post-event activities		- Awareness - Knowledge	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Slovenia									
#35 Information on disaster reduction	National	Earthquake, flooding	- Prevention/preparation: Information - Warning	- Awareness raising - Guiding behaviour	- Leaflets and brochures - Internet - Mass media - Posters	- Diversity of channels - Specific focus on informing children - Psychological effects are addressed		- Awareness raising - Knowledge (behaviour) - Psychological capacities	1
#36 "Slano Blato" landslide	Local	Landslide	- Warning - Emergency intervention - Reconstruction	- Informing the public - Acceptance for interventions	- Mass media - Village meetings	- Daily information on public safety - Direct information by experts/authorities	Poor: - Top-down communication (state plan) Challenge - Division of responsibilities	- Motivation/attitudes Relationships - Organisational learning (communication)	1
#37 Landslide and debris flow Mangartom	Local	Landslide Debris flow	- Information - Warning - Reconstruction	- Trigger protective behaviour - Acceptance of decisions (evacuation)	- Rapid response system (involvement of fire brigade) - TV - Risk map - Communication conference - Alarm system	- Communication between state agency and local fire brigade - Attempt to build up an alert system	Poor: - Risk systems (map, alert system) not explained - Residents not included in reconstruction - Unclear responsibilities (nobody was really in charge of communication to the public)	- Knowledge (experience) - Self-efficacy (self help, solidarity) - Loss of trust	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Spain									
#38 Action plan Catalonia heat-waves	Regional (Catalonia)	Heat waves	- Prevention/preparation: Information - Warning	- Informing and triggering protective behaviour among individuals and in communities - Improve coordination between 18 responsible organisations	- Info leaflet to the general public, hospitals, nursing homes, municipalities etc. - Hotline - Media (alerts)	- Stratified information according to target group - Communication changes during summer months - Regular evaluation and improvements (since 2003)	Poor: - Top-down approach only Challenge: - Might breed complacency among communicating agency	- Awareness - Knowledge - Relationships between organisations	2

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Sweden									
#39 Public announcement system	National	All types of emergencies	Warning	- Informing and triggering protective behaviour	- Sirens - TV and radio - RDS system	- The alert is focussed on the exact areas affected - Combination of alarm and information	Poor: - Limited to towns with populations larger than 1000. - Sirens on/off	- Awareness - Knowledge (behaviour)	2

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Switzerland									
#40 Snow avalanche bulletin, education and decision support tools SLF*	National, regional	Snow avalanche	- Prevention/preparation: risk information/forecasting, training - Warning	- Informing the public and experts (safety services) - Raising awareness	- Texts, graphics, maps, excursions, guided tours, videos, exhibitions, learning-CD, e-Learning, White Risk mobile, training courses	- Diversity of channels/tools/modes - Content fits varying user needs - Continuity - Up-to-date - Single point of access - Specific behaviour advice - Self-responsibility	Poor: - Understandability of language/terms	- Knowledge - Awareness	2
#41 IFKIS-Hydro and GIN (Common Information Platform for Natural Hazards)	National, regional	Floods, debris flow	-Prevention/preparation: risk information/forecasting - Warning	- Informing safety services and intervention forces to improve decisions - Raising awareness	- Online Information Platform	- Continuity - Up-to-date - Summarise available information (single voice) - Single point of access	Challenge: - Different user needs	- Awareness - Knowledge - Shared knowledge basis for cooperation/improved coordination	2
#42 Insurance IGV*	National	Floods, debris flow, landslides, snow slides, storm, floods, hail	- Prevention/preparation: Information	- Raising Awareness - Triggering protective behaviour	- Brochure	- Design - Specific advice on personal mitigation measures	Challenge: - Outreach	- Awareness - Knowledge	1
#43 RiskPlan	Regional, Local	Alpine hazards, e.g. floods, mountain torrents	- Prevention/preparation: Development of structural prevention measures and property protection	- Tool to support decision-making at the strategic level	- Dialogical workshops with cantonal engineers, local experts, safety services, intervention forces and insurance experts	- Visualisation of direct consequences and costs/benefits of mitigation measures to support better decisions - Workshop participants can act as 'multipliers' for the society		- Knowledge	1
#44 Intervention plan	Local	Floods	- Prevention/preparation: Information - Warning	- Informing intervention forces to improve decisions and work	- Water resistant information sheet	- Design - Specific behaviour directions/intervention measures - Content fits user needs	Poor: - Only local applications	- Knowledge - Shared basis for cooperation	2

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Switzerland									
#45 Glyssibach	Local	Debris flow	- Prevention/preparation: Implementation of hazard map and planning and implementation of structural mitigation measures	- Informing the public also to promote acceptance of prevention measures - Consulting viewpoints within the public - Facilitating participation in decisions on protection concept	- Review group with independent mediator, meetings, public presentations and discussions	- Integration of local residents into the planning phase - Outreach (those who participated spread knowledge in community)		- Relationships among residents (helping each other during the recovery phase brought people together)	1
#46 Valais	Local	Avalanche	- Prevention/preparation: Implementation of structural measures (avalanche deflection)	- Informing the public to promote acceptance	- Public hearings and face-to-face discussions with affected persons	- Professional communication concept	Poor: - Better and earlier involvement in planning phase was requested by directly affected people Challenge: - Engineers did not want to be influenced by public opinion in an early planning phase	- Knowledge - Awareness	1
#47 Sarner See	Local	Floods	- Prevention/preparation: Planning of large scale structural measures	- Informing to gain acceptance - Facilitating participation of stakeholders in decision-making	- Stakeholder workshops - Public information events	- Participatory approach (interests, visions) - Participatory assessment (options) - Open and full information	Poor: - Implementation and reflection (design, purpose of workshops, room for negotiation, available time, link between expert and participatory assessment) Challenges: - Transparency - Variety of interests	- Knowledge - Local initiatives	1

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
Switzerland									
#48 Weggis	Local	Debris flow, shallow landslides, rock fall	- Prevention/preparation: Implementation of structural and non-structural measures (land-use planning)	- Informing the public mainly to gain acceptance - Raising awareness - Facilitating participation of the public in decision-making (referendum)	- Information events, field inspections, personal meetings, info letters and brochure - Referendum	- Diversity of modes and channels - Open and full information	Poor: - Implementation (length and design of material) and reflection (on ways to mediate interests) Challenge: - Equity, fairness, solidarity in community - Socio-political conflicts	- Awareness - Knowledge	1
#49 Felsberg	Local	Rock fall and rock avalanches	- Prevention/preparation: Implementation of non-structural measures (information, training) - Warning	- Informing the public - Triggering protective behaviour - Reassurance of the public - Information management (rumour spreading, media)	- 'Gemeindeführungsstab' (a local committee) - Local gazette, leaflets, info events, field inspections, personal letters and talks - Infobox and press communications	- Diversity of modes and channels - Living committee active across risk phases - Regular emergency exercises - Proactive media work	Challenge: - Media attention - Balance of safety and self-responsibility	- Awareness - Organisational learning - Relationship building - Trust in authorities	2
#50 Augand	Local	Floods	- Prevention/preparation: Planning and implementation of large-scale structural measures	- Informing the public and stakeholders - Promote acceptance - Promote mutual understanding among authorities and stakeholders - Participation of stakeholders in decision making	- Public hearings, face-to-face information of landowners - Written information and field inspections with stakeholders - Stakeholder planning committee	- Early involvement of stakeholders and public - Room for negotiation - Two-fold approach: information and interaction	Challenge: - Long duration	- Knowledge - Communication and cooperation abilities of authorities - Trust in authorities	2
#51 Samedan	Local	Floods	-Prevention/preparation: Planning and implementation of structural and non-structural measures, information	- Informing - Promoting consensus - Facilitating participation of stakeholders and the public in decision-making	- Info events, newsletters, public voting, working groups, personal talks with landowners and field inspections	- Integrated communication (safety, ecology, tourism) - Two-fold approach: information and interaction - Participatory assessment (options)	Challenge: - Urgent need for protection measures - Variety of interests	- Knowledge - Awareness - Local sense of self-efficacy - Mutual learning - Ability to find creative solutions - Mutual trust	3

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
United Kingdom									
#52 'Preparing for Emergencies' campaign	National	All	-Prevention/preparation: Information	- Informing to build up knowledge - Raising awareness - Triggering protective behaviour	- 22-page booklet to households, Website	- Language/terms (simple message) - Behaviour advice	Poor: - Language (too simplistic and patronising in tone) - Content (too generic with focus on terrorism) - Inconsistent with the messages of other campaigns Challenge: - Inconsistencies with campaigns focussing on specific hazards	- Knowledge - Awareness	2
#53 UK Resilience Website	National	All	- Prevention/preparation: Information - Emergency response and recovery	- Informing emergency practitioners	- Website run as a news and information service	- Single point of access - Diversity of content	Poor: - Design (not user friendly and hard to find information) - Amount of information Challenge: - Public are not currently targeted	- Knowledge - Awareness	1
#54 Flood Warning Service	National	Floods (river and sea)	- Prevention/preparation: Information/forecasting - Warning	- Informing - Raising awareness - Warning - Triggering protective actions	- Webpage, TV and radio weather and travel reports, telephone, text messaging, email, fax or pager, Flood Wardens, loudhailers, siren systems, Floodline number	- Diversity of channels and tools - Specific behaviour advice according to 4 different risk levels - Language (clear and simple)	Poor: - Coverage (not all areas are covered) - Timing of warning (two hours' notice only)	- Knowledge - Awareness	

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
United Kingdom									
#55 Heat-Health Watch Scheme	National	Heatwaves	- Prevention/preparation: Information - Warning	- Informing stakeholders and the public - Raising awareness - Triggering protective behaviour	- Website, advice booklets, warnings during routine TV weather forecasts	- First warning practice on heatwaves - Proactive warning - Specific behaviour advice - Content fitted to needs of vulnerable groups	Poor: - Low awareness of practice among staff working with the elderly - Timing of advice - Advice rarely translates into action	- Knowledge - Awareness	2
#56 Drought conditions	National, regional	Droughts	- Prevention/preparation: Information	- Informing - Triggering attitude and behaviour change - Awareness raising	- TV, radio, Website, leaflets		Poor: - Inconsistency - Discrepancies between water companies Challenge: - Fragmentation of water management between private water companies - Conflict of interests - Low public trust in companies - Drought is not yet regarded as a 'UK hazard'	- Knowledge - Awareness raising - Public trust in companies	1
#57 Ensemble flood forecasting and warning*	National, regional	Rainfall, snow, flooding	- Prevention/preparation: Information/forecasting - Warning	- Information (floods) between experts at national and regional levels to support decisions - Informing (rainfall, snowfall) the public - Warning	- Website, risk map at national and regional level - National and regional broadcast media, electronic media - Email, fax	- Continuity - Up-to-date - Improved national practice	Poor: - Channels (need to be better defined) - Content (needs to be more targeted) - Language/terms (Understandability of probabilities)	- Knowledge - Coordination/ focussing actions	1
#58 'Snakes and ladders' game	National, local	Floods	- Prevention/preparation: Information, Training - Recovery	- Informing to build up knowledge - Facilitating mutual exchange/understanding - Improving relationships between residents, stakeholders, policy makers - Triggering protective behaviour	- Interactive flood recovery simulation tool	- Continuity, availability - Flexibility, adaptable to local situation and user needs - Innovative, informative yet entertaining - Integrated information (actions, behaviours, psychological effects)	Challenge: - Not yet available to a wider audience	- Knowledge - Motivation and interest building - Change of attitudes towards flood recovery	3

Location/name	Level	Hazards	Management Phase/s	Communication objectives	Channels/Tools	Good or innovative aspects**	Poor aspects or challenges**	Contribution to social capacity building**	Evidence***
United Kingdom									
#59 Flood Map	Regional, local	Floods (river and sea)	- Prevention/preparation: Implementation of hazard/risk maps	- Informing stakeholders and the public - Raising awareness - Triggering preparatory/protective actions - Reassuring the public - Facilitating mutual exchange and improving relationships between authorities, stakeholders, planners, the public	- Maps in web service	- Continuity - Regular updates (4 times a year) - Content (flood probabilities and extensions)	Poor: - Content (no information for individual properties, lack of information on speed, depth, volume etc.)	- Knowledge - Awareness	1
#60 'Making people flood wise', Flood awareness raising campaign	National, local	Fluvial and coastal flooding	- Prevention/preparation: information - Warning	- Raising awareness - Informing - Encouraging the public at risk to prepare in advance of flooding and to take appropriate action in response to flooding - Building trust within communities.	- Advertising in national and local media - Booklets, guides, floodline pack and directories - Flood warning services - Public events and face-to-face information	- Multiple-step and long-term communication strategy - Instruments and Content (diverse, fits the needs of the audience) - Target levels of communication programme are clear - Extensive programme of preparatory research and evaluation of success	- Costs	- Knowledge - Awareness and interest - Trust in authorities and within communities	3

*Similar practices exist in other countries too. **Not necessarily exhaustive as based on review of available material rather than on systematic empirical analysis.

***Contribution to social capacity building: 1= Assumed, 2=Some evidence exists, 3=Empirically confirmed

Overall, our guide for mapping communication practices worked well in that all practices could be assigned to specific positions in the risk cycle. The most important observations from the review of communication practices are listed below.

- The highest number and diversity of practices in terms of objectives and tools were found for floods. There are flood communication practices taking place at national, regional as well as local level.
- At national and regional level one-way communication with stakeholders and the public dominates. Two-way communication with stakeholders and the public is largely limited to the local level of the municipality. Two-way communication practices were found for floods but hardly any for other natural hazards.
- Overall, communication with the general public is largely limited to one-way communication aiming at informing the public (on the hazard, on risks, on mitigation and prevention measures, on how to behave in the case of an event, and to promote acceptance), raising awareness, triggering protective action, and warning of upcoming events.
- Only a few practices explicitly consider relationship management, outrage management, the preparation for adverse psychological/emotional effects, mutual understanding, keeping memories alive and learning as explicit objectives of communication. Or, from the perspective of social capacity building, the bulk of communication practices aim at developing knowledge capacities and attitudinal/motivational capacities (e.g. awareness) rather than at fostering social/organisational and psychological capacities.
- In some local practices (and only one regional one) stakeholders are involved in a two-way, dialogical communication process. This is mainly to inform them, to facilitate their participation in the planning and/or implementation of structural measures and/or non-structural measures. With respect to the planning (rather than implementation) of hazard/risk maps we did not find any two-way dialogical practices.
- Practices that involve stakeholders or the public in the pre-assessment/appraisal of risks are an exception. Two-way communication with stakeholders usually starts only in the planning or implementation phase of prevention measures.
- We did not find any practice that tried to involve stakeholders or the public in the development of information tools, warning tools or overall communication strategies.
- Practices range from very few tools to many tools. They are rarely embedded in a comprehensive long-term communication strategy.
- Prevention/preparation and immediate warning as two distinct phases in the risk management cycle focus on different objectives and use different sets of communication tools. They also differed in terms of good/poor qualities that came up in the appraisal of practices. Hence, the review process supports the point made earlier in this report that it is neither possible nor achievable to come up with one single best practice guide for all risk communication practices. While for warning continuity, up-to-date availability and effective

outreach, timing and clear crisp directions were prominent criteria, for prevention/warning full/open and transparent communication, a combination of information and interaction, and a mix of permanent, episodic, and one-off communication and a flexible (time, modes, channels, tools) implementation of communication tools according to the requirements of a specific situation/context were mentioned.

- The extent to which responsibilities for communicating with and to stakeholders/the public were clear differed greatly between the reviewed practices.
- There were only a few practices in which bodies (committees, organisations) exist and learn with some consistency through the years and communicate/coordinate across risk phases and/or integrate across a number of environmental issues.
- Communication practices are rarely based on prior research into the needs of the audience and whether and how they want to be involved.
- There are hardly any empirical evaluations with respect to the objectives of communication and its contribution to social capacity building.

In general, existing practices have been found to have both good and poor qualities. In the following we list good and poor aspects of the reviewed practices and the challenges to communication practice.

Good aspects	Poor aspects
<p><i>Content:</i></p> <ul style="list-style-type: none"> - Specific behaviour advice; fits user needs; communicates self-responsibility; addresses psychological effects; tailored to the needs of vulnerable groups; integrated information (information on different landscape/environment aspects); informative yet entertaining; innovative—curiosity arousing; simple message; information is clear/concise/complete 	<p><i>Content:</i></p> <ul style="list-style-type: none"> - Inconsistency of message with other messages; no information on specific spatial levels; too generic with focus on alarmism; too much information; communication of a false sense of security; needs to be more targeted
<p><i>Language/terms:</i></p> <ul style="list-style-type: none"> - Simple; expert-independent; clear 	<p><i>Language/terms:</i></p> <ul style="list-style-type: none"> - Too simplistic and patronizing; no translation into foreign languages; understandability of probabilities and terms
<p><i>Design:</i></p> <ul style="list-style-type: none"> - Graphically concise; clear; consistent with international norms; easy to navigate/user friendly 	<p><i>Design:</i></p> <ul style="list-style-type: none"> - Not user friendly; readability; usability; length of material
<p><i>Instruments:</i></p> <ul style="list-style-type: none"> - Diversity of channels, tools and modes; tools fit objectives; regular emergency exercises, combination of information and training; flexible tools that are adaptable to contexts and needs; availability; warning tools are complemented with evacuation plans and public information campaigns 	<p><i>Instruments:</i></p> <ul style="list-style-type: none"> - Written communication only; communication channels not sufficiently defined; participatory practice is poorly implemented (design, purpose of tools, room for negotiation, available time, link expert and stakeholder assessment); coverage (forecast/warning systems do not cover all parts of a country); tools are not available to all (Internet), top-down and centralised communication only

Good aspects	Poor aspects
<p><i>Time:</i></p> <ul style="list-style-type: none"> - Continuity; up-to-date; intensity/content of communication follows temporal development of (seasonal) hazards; mix of one-off, episodic and permanent communication 	<p><i>Time:</i></p> <ul style="list-style-type: none"> - Timing of advice; timing of warning; only one-off (emergency training, campaigns)
<p><i>Outreach:</i></p> <ul style="list-style-type: none"> - Multiplier effects through peer-to-peer communication; proactive work with the media 	<p><i>Outreach:</i></p> <ul style="list-style-type: none"> - Lack of promotion of tools; only local applications of a useful practice
<p><i>Transparency:</i></p> <ul style="list-style-type: none"> - Open and full information 	<p><i>Spatial and context specificity:</i></p> <ul style="list-style-type: none"> - Detached from local situations; does not provide local information
<p><i>Source:</i></p> <ul style="list-style-type: none"> - Single access point; single voice 	<p><i>Effects:</i></p> <ul style="list-style-type: none"> - Low effectiveness to change attitudes, behaviours
<p><i>Others:</i></p> <ul style="list-style-type: none"> - Communication strategy/plan from the outset - Clear responsibilities - Two-fold approach: information and interaction - Regular evaluation and improvements - Improvement on current practice - Participatory approach (visions, interests, options) - Early involvement of stakeholders - Room for negotiation - Communication/cooperation beyond a single municipality; all municipalities of the affected area (e.g. catchment area) engage in communication - Preventive approach to climate change - Flexible planning decisions that are adaptable to new and more valid scientific knowledge on the impacts of climate change - The warning system has been exercised - Long-term unofficial risk communication between local people through verbal and visual means. - Citizen's knowledge and preferences are elicited and used to design communication and evacuation plans 	<p><i>Others</i></p> <ul style="list-style-type: none"> - Lack of willingness to communicate on behalf of those responsible - Unclear responsibilities (nobody is really in charge of communicating with the public) - No communication plan - Lack of reflection on ways to mediate between different interests particularly at the local level

Challenges

Source, content and design

- Fragmentation of communicators (e.g. water companies), division of responsibilities, multiple agencies
- Inconsistencies between campaigns. For example, the 'Go in, Stay in, Tune in' advice issued by the 'Preparing for Emergencies' campaign in the UK (practice # 51) is directly contradicted by a campaign run by the UK Fire and Rescue Services, whose common sense catch phrase is 'Get Out, Stay Out, Call Us Out'.
- Too many sources of warning are problematic as they may lead to confusion and reduce the credibility of both the message and the sender.
- Generic warning scales and graphics across the spectrum of hazards with very different consequences might not be appropriate.

- Correctness of warnings (false warnings might undermine credibility and trust in services)
- Balance between communicating safety and self-responsibility
- Complacency with achievements (information campaign)
- Different user needs

Availability and outreach

- Tools are not yet available to a wider audience. Communication channels (e.g. Internet) are not available to all.
- High media attention may trigger 'event tourism' which potentially poses an additional challenge for emergency services (e.g. crowded access routes)

Awareness and willingness

- Frequent warnings may reduce vigilance
- Low awareness of tools, limited outreach and advertisement for information and warning tools
- Lacking national awareness because of novelty of hazard
- The audience's willingness to actively participate in the design of communication tools or evacuation plans might be low.
- Experts (e.g. engineers) do not want to be influenced by public opinion in the early planning stages (i.e. in analysing the situation and identifying potential measures)

Trust, fairness and conflicts

- Lack of public trust in companies and authorities
- Variety of interests and existing socio-political conflicts
- Transparency (what has to be communicated and what what not)
- Perceptions of the (in)equity and (un)fairness of mitigation measures and a lack of solidarity in communities can compromise the acceptance and implementation of such measures. A challenge is to actively address these issues in the communication process.
- Experts coming into a locality might not be aware of the already existing local knowledge and information produced by residents.

Resources

- High costs, time and energy
- Long duration of participatory planning processes
- Lack of funding
- Urgent need for protection measures (time to act is limited)

4 Empirical examples of risk communication in Europe

The purpose of the empirical examples is to gain a deeper insight into the practice of risk communication and its impacts. In contrast to many of the risk communication practices in the inventory the following cases have been subject to empirical research and hence provide more nuanced assessments of risk communication procedures. Both the Barcelona Drought and the Elbe Flood are also featured in the other CapHaz-Net thematic reports where further background information on the cases can be found (see CapHaz-Net WP1-4 reports).

4.1 Heat-related Hazards – The case of the 2007-2008 Barcelona Drought (by Meera Supramaniam)

Situation:

The Regional Government of Catalonia, Department and Habitat and Agència Catalana d'Aigua launched a Communication Campaign during the 2007-2008 drought in Barcelona. The aim was to reduce water demand to prevent reservoir levels reaching 20% of capacity (emergency declaration), at which time restrictions have to be made on urban and household use. In Urban areas the lack of water for household and industrial uses may be a more severe problem during a summer of heat wave periods. In terms of agricultural uses, the drought limits growth, particularly of water dependant plants and, depending on its severity, there may be a loss of crops for the season.

Chronology of communication and results:

With reference to the Barcelona drought (see also CapHaz-Net WP2 report on risk governance by Walker et al. 2010), table 12 below provides the chronology of the communication campaign. The table shows that the communication practice for the drought evolved and changed as the status of the reservoir changed. The framework for this, in relation to the levels of the reservoir and the actions necessitated, was already set within the Regional Drought Decree 84/2007 3 April. Households were targeted in the communication campaign and vulnerable groups were not identified specifically. However if the water level reached an emergency situation, limited access to water would be disproportionately absorbed by lower income households which do not have any alternative access to water. If droughts occur together with other hazards such as heat waves, the rationing of water would severely limit households' capacity to deal with these hazards.

The campaign was effective in achieving a reduction in water consumption, as during March 2007 to January 2009 there was around a 14.45% reduction with respect to the baseline from 2005-2007. Interestingly, a 5% average water saving remained after the drought had finished in the region, suggesting that the communication campaign had some long-term effects. However at March 2008, the reserves were at 21%, 1% above emergency level, and water had to be shipped in from other regions, hence the communication practice would not have achieved

its goal of preventing an emergency declaration, had the rains not come. Nevertheless, the entire situation has led to a change in management of drought practices.

In terms of social capacities, the water debate of Catalonia 2008 was created after the drought. This provides avenues for the public to participate in the development of new management and financing models for water in Catalonia by 2010, although the effectiveness of this has not yet been evaluated.

The major positive outcome of the drought is that it led to public participation in water management, resulting in the division of a new plan by 2010.

Table 12. Chronology of main events and measures during the 2007-2008 drought episode in Catalonia (Martin-Ortega and Markandya 2009)

Date	Main events	Main measures
<i>End 2006 Jan 2007</i>	First warning reports on significant lack of precipitation (pre-alert status). Reserves at 52% of capacity	Establishment of the Drought Management Plan and the Drought Permanent Committee
<i>Feb 2007</i>	Persisting lack of precipitation	First public communication campaign for water saving
<i>Mar-Apr 2007</i>	Drought Decree by the Catalan Government (3 rd April, enters into force 17 th April) Llobregat River Basin enters level 1 of exceptionality	15% decrease of irrigation resources. Cancellation of spillovers for purely hydroelectric uses. Intensified user controls & wastewater restrictions. All drought related information is published on the river basin authority website
<i>May- Aug 2007</i>	Reserves at 40.5% of capacity. All river basins at level 1 of exceptionality	General water saving measures (restrictions in public use of water: gardening, swimming-pools, etc.). Subsidies for the improvement of distribution networks, water re-use and external supply options at the municipal level. Public warning campaign + communication campaign (letter, fax, telephone) to stakeholders
<i>Sep-Dec 2007</i>	Reserves at 30% of capacity. Drought Decree prorogued	Authorization and subsidies for the reopening of not-in-use water sources. Actions for groundwater use. Desalination plants enlarged and improved. Intensification of the activities of the Drought Permanent Committee. New communication campaign
<i>Jan-Feb 2008</i>	Reserves at 24% of capacity. Drought intensifies. Ter-Llobregat system reaches level 2 of exceptionality	Actions on groundwater sources. Prohibition on the use of potable water for municipal uses (gardens, recreational parks, etc.). Periodic press conferences by the Catalan Minister of Environment to inform on the drought. Distribution of 650.000 'water-saving kits' among the population. Announcement of a water shipping plan
<i>Mar 2008</i>	Reserves at 21% of capacity. Organization and contracting of water shipping from Tarragona and Marseille	Set up of a specific drought web-site www.sequera.gencat.cat + a telephone information system for users. Public announcement of the water shipping program
<i>Apr 2008</i>	Precipitation. Spanish Central Government Royal Decree	Plan of a water transfer from Ebro River and authorization of water rights acquisition from Ebro River's irrigators. Constitution of the Drought Committee
<i>May 2008</i>	Precipitation. Reserves at 29% of capacity. Modification of the Catalan Drought Decree: Ter-Llobregat system gets back to level 1	Water shipping 13 th May, first ship arrives at the port of Barcelona

Date	Main events	Main measures
	of exceptionality (Muga system remains at level 2)	
June 2008	Partial recovery of water reserves (58.5% of capacity). Water shipping finishes. Spanish Royal Decree derogated. Water reserves increase (70% of reserve capacity for Ter-Llobregat system, Muga system remains at 31.5%)	Water shipping ends (7th June). Water transfer from Ebro River cancelled
July-Sept 2008	Water reserves decrease due to a lack of summer precipitation and increase on the water consumption	Irrigation in the Muga system is reduced to a minimum. Change from irrigated crops to non-irrigated crops (e.g. sunflower)
Oct 2008	Reserves at 59% of capacity at the Ter-Llobregat system and 22.8% at the Muga system	
Nov 2008	Ter-Llobregat system recovers to pre-summer levels. Muga system's reserve continues to decrease	Specific measures for improving water supply in the Muga system (desalination, emergency sources, water transport by lorry)
Dec 2008 Jan 2009	Ter-Llobregat system gets back to 2004 levels. Drought Decree prorogated for the Muga system (reserves at 22% of capacity). End of December: intense precipitation. General reserves at 77% of capacity. All river basins get back to normal (including Muga). Catalan Drought Decree derogated (13rd January)	Establishment of the <i>Water Debate in Catalonia</i> (public participation dialogue)

4.2 Alpine Hazards – Warning system in Vipiteno-Sterzing (by Anna Scolobig, Bruna de Marchi, Luigi Pellizzoni, Chiara Bianchizza)

Case study

In this empirical example we will compare experts' and residents' views, perspectives and experiences about the warning system and emergency communication in the location of Vipiteno-Sterzing⁶, in the Italian Alps. On the one side, we will focus on the main difficulties faced by the

⁶ Vipiteno and Sterzing are respectively the Italian and German names of the municipality located in the Province of Bolzano/Bozen, Trentino Alto Adige Region. According to official data (Census 2001), three quarters of inhabitants belong to the German speaking group and one quarter to the Italian one.

experts⁷ in communicating with the public. On the other side, we will explore residents' knowledge about the warning system together with their prospective and actual behaviours in case of emergency.

Vipiteno/Sterzing exemplifies the situation of areas characterised by high flood risks, where the last major event occurred a long time ago. This medium-sized town of 5,785 inhabitants (Census 2001) had often been flooded in the past, but without severe negative consequences. The last destructive floods occurred in 1965 and 1987. In both cases the Rio Ridanna/Ridnaunerbach torrent and the Isarco/Eisack river broke their banks, submerging either the railway line or the highway and causing the evacuation of part of the town.

The warning system for Vipiteno/Sterzing is coordinated at the provincial level. There are actually two different systems, one for alerting the public (SAP) and one for providing the population with information (SIP)⁸. They are not differentiated according to the type of danger, as both are used for floods, fires, earthquakes and other emergencies. The SAP uses a blanket signaling network of fire brigade sirens, providing three distinct signals: i) alert: sirens sounding a single note for three minutes. The instruction is "Turn on your radios and await further instructions"; ii) alarm: sirens sounding with an undulating pitch for one minute. The instruction is "Close your doors and windows immediately and listen to your radios for information"; iii) all-clear: sirens sounding a single note for one minute. The instruction is "The danger has passed".

The SIP (i.e. the system for providing the public with information) is a computerised system for the dissemination of information to radio and television stations, which provide situation reports, recommendations and instructions on the behaviours to be adopted (Oben 2006).

This empirical example summarises a research work aimed, among others, at gaining a better understanding of the effectiveness of this warning system. The research was performed within one task of the EC funded project Floodsite⁹.

The triangulation of research methods

The research design involved the triangulation of different methods and techniques for collecting information, including both data amenable to statistical treatment and narratives subject to hermeneutical interpretation. We collected existing data from secondary sources (census, historical archives, newspapers, etc.), spent time in the community as "participant observers", conducted interviews and focus groups with local experts, and performed quantitative surveys for a total of

⁷ We use the terms "experts" and "professionals" as synonyms to indicate all those individuals who deal with risk assessment and emergency management out of their technical skills or the professional tasks assigned to them. Under these terms we group people in charge of and/or operating in dedicated services and agencies, elected officials, and public administrators.

⁸ <http://www.provincia.bz.it/protezione-civile/2603/downloads/2007/protezione-civile.pdf>.

⁹ FLOODsite – "Integrated Flood Risk Analysis and Management Methodologies" – was an interdisciplinary project integrating expertise from physical, environmental and social sciences, as well as spatial planning and management. The project ran from 2004 to 2009 and had over thirty research tasks. This chapter derives from research accomplished in task 11, "Risk perception, community behaviour and social resilience" (Steinführer *et al.* 2008, Steinführer *et al.* 2009). Within this task, parallel research was performed in Germany by Annett Steinführer and Christian Kuhlicke at UFZ Leipzig (Steinführer and Kuhlicke 2008), and in the UK by Sue Tapsell, Sylvia Tunstall, Colin Green, Edmund Penning Rowsell and Amalia Fernandez-Bilbao at FHRC Enfield (Tunstall *et al.* 2007). The project was funded by the European Commission Sixth Framework Programme (contract GOCE-CT-2004-505420, <http://www.floodsite.net>)

186 subjects, using largely pre-structured questionnaires. There were many overlaps among the different phases and each provided insights for interpreting the findings from all the others. Table 13 provides an account of the main phases of the research (for an overview see De Marchi et al. 2007).

Table 13: The research design

Gathering of qualitative information	1 focus group with officers from provincial services and agencies in charge of civil protection, risk prevention, water resources and demographic data collection and treatment 1 group discussion with officers from municipal services 3 semi-structured interviews with local experts
Piloting	22 face-to-face pre-test interviews with draft questionnaire
Pre-structured questionnaire protocol	Mostly pre-structured questions plus some open-ended ones. Close-ended (sometimes grouped in batteries): 107 Open-ended: 23 Italian and German versions
Fieldwork preparation	Contacts with local authorities and media Training of interviewers Letter for contacting local population
Sampling	Quota sample based on: gender, age, educational qualification, risk exposure (high, medium, low)
Number of subjects	186
Response rate	62.4%
Interviews collection	Face to face by six trained interviewers with supervisor

Experts' and residents' views on warning systems and emergency communication

Problematic aspects of communication

There was a virtually unanimous agreement, around focus groups participants and interviewees, that closer attention should be devoted to warning and emergency communication. The main issues related to communication that were singled out during the discussions regarded: i) the method (instruments, techniques and most suitable channels); ii) the content of the messages (synthesis of the most useful information and simplification of technical jargon); iii) the differentiation of the messages according to different addressees (tourists, new residents, long time residents).

More precisely, foreseeing how the addressees will react to an alert is one of the main difficulties for those in charge of the different organisations operating during emergencies. It is considered a priority to make the message understood by the addressees, so that they can behave accordingly. Several experiences were mentioned, when communication between residents and officers did not work, producing undesired effects. A relevant example is the case in which the officers did not provide the very information necessary to enact life saving behaviours, such as the indication of viable escape routes.

An officer from the provincial agency in charge of risk mitigation stressed that communicating meaningful information requires not only communicative abilities, but also the understanding of the residents' risk perception and prospective behaviours during warning and emergency. In our research the persons in charge of the fire brigades particularly underlined that, to foresee the reactions of the residents, it is necessary to know if they are aware of the dangers, if and how they evaluate them, what environmental signals generate alert and why, which types of reactions and behaviours the messages can trigger. Because of these reasons, some officers from agencies in charge of risk prevention and water resources judge it necessary to activate a 'monitoring system of risk perception', in order to know 'what people know and think about these phenomena' and on which basis to orient and diversify the messages to be disseminated to the population.

Another problematic aspect emerged during the focus group discussion, regards the decision about the timing and the starting up procedures of the alerts. It is agreed that the technicalities of the alert system are well tested, but this is not the case for the organizational procedure. At the provincial level several cases of false alarms or, on the contrary, of delayed ones have been signalled, possibly deriving also from disagreement between services and local authorities. This is attributed to competence overlappings and the difficulty in coordination in conditions of great uncertainty. In order to provide useful and reliable information in appropriate time, a greater coordination would be necessary: 'Sometimes we are unable to verify who and why has issued an alarm' (Officer from provincial services in charge of civil protection).

A final consideration regards communication during the evacuation of areas threatened or struck by a flood event. In this case the issue is to promote the correct behaviours and make information immediately available by setting off specific evacuation plans, particularly in the residential complexes. In fact in order to avoid or reduce damage, it is necessary to leave these areas as quickly as possible. There are also many difficulties in executing evacuation plans. These concern the determination of the escape routes, the provision of transport means for those who need them, the organization of traffic flows, the meeting of the households, the identification of the most vulnerable people and/or households, the procedures for evacuating people with particular needs (e.g. the disabled).

Residents' knowledge about the warning system and involvement in past events

The questionnaire survey inquired whether residents knew of the existence of a warning system and what they would do when hearing the continuous sound of a siren for a few minutes. However, we were interested not only in prospective but also in actual behaviors. Therefore, as no significant hydrological events have occurred in Vipiteno/Sterzing in recent years, we asked interviewees whether they (or their relatives) had been involved in the floods in 1965 and/or 1987 and how they behaved.

For what concerns survey results, three-quarters of the interviewees (75.3%) were aware of the existence of a warning system. Most of the remainder (22%) say that they "do not know" of one and some (2.7%) say that there is no such system. Those who stated that they were

aware of the existence of a warning system (n=140) were asked what it consisted of. The following answers were given:

- sirens (71.4%);
- sirens and radio (14.3%);
- sirens, radio, TV, emergency plans (6.4%);
- sirens and bells (2.1%);
- water level measurements (2.1%);
- sirens and road closures (0.8%);
- no answer (2.9%).

While sirens are cited by almost all those who are aware of the warning system (95%), the radio is mentioned by merely one fifth (20.7%). This shows that residents do not know much about the SIP system. To better understand this result, it should be pointed out that the town's voluntary fire service tests the sirens once a week during its exercises, and many respondents mentioned the sirens specifically with regard to those tests. Some interviewees admitted that there were many things they did not know about the warning system. Many know that the sirens sound for different lengths of time, but did not remember the behavioural instructions connected to each sound. Others did not remember how long or how many times the sirens sounded. Others again think that the sirens are meant only for the voluntary fire service and the other organisations which intervene in an emergency. In short, residents seem not to distinguish properly among the three distinct signals provided by the SAP (alarm, alert and all clear).

Another question was designed to find out what the interviewees would do if they heard a siren sounding continuously for some minutes. The answers were:

- seek information through informal networks and channels such as friends, relatives and colleagues (35.5%);
- seek information through institutional networks and channels such as the voluntary fire service and civil protection service (24.7%);
- seek information on the radio (17.2%);
- seek information on the radio and through institutional networks (5.4%);
- await information or just be passive (8.1%);
- don't know (8.1%);
- get out (1.1%).

It therefore appears that little more than one fifth of the sample (22.6%) would behave according to the instructions provided by the warning system and switch on the radio. These figures match those produced by a survey on the effectiveness of the warning system carried out in 2003 by the statistical institute of Bolzano/Bozen on a sample of families living in the 116 municipalities in the province (n=705; Zuech 2004).

Finally some questions regarded the involvement in past events and the actual behaviors exhibited during a warning. Very low percentages of the interviewees were involved either in the 1965 or in the 1987 flood (9.1% and 12.9% respectively). Furthermore, in respect to neither case the answers were very thorough. The results show that when the last event occurred a

long time ago, the behaviours exhibited by the few residents involved do not represent such a reliable point of reference for the design and planning of the warning system. The main source of information remains therefore residents' prospective behaviours.

Conclusion

By analyzing experts' and residents' views and perspectives, we intended to reconstruct a 'picture', while highlighting some divergences which need to be taken into account for future improvement of warning and emergency communication.

Maybe the most meaningful divergence observed regards residents' prospective behaviours during the warning. Instead of acting according to the instructions given by the civil protection (i.e. switching on the radio for further information), most of them (65.6%) state that they would rely on institutional and informal networks.

This divergence between instructions and prospective behaviours has some practical implications related to the messages which have to be disseminated in the warning phase. There seem to be at least two alternatives: messages may be aimed either at changing behaviours that residents might spontaneously enact (e.g. Do not trust informal sources of information, but rely only on the radio.) or at 'going along with' prospective behaviours. In the last case, an investment in strengthening residents' formal/informal networks and preparedness becomes a priority. This might be done for example by training some residents to become 'official' qualified informers during the emergencies. Of course these activities require time and resources, but they also allow the creation and development of reciprocal help and solidarity networks in the communities involved.

Another divergence emerging from our results which is partially related to the previous one, regards the experts' 'wishful thinking'. They are aware that warning messages should be targeted on the basis of residents' risk perception and prospective behaviours during emergencies, but this seems not to happen in practice. The experts seem rather to design the warning system instructions on their organizational-coordination needs and on their 'perceptions of residents' risk perception' or prospective behaviours. As a result, misperceptions may abound, causing several negative consequences for the effectiveness of the system. In other words planning the actions of all the services involved in detail and providing technically correct and precise instructions to the residents on how to act is only the first step to designing an effective warning system. To reach this aim, rather, it is vital to involve the residents in the design of the system from the very beginning and to take into account contextual elements, such as existing synergies and informal/formal networks which may be activated during an emergency.

4.3 River Floods – Risk communication efforts in Grimma (Germany) after the 2002 flood (by Annett Steinführer, Daniela Siedschlag, Christian Kuhlicke)

Background and context

Like other parts of Central Europe, many towns and villages in eastern Germany (particularly in Saxony) were affected by the 2002 Elbe flood. In the area of the Vereinigte Mulde River, one of the tributaries of the Elbe, the small town of Grimma (with about 18,000 inhabitants in 2002) belonged to those settlements most heavily affected. This was due to the severity of the flood (later defined as an event with a return period of 1:200 – 1:250) and the particular exposure of the historical centre of Grimma (with about 2,000 inhabitants in 2002) which is located close to the river and with (then) almost no structural measures protecting the town and its inhabitants. All over the old town, the water flooded private houses and shops as well as the municipal archive with a flood depth of up to 3.5 metres. The overall monetary value of the damage incurred was about 234 million Euros, as estimated by the municipality. However, supported by large-scale public funding and private donations (Schildt 2006), the old town was almost completely reconstructed already by the end of 2004. As such, it proved to be attractive for largely younger immigrants: between 2003 and 2008 (with the only exception of 2006) the migration balance of the old town was positive (+372 persons 2002-2008). With regard to the average age of its population, today the old town is the youngest district of Grimma. A survey carried out in 2008 (Siedschlag 2009) found 43% of newcomers in the area.

After the 2002 flood, the responsible Saxon State Ministry of the Environment and Agriculture (SMUL) initiated the development of new flood protection along the major rivers in Saxony. Under supervision of the State Reservoir Administration (Landestalsperrenverwaltung LTV), 47 flood protection concepts (Hochwasserschutzkonzepte HWSK) were developed. They mainly consisted of structural measures, such as new or heightened dikes or flood protection walls. The indicative protection goal defined by SMUL and LTV was to protect settlements against floods up to a return period of 1:100. Moreover, a flood warning system for the whole of Saxony was established which is run by the Saxon State Agency for Environment, Agriculture and Geology LfULG (Meyer and Kuhlicke 2008).

As for Grimma, a long public debate about the most appropriate flood protection of the town started immediately after the clear-up. Several options were discussed. A solid protection wall that was given high priority by the responsible state agencies was rejected by many inhabitants and also by representatives of the municipality who argued that this wall would negatively influence the cultural heritage, touristic importance and appealing character of the old town of Grimma (Schildt 2006). Currently (in 2010) a revised project is under construction which tries to both reconstruct the historical town wall along the river and to integrate it into the new concrete protection wall which also contains mobile elements, a rampart and further measures (Kuhlicke and Meyer 2008).

Beside structural measures, a second major constituent of the post-2002 culture of flood risk in Grimma was established: a local flood warning and information system which operates

independently from the official warning system operated by the state's flood protection centre. Interviews with local stakeholders revealed relatively low running costs of this complex local system (about 4,200 Euro annually). However, decision makers at the level of the state (Land Sachsen) are critical of the fact that the warning levels have not been adjusted to the Saxon system. However, they tolerate the co-existence of the local system (Meyer and Kuhlicke 2008). The local flood warning and information system consists of the following five components:

- central hooter sirens on town roofs (three in the old town and two in other flood-prone areas which are all tested once a month),
- autonomous text message information network for mobile phones (with 420 registered users in early 2009),
- a camera shooting the river gauge (Figure 8) with live streaming on the internet (at the municipal website),
- continuous information in situations of approaching flood conditions on local TV Muldentale,
- door threshold measuring to assess at which river height the water will inundate the respective house (with 130 measurements as of early 2009; Figure 9).



Figure 8: Water gauge at ruins of Pöppelmann Bridge in Grimma



Figure 9: Altitude sign of private threshold (indicating its position 5.12 m above the normal river altitude of 123.36 meters)

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These five components are thus different elements in a complex local risk communication strategy. Most of them require at least a certain degree of active behaviour on the side of the local inhabitants: they need to register for the warning system (once), they need to order threshold measuring (once, includes a payment of 15 Euro) and to understand the meaning of the number provided (see Figure 9). Thus, in general, this system requires some knowledge about 'normal' and 'non-normal' river heights and about the implications of changing gauges and the mounting river. It contains both continuous (or at least latent) elements (sirens, text messages, gauge live stream and TV information) as well as one-off elements (threshold measurement).

The research

In 2008 an empirical investigation was carried out in Grimma focusing on the knowledge about public and private mitigation measures as well as the degree of the actual application of private preparedness and prevention measures by the households living in the old town (Siedschlag 2009). For this research a mixed-method research design which combined qualitative and quantitative techniques was applied. During the initial exploratory phase, information was gathered by semi-structured expert interviews with municipal decision makers (N=4). The main method was a subsequent household-based questionnaire survey in the old town of Grimma, which was carried out in autumn 2008. 250 questionnaires were distributed out of which 164 completed questionnaires were collected and used for the interpretation. Altogether the quantitative survey represents 17% of all households living in the old town of Grimma.

Thus, while the research was not primarily focused on risk communication or its improvement, some results can shed light on the acceptance of public risk communication efforts among the local population and their effects on people's actual behaviour.

Main results with respect to risk communication

When asked via an open-ended question, the majority of the respondents (63%) could not mention any preparedness or prevention measure they had applied. Just a minority of 5% remembered registering for the text message warning system, and only in 4% of the cases did people mention that door thresholds had been measured. However, when asked directly for certain measures, the picture changed completely (Figure 10).

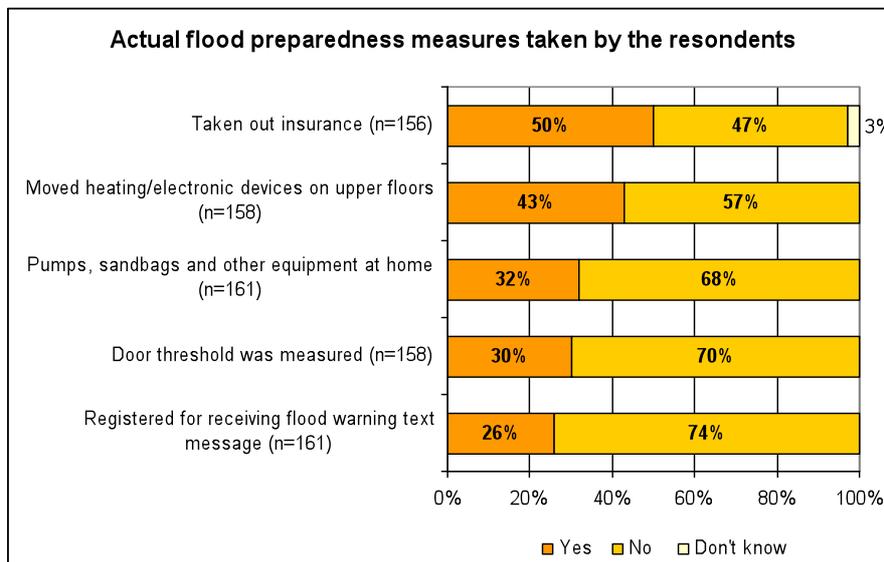


Figure 10: Application of selected preparedness measures (to be chosen from given categories)

The actual application of prevention measures proves to be much higher than the first self-assessment of the respondents would suggest. This implies that the inhabitants do not regard

the measures taken as part of an overall flood risk management strategy. From Figure 10 it becomes also obvious that two major elements of the local information and warning system (text message registration and threshold measurement) are the measures with least relevance for the local population. At the same time, these are measures requiring relatively low costs and commitment in comparison with moving electronic devices or heating to higher floors. Probably, the residents – particularly those who moved to the old town rather recently – are not well informed about the existence of the single information and warning opportunities. To test this hypothesis, we divided the sample according to people's length of residence. Figure 11 shows that pre-flood residents are indeed better informed with regard to both local and regional flood-related information offers. In particular the relevance (and, most probably, the meaning) of the threshold measuring is obviously not known by the post-flood residents of the old town. Yet, from the way the question was asked (degree of being informed) it is difficult to judge what residents actually know about the single measures, their content and meaning. The high degree of knowledge about the local flood warning sirens is certainly due to the regular tests of the system – but whether all people indeed relate this tone to flooding and how they would behave in case of emergency is another question.

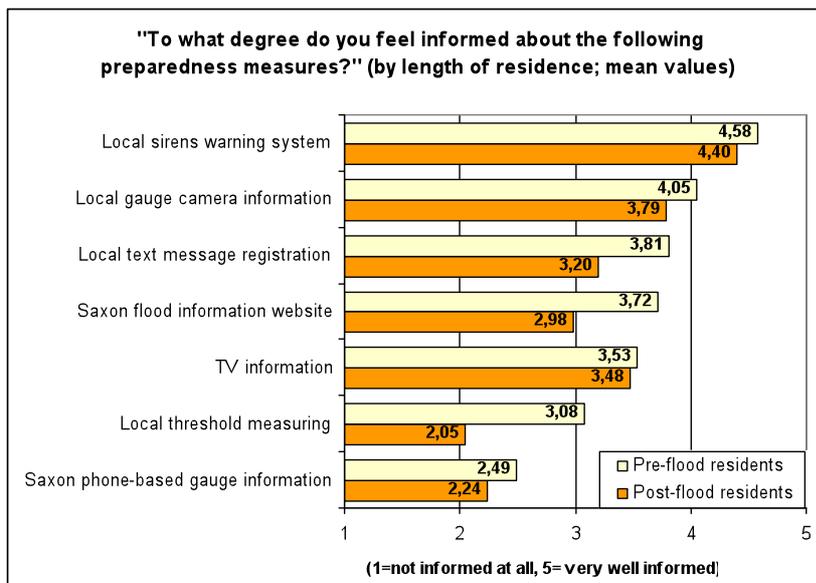


Figure 11: Knowledge about flood information and warning opportunities, by length of residence

Moreover, we expected age-specific differences in the degree of flood-related information. Figure 12 confirms this hypothesis but also provides some unexpected results: it is not the older generation which feels rather poorly informed but, in almost all categories, it is the younger generation of working age (18-39 years old) which perceives its own degree of knowledge as moderate or even not good (ranging from 2 to 3 on a 5 point-scale). With the exception of the local text message registration, the internet-based information system and the threshold measurement, the 60+ generation considers itself better informed than all the other groups. Moreover,

the older the respondents, the more important they regard flood markers at public buildings as ‘sustainers’ of local flood knowledge. However, age-specific differences in media use are meaningful: although many older respondents knew about the opportunity to receive flood-related text messages, most of them do not possess a mobile phone at all and thus could not make use of text messages. Among the youngest generation (18–39 years old) the situation was just the opposite: having a mobile phone did not necessarily imply knowledge about mobile phone-based warnings and information.

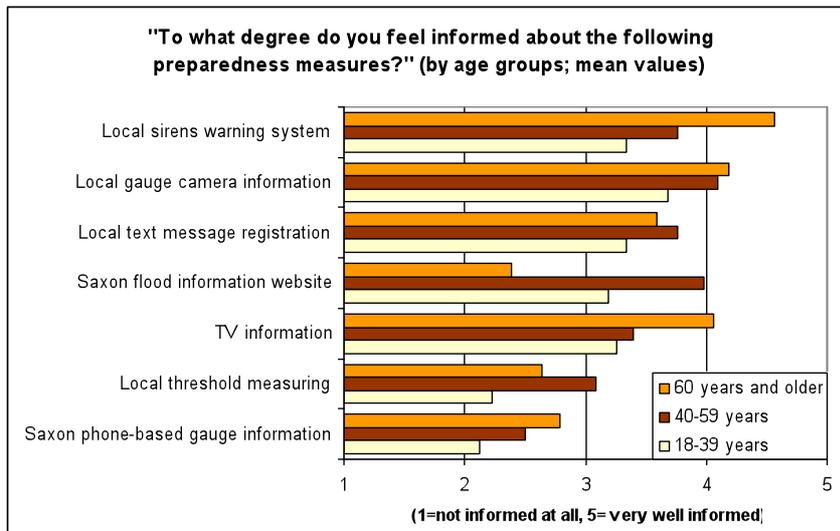


Figure 12: Knowledge about flood information and warning opportunities, by age groups

Interestingly, these non-structural measures (information and warning) receive fairly high values from the respondents with regard to their perceived effectiveness for damage reduction. Also structural measures in the households (such as moving electric devices or heating) and in the region (retention areas and dikes) receive high values – in contrast with the local flood protection wall which also in its adapted form is rejected by quite a few inhabitants.

In the case of a flood event, the local warning system (including TV information) and the internet would be the most popular sources of information, ranking far above personal networks or personal river observations.

Concluding remarks

The 2002 Elbe flood was a dramatic experience for the whole region affected and its population. Thus, many actions taken in flood risk management today – be they structural or non-structural, private or public measures – date in their origin back to this extreme event. Grimma proved to be a specific case from the very beginning: in the magnitude of the local damages, its media presence during the event, its contentious decision-making process with regard to the flood protection wall as well as its establishment of a local information and warning system. Risk communication in Grimma to date builds upon both structural and non-structural measures. It occurs

mainly as top-down, one-way communication (via the municipal gazette, project flyers, information boards), with the help of a variety of media (such as newspapers, flyers, the internet, flood markers, bridge gauge, text messages, television). It focuses on the provision of different types of information and tries to convey both risk and safety-related information. As such, our research shows that it is effective in the sense that people are aware of the different sources of information. Information campaigns also led to concrete preparedness measures in the households. The five elements of the local information and warning system as well as some further information sources are highly accepted but not all people actually apply or use them. With increasing temporal distance to the event, renewed efforts will be needed to maintain the levels of information and acceptance, to increase the level of preparedness, to really involve the local population in flood risk management and to develop group-specific risk communication tools.

4.4 Summary

The foregoing examples illustrate different ways of communicating hazards with different characteristics. The Barcelona drought emphasises the need for long-term and flexible risk communication strategies and campaigns that change as the risk from a given hazard or the multiplying effects from secondary hazards evolve. Furthermore, different audience groups may depend on different warning lead times to be able to prepare themselves for the impacts. For instance, farmers may need to know about an upcoming drought several months in advance to adapt their crops accordingly.

The Vipiteno/Sterzing case makes clear that it is not only the official side of risk communication that attention must be paid to. Rather, the effectiveness of official flood warnings is intimately connected to the existence and functioning of local unofficial communication networks between residents. Risk managers should consider that, at times, official and unofficial risk communication can favour different behaviour options in one and the same situation (the consequences of competing official and unofficial risk communication have also been discussed by Handmer 1991). A way to reconcile these two spheres of communication and to benefit from their respective strengths is to initiate a two-way communication between them when designing warnings and alarm systems. Supporting residents' formal/informal communication networks and using them to disseminate official risk communication is another way.

The Vipiteno/Sterzing case in particular shows that there are still huge differences between the theory of good risk communication and current practice. Although practitioners seem to be aware that warnings and communication in general should be targeted on the basis of the audience's perceptions and needs, they do not necessarily do so.

Finally, the empirical findings from the Grimma flood communication reiterate that risk communication tools can be understood differently by distinct socio-economic groups (e.g. long-term residents versus newcomers). Thus, combining a diversity of tools and channels as part of a long-term strategy seems most promising for reaching a variety of audiences and sustaining their awareness and capacities.

5 Recommendations for future risk communication practice

Our inventory of risk communication practices and the empirical examples suggest that only very few communication efforts actually correspond with the three conceptual approaches to risk communication in the natural hazard literature (section 1.3, pp 29-33). More specifically, practices #30 in Poland and #60 in the UK best mirror the approach to raise awareness and change risk related behaviours, whereas practices #21 in Italy, #51 in Switzerland and #13 in Germany particularly focus on enabling mutual dialogue and decision-making between actors. Practice #15 illustrates how communication to improve relationships, networks and coordination between actors and institutions can be enacted.

The bulk of the reviewed practices include good or innovative elements that could be combined to produce more integrative and more effective communication strategies. Indeed, while many promising tools are currently being trialled, they are often disparate and not embedded in more comprehensive long-term communication strategies. In Table 14 we describe how such communication strategies might look like in the prevention of and preparation for natural hazards and in the warning phase. We further indicate examples for good practices. The strategies concern the communication between authorities and stakeholders and/or the public and should be applicable across the spectrum of natural hazards. The good practice principles listed in section 2 (pp 52-53) apply to the proposed communication strategies. We, again, stress that there is no single best guide for all situations and the specific combination and application of tools will necessarily vary.

Table 14. Communication strategies to prevent, prepare for and warn of natural hazard events

	Overall Goal	Main Challenges for communication	Good communication strategies	Tools and good practice examples
Preparation-Information	<ul style="list-style-type: none"> To trigger protective/preparatory behaviour among people at risk 	<ul style="list-style-type: none"> Raise and sustain awareness and the motivation/interest to reflect on personal situations and to act Lacking ability or willingness to transfer awareness and knowledge into action 	<p>A long-term strategy is needed that pays attention to different communication needs and</p> <ul style="list-style-type: none"> raises awareness and the interest/motivation to act through connecting people cognitively and emotionally with the issue, and through engaging cues. builds up knowledge on how to act. show people how to enact knowledge. builds up psychological resources to cope with situations of stress and anxiety. keeps memory alive, sustains awareness and maintains abilities to act. combines a) conventional and innovative tools, b) one-way communication and communication with feedback possibilities, and c) one-off, episodic, regular and permanent activities/tools. 	<p>Good examples:</p> <ul style="list-style-type: none"> # 14 'Blauer Plan' Regensburg, Germany # 15 Flood partnership Baden-Württemberg, Germany # 30 Flood Damage Mitigation Gorzanow, Poland # 38 Action plan Catalonia heatwave, Spain # 40 Snow avalanche bulletin, Switzerland # 60, 'Making people flood wise', UK <p>Potential tools:</p> <ul style="list-style-type: none"> Brochures/campaigns, e.g. # 2, #25, #32, #35, #42, #52 Websites, e.g. #1, #5, #6, #8, #35, #53. Films prepared by managers and/or residents, e.g. #17, #23 Official and unofficial risk maps, e.g. #4, #12, #33, #59 Flood art, #17 Games, #58 Gauge towers, #18 Flood animation box, #16

	Overall Goal	Main Challenges for communication	Good communication strategies	Tools and good practice examples
				<ul style="list-style-type: none"> • River bus, exhibitions and festivals, e.g. #10, #21 • Flood markers or other quiet witnesses of past events, e.g. #18, #14 • Exercises and trainings, e.g. #19, #40, #44 • Personal vulnerability assessment, #9 • Public hearings and talks, e.g. #14, #23, #24, #26, #30, #45, #46, #60
Prevention	<ul style="list-style-type: none"> • Development and implementation of prevention measures (structural, land-use-planning, evacuation plans and risk information tools) 	<ul style="list-style-type: none"> • Potential interest of conflicts • Using and integrating different forms of knowledge • Social appropriateness and acceptance of prevention measures 	<p>A communication strategy is needed that:</p> <ul style="list-style-type: none"> • enables dialogue between actors with different forms of knowledge and interests. • involves stakeholders and people at-risk in the pre-assessment of risk and in the planning and decision-making on structural and nonstructural measures through two-way communication. • informs the general public about decisions and measures. • goes beyond hazard prevention and integrates it with wider issues of sustainable community development. • targets the affected area (e.g. catchment area, river basin) and the whole of affected municipalities. • provides continuity in that it supports lasting communication networks between actors. 	<p>Good examples:</p> <ul style="list-style-type: none"> # 21 Etsch-Dialog, Italy # 24 Vipiteno-Sterzing, Italy # 51 Samedan, Switzerland <p>Potential Tools:</p> <ul style="list-style-type: none"> • Working groups #51 • Newsletters #51 • Public meetings #24 • Excursions #21, 51 • Scenario workshops #21
Warning	<ul style="list-style-type: none"> • To warn people and to trigger immediate actions 	<ul style="list-style-type: none"> • Different sources of communication • Time constraints • Lack of trust and compliance 	<p>A communication strategy would:</p> <ul style="list-style-type: none"> • combine continuous and up-to-date forecasts with effective warning and alert systems. • introduce people to the warning and alert system and show them how to act upon receiving a warning as an integral part of preparation communication (see above). • include emergency training/exercises (as part of preparation communication, see above). • build trust between the sender and the receiver of warnings through prior long-term communication (integrative part of preparation communication, see above). • integrate local initiatives with official communication, i.e. involve local residents in the development of warning and alert systems and use local networks to disseminate warnings. • use effective one-way communication but also two-way channels that allow for feedback and confirmation. 	<p>There seems to be no single best practice. Rather, good elements of different practices should be combined.</p> <p>Good examples:</p> <ul style="list-style-type: none"> # 1 Severe weather warnings, various countries # 5 Peak discharge information system, Austria # 6 Flood forecasting system, Czech Republic # 11 Coordinated emergency training, Pays d'Aix, France # 39 Public Announcement System, Sweden # 19 Evacuation and warning simulation, Iceland # 26 Åknes rock slope, Norway # 27 IMGW forecast and warning system, Poland # 31 Flood warning and evacuation Raciborz, Poland # 41 IFKIS Hydro and GIN, Switzerland # 49 Felsberg, Switzerland # 57 Ensemble flood forecasting, UK

6 Risk communication within CapHaz-Net

This section further elaborates the inter-linkages between risk communication and all the other Work Packages in CapHaz-Net.

6.1 Social capacities

As proposed earlier, different communication approaches yield different potential for social capacity building. Whether knowledge, attitudinal/motivational, social/organisational and/or psychological capacities are fostered at the individual, community or organisation level will arguably depend on the purpose and content of communication as well as the selected modes, channels and tools. We might hence hypothesise that the more capacities are lacking, the more diversified the communication modes, channels and tools have to be in order to address these 'deficits'.

While we have discussed communication as a means to build social capacities, communication (the ability and skills to communicate) might also be viewed as basic social capacity (of social systems and their entities) itself (as in the CapHaz-Net WP1 report on social capacity building by Kuhlicke and Steinführer 2010, p 17 and in the participation literature, e.g. Powell and Colin 2009). Communication capacities are basic in that they are fundamental prerequisites for forming networks and relationships.

Communication is furthermore the process through which actors define what capacities are needed, who lacks what capacity and how this deficit could be dealt with. Again, we might speculate whether the result of this process would alter depending on what actors are involved and through which modes, channels and tools they communicate. Or in other words, would dialogical interaction between 'capacity builders' and those who should develop capacities result in different perceptions about what capacities are needed than for instance consultative communication alone (see also the CapHaz-Net WP1 report)?

Time is also a crucial factor when elaborating the relationship between communication and social capacities. Not all capacities develop in the same time frame. In particular social and organisational capacities arguably require more time to unfold than others and they may not necessarily evolve in a linear fashion but alternately progress and regress (Powell and Colin 2009). The choice about one-off, repeated or continuous communication is thus a vital one.

In the reasoning of CapHaz-Net social capacity building can be seen as an iterative learning process within and between individuals, communities and organisations (see also WP1 report). An overarching function of communication is hence to enable iterative evaluation, critical reflection and feedback on practices, and to store and pass memories and experiences. In this way, communication is a means to learn from practices and to adapt them. Translated back to natural hazards this means that capacity building not only requires communication to review outcomes of single risk phases but also communication to enable learning between risk cycles (see Figure 13 overleaf). Such evaluation and learning processes ideally take place within and outside the official management domain.

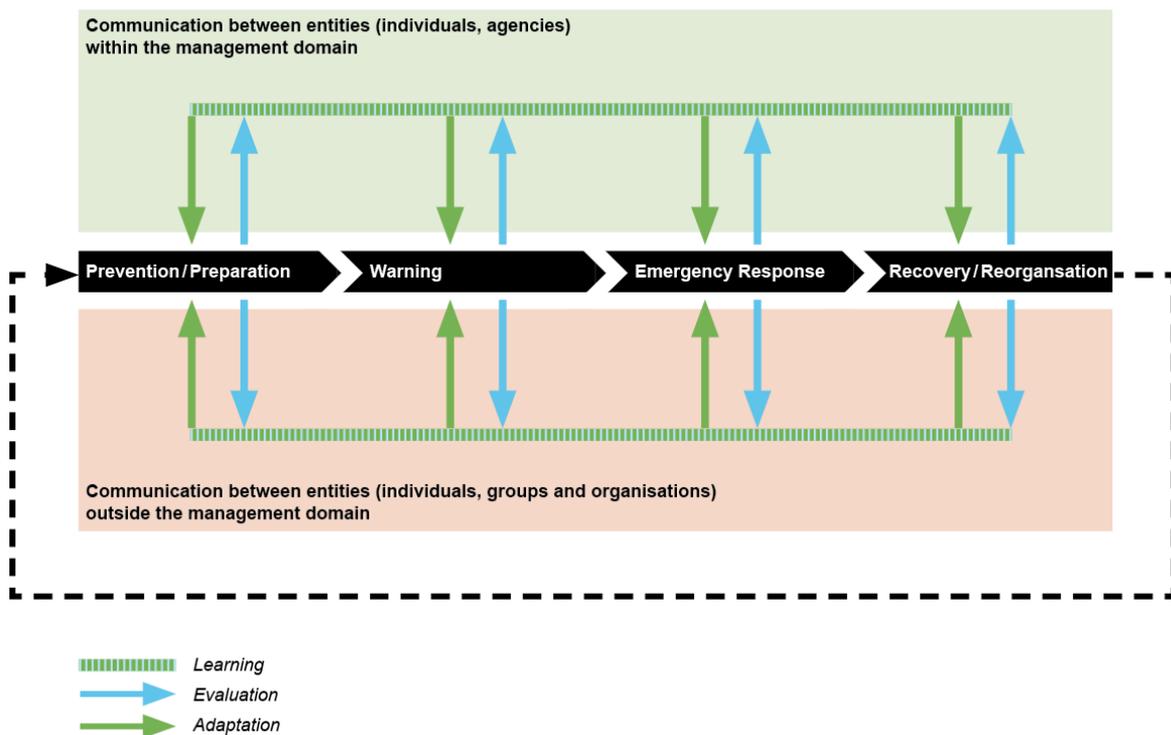


Figure 13: Communication as evaluation and learning cycles

6.2 Risk governance

Risk communication is conditioned by the governance and management structures in place. However, it also shapes the functioning of these structures. Predominant objectives, contents, modes, channels, and tools of communication will differ depending on the grade of centralisation, liberalisation, and inclusiveness of governance/management systems, and on the strength of the technocratic paradigm (see CapHaz-Net WP2 report on risk governance by Walker et al. 2010; Dryzek et al. 2003). While top-down, one-way communication might be argued to be more typical of highly centralised, exclusive and technocratic systems, multiple-level and multi-actor governance structures could be expected to be more conducive to more participatory two-way communication.

Another point is that what is considered as ‘good’ risk communication practice will vary depending on the constellation of actors and the scale at which they are interacting. The wider distribution of power and responsibilities in multi-level governance systems comes with the need for effective intra and inter-organisational – as well as inter-individual – communication, and hence with the need for building up human and relationship capital. Fostering such capital or capacities is an important objective of communication that is well recognised in organisational research, whereas the natural hazard literature is only now beginning to pay closer attention to the subject issues.

Also, the question of how communication flows within and outside the management domain interact has received less attention, despite the fact that this question is vital for a deeper understanding of system resilience.

Other perennial issues at the intersection of governance and communication are the (self)-selection of actors, the power relations between them and the question of which are the most appropriate one-way and two-way communication tools in specific risk management situations and community contexts.

Furthermore, the legal tools relevant to risk communication at the European and national level – for example, how they are implemented, their pitfalls and practical challenges – are another under-studied though important subject in the natural hazard literature. Finally, how are good governance principles of transparency, fairness and equity enacted in the specific risk cycles and what role does communication play in this context?

6.3 Risk perception

Risk communication and risk perception are closely interlinked. However, the ways they interact are neither simple nor well understood. Risk perception and awareness as the basis for risk communication has been discussed in for instance in the INTERREG IIIB project MONITOR (Hazard Monitoring for Risk Assessment and Risk Communication, see MONITOR 2008).

According to existing theories on risk perception, in particular the mental model approach (Kolkman et al. 2007), risk perception has strong implications for the success of risk communication, but it is also expected that risk communication shapes risk perception. Experts and decision makers' interpretation of the public's risk perceptions arguably influence the ways they communicate with the public. These interpretations however often lack empirical evidence and a deeper understanding of an audience's communication needs which results in poor communication strategies (e.g. Parker et al. 2007). For example, people will not react to risk warnings if foregoing communication has not motivated and prepared them to see a connection between the risk of a hazard event and their livelihood or if people do not perceive the communicators as trustworthy. They may also not read and assimilate risk information if this information does not address their concerns associated with this risk.

Hence, influencing people's perceptions of risk situations through risk communication requires a better understanding of the nature of people's mental models of risks. As these are not only based on their individual and collective experiences and interests (Kolkman et al. 2007), but also embedded in their overall risk framings (Jurt Vicuña Muñoz 2009), they are often resistant to one-off information provisions alone. Rather, revisions of mental models often only occur when people are confronted with new practical experiences (e.g. the success of new strategies or measures). However, specific communication techniques aiming at a better mutual understanding of risk perceptions such as concept mapping (Heeb and Hindenlang 2008; van Kouwen et al. 2009) also appear to be successful in producing shared mental models of risks. Future research efforts are needed to better understand the interactions between risk percep-

tion and risk communication as well as the social processes needed to achieve shared perceptions of risks and appropriate measures.

6.4 Social vulnerability

In general, risk communication aims at reducing people's vulnerability to hazards by raising awareness, building up knowledge, stimulating preparatory/protective behaviour, preparing people for the adverse psychological impacts of hazard events or by promoting acceptance for structural/non-structural mitigation measures. However, the relationship between communication and social vulnerability is neither simple nor linear. More communication does not necessarily mean that it is equitable or accessible to all, or that the needs and views of a wide range of actors are considered. Tapsell et al. (2005) for instance find that not all flood warning and alarming technologies perform well in reaching groups with special needs and communication barriers. Similarly, flood risk maps are a good way of informing the public. However, they are not sufficient on their own because they may not reach or be understood by all groups in society (Steinführer et al. 2009). The process of elaborating risk maps, land-use plans and technical measures can be more or less open to the concerns of those directly affected by decisions. For example, the criteria used to decide whose land will be protected by avalanche barriers and whose land will not may be more transparent and equitable in some cases than in others. Vulnerabilities and specific communication needs may also vary across the different phases of the risk or hazard cycle (see also CapHaz-Net WP4 report on social vulnerabilities by Tapsell et al. 2010).

Particularly with respect to floods, social scientists have not yet paid much attention to vulnerability issues in the prevention phase. However the question of whether and how prevention/mitigation measures reduce, increase or reproduce vulnerabilities at the individual and community level is an important one. Who gains and who loses from structural and non-structural prevention measures and why and how communication deals with equality and fairness issues is a key concern. For example, personal profits and losses might influence risk perception as documented in the case of Ukrainian nuclear technology in the WP3 report on risk perception (Wachinger and Renn 2010). Non-structural measures such as risk zone maps might, for instance reduce the value of farm and residential land or a community's attractiveness to tourists, making those affected more vulnerable in socio-economic terms. People's perception of their own vulnerability might hence not only stem from the objective risk of being hit by a flood but also from their personal assessment of related social, economic or cultural risks. Communication can elicit perceived vulnerability and mediate between people's perceptions and 'objective' measurements of their vulnerability.

That communication does not necessarily reduce social vulnerability or increase the socio-economic resilience of individuals and communities is also clear from the case of the Hull flood (see CapHaz-Net WP2 report on risk governance by Walker et al. 2010). A lack of communication channels through which to give authorities feedback on their performance and to provide them with insights on what kind of help and support is actually needed in the aftermath of a

hazard event, can thus reproduce vulnerabilities (social and psychological) and unfit management structures.

Another point to bear in mind is that the socio-demographic factors that are often used to measure people's vulnerability might also affect their ability to transfer knowledge into action. The literature on fuel poverty, feminist literature showing women taking on more of the burden of climate change mitigation actions, and people who cannot afford to choose where and how they live, are cases in point (MacGregor 2007; Boardman 2009; López-Marrero and Yarnal 2010).

6.5 Risk education

Risk communication and risk education are often used synonymously. In CapHaz-Net though we chose to understand risk education as the formal education of particularly children but also the training of adults (see also Introduction to this report). In this sense, risk education efforts can be part of risk communication practices. Particularly in the prevention phase and emergency training phase education tools are relevant and embedded in broader communication strategies.

Early integration of natural hazards in curricula prepares the ground for more effective risk communication practice in that it arouses interest, awareness and a basic understanding of hazards, involved risks, and of what kind of information/action is needed. Done from a young age on, this increases the chance of forming habits and is hence an alternative and arguably more promising way to alter behaviours than trying to change existing attitudes alone (Verplanken forthcoming 2010).

7 Conclusions and Research Questions

Conclusions

- This report studied the field of risk communication across the prevention, preparation and warning phases for floods, heat-related hazards and alpine hazards. By reviewing risk communication practices in a number of European countries we were able to identify and map a diversity of innovative or insightful practices with good and/or poor qualities.
- Compared with other risk related fields, risk communication in the context of natural hazards is clearly under-researched. The challenge for researchers is to elaborate more on the specific questions relevant to the field of natural hazards rather than simply adopt lessons from risk communication in other fields.
- There are only a few 'best practices' that comprehensively apply lessons and guidelines from the risk communication literature, e.g. that communication should be based on the needs of the audience. In this way, we can conclude that there is a considerable gap between the theory and practice of risk communication on natural hazards in Europe.
- Of the natural hazards CapHaz-Net is looking at, research on floods is clearly the most advanced both in quantity and quality. There is comparatively little grey or scientific literature on risk communication regarding alpine and heat-related hazards.
- Overall, communication practices are largely limited to one-way communication aimed at informing the public (on hazard, risks, mitigation and prevention measures, how to behave in the case of an event, and to promote acceptance), raising awareness, triggering protective action, and warning of upcoming events. Few practices explicitly consider relationship management, outrage management, the preparation for adverse psychological/emotional effects, keeping memories alive, mutual understanding and learning as explicit objectives of communication. Or, from the perspective of social capacity building, the bulk of communication practices aim at developing knowledge capacities and attitudinal/motivational capacities (e.g. awareness) rather than at fostering social/organisational and psychological capacities.
- In the case of dialogical communication on alpine hazards, it seems that there is no established practice particularly at the regional and local level. One reason might be that alpine hazards are more local in their spatial extent and single municipalities are confronted with different risk situations. While risk communication seems to be considered an important issue by the responsible authorities, particularly at the municipality level, they have hardly any support or guidance on how to actually communicate with stakeholders and the public to help them in their work. Furthermore, there are few efforts by national and regional authorities to trial and support risk communication practices despite considerable theoretical debate on the subject. The areas receiving most attention and support seem to be national and regional warning systems and where two-way communication is required and supported by legal tools such as the EU Water Directive.
- Risk communication is largely understood and enacted as transfer of information on hazards, on probabilities, on the likely consequences and on what one should do about it. It seems that there is hardly any discussion of the benefits, dangers, the costs of mitigation measures, residual and emerging risks, the thresholds of acceptable risks and of achievable/desirable safety levels as is happening in the field of technology and health (pre-assessment/appraisal phase of risk management). Communication practices in the natural hazards centre around the communication of events and the objective risk of them happening rather than on understanding

the wider social, economic and cultural risks that are relevant to people and communities at risk. These mental models or subjective perceptions of risk and vulnerabilities though shape people's response to natural hazards. For example, in management practice vulnerability seems to be understood mainly as a result of exposure to natural hazards rather than as a result of socio-economic-cultural characteristics and conditions that may constrain people's ability and willingness to receive communication and to respond to it. In theory and practice, there is even less reflection and discussion on vulnerability as a result of direct and indirect consequences of mitigation measures, and issues of fairness, equity and solidarity in communities.

- What is more, there is hardly any active reflection on what capacities are actually needed and to what extent. Or in other words, what is the target level of risk communication efforts? Another related though under-reflected question is how far target levels relate to the propagation of safety through mitigation measures, which might reduce the perceived need for building up capacity.
- Furthermore, there is little critical reflection on the effectiveness, local suitability and the implications of sophisticated technology assisted warning systems. While support for such technologies is understandable in principle, social scientists should better understand their contribution to resilient systems as well as their potential pitfalls (e.g. local redistributions of power-relations and cost-benefits, implications for risk-ownership and self-responsibility, local knowledge and unofficial warning/alarming systems might be undermined, emergency services and local authorities might lose credibility as a result of false warnings).
- There are remarkably few empirical studies evaluating the effects of communication with respect to its purposes and with respect to its contribution to social capacities (knowledge, attitude/motivation, social/organisational, psychological). Hardly any of the reviewed practices had been assessed for their effects on social capacities. This is not a purely European phenomenon but has been reported from elsewhere too (e.g. Rohrman 1998 for fire communication practices in Australia).

Research questions and challenges:

- The literature is unclear about the actual content of specific risk communications. This arguably compromises our ability to learn from them. Future research should be more specific about the content, format and language used in risk communication practices. What is the message/what is being communicated: e.g. safety, threat, control, ownership, self-responsibility, residual risks, or different kinds of uncertainty?
- Little is known about the influence of design and framing on the outcome of risk communication efforts in the field of natural hazards and it seems that, although a key to successful information transfer, these issues have been largely neglected by researchers and practitioners so far.
- The implementation of two-way and dialogical communication in risk management practice remains a challenge (both in the assessment of risks as well as the planning of measures). What can specific tools contribute in particular situations or local contexts? How can the quality of implementation be assured?
- The bulk of the practices in our inventory include good or innovative elements that could be combined to produce more integrative and more effective communication strategies. Indeed, while many promising tools are currently being trialled, they are often disparate and not embedded in more comprehensive long-term communication plans. The implementation and fund-

ing of such strategies remains a challenge in the prevention, warning as well as the recovery phase.

- The ways transparent and open communication can be realised (including the acknowledgement of what is uncertain or unknown) and how this affects risk management and the audience should be better understood in the context of natural hazards to support practitioners in their search for effective forms of communication.
- How can organisations or stakeholder platforms focussed on coordinating integrated management of natural resources and their risks be established? It is particularly important that these bodies are set up in ways that will enable them to grow and learn from experience and from each other.
- How can an integrative pre-assessment and appraisal of the variety of natural, socio-economic, cultural and political risks that are relevant to the everyday life and the quality of life of people and communities be initiated and sustained? And who should advocate and manage such a discussion? How can the public dialogue on regional risk management be integrated into a wider public discourse on sustainable regional development (e.g. ecology, economy, health, life quality) and thus help in bringing natural hazards closer to people's lives?
- Research efforts are needed to better understand the role of two-way communication in warning and how official and unofficial communication can be integrated beneficially.
- Both researchers, the media and practitioners should endeavour to find ways to balance the benefits of media communication on natural hazards and its drawbacks (e.g. focus on sensation, newsworthiness and creating conflict situations rather than mere information provision, disaster tourism, information fatigue).
- Researchers and decision-makers should also engage more actively in a discussion on thresholds, e.g. how safe is safe enough, and how prepared (capacitated) should we be? Or, in other words, what is the target level of risk communication?
- Finally, efforts are needed to evaluate and monitor the effects of risk communication practices in a systematic yet practical way.

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Annex: Description of communication practices

Practice #1 (by Andreas Pichler and with additions by Corina Höppner)

Title/location/time: Austrian severe weather warning system (in collaboration with meteoalarm (EUMET-NET))/ Austria/Europe/ continuous. www.uwz.at

Type of hazards and the risks involved: Hurricanes, gales, flooding, fog, storms, heat and cold.

Position in the risk cycle and measures: Forecast and warning.

Purposes/functions of communication, content of communication and specific challenges: To inform of extreme weather expected to occur somewhere over Austria/Europe and to trigger protective actions.

Actors in communication: Experts to general public at national/European level.

Communication tools, channels and time dimension of communication: Website, risk map at national/European and regional level. Information on risk levels is disseminated via internet, SMS, e-mail, telephone, radio (national and local channels, daily), TV (national channel), teletext.

Appraisal of good and/or poor aspects of practice: Information is updated daily, available for the national/European and regional level, disseminated via different channels and tools and offers not only information but also individual advice (in special cases). The bulletin icons used are harmonized along the EUMETNET network which increases the understanding of these icons across Europe (this is important e.g. for countries with a big touristic share).

Contribution to social capacity building: Depends on the personal interest, motivation and need of individual users to learn about extreme weather conditions and events. The information platform has become an early-recognition tool that is important for the economy and traffic, thanks to the precise presentation of the weather forecast. Travelers also use the platform to assist short-term holiday plans. Further fields of application include the agricultural industry and the early securing of sites at risk.

Relationship to social vulnerability: The information is available in German and other European languages. Information is disseminated via different channels and tools. The European wide Meteoalarm is available in all European languages.

National setting: Embodies the national practice. Similar practices exist in a number of other countries too. MeteoSchweiz is the Swiss equivalent that also collaborates with Meteoalarm.

General reflection: To our knowledge the ability of these practices to communicate information and social capacities has not been evaluated.

It should, however, be noted that there are many providers of severe weather warnings via sms, phone etc. nowadays. The resulting increase in warnings is not uncontested and can have serious drawbacks in practice. In geographically small areas such as Central Switzerland where weather events can be very local, these warnings are usually not precise enough and do not come with a sufficient lead time (Graf 2008). Many warnings turn out to be false which, over time, can compromise the credibility of the message and reduce the motivation of civil servants and fire brigades, leading to high costs. There has been a considerable increase in warnings in Central Switzerland (An average of 1 warning per day was emitted in the Canton of Luzern, see Graf 2008) which might also negatively impact on people's motivation to act. However, other actors such as building insurers support these warnings as they can save money with homeowners preparing their properties for any potential event. Hence, when evaluating such communication practices it is important to consider whether they actually make sense at the local level and which actors may benefit, or be disadvantaged by, the wider societal impacts they may have.

Practice #2 (by Andreas Pichler)

Title/location/time: "Die Kraft des Wassers"/ Lebensministerium Austria/ single publication with revisions.

Type of hazards and the risks involved: Fluvial and groundwater flooding.

Position in the risk cycle and measures: Implementation of structural and non-structural prevention/preparation measures.

Purposes/functions of communication, content of communication and specific challenges: Introduce and inform about opportunities with regard to flood proofing measures.

Actors in communication: Experts to general public at national level.

Communication tools, channels and time dimension of communication: Brochure; internet, mail; ongoing.

Appraisal of good and/or poor aspects of practice: The brochure is part of a series to inform the public about natural hazard and risk management measures and strategies in Austria. It introduces laypeople to the types of hazards and forces that can occur during fluvial and groundwater flooding events with respect to structures and buildings and gives hints that can be implemented during the construction/re-construction of a building to overcome problems related to these hazards/forces.

Contribution to social capacity building: Depends on the personal interest, motivation and need of individual users to be informed about opportunities to prevent damages to the structure and/or to the contents of buildings located in flood hazard areas. The brochure is focused on awareness building and supports the idea of a greater ownership of risks.

Relationship to social vulnerability: The brochure is available for free via the internet or can be ordered by mail / telephone.

National setting: The brochure embodies national practice for flood proofing measures.

General reflection: The brochure has not been evaluated with respect to the purposes of communication and its actual contribution to capacity building.

Practice #3 (by Andreas Pichler)

Title/location/time: Snow avalanche bulletin / Austria/ continuous. www.lawine.at

Type of hazards and the risks involved: Snow avalanches.

Position in the risk cycle and measures: Non-structural prevention/preparation measures and warning.

Purposes/functions of communication, content of communication and specific challenges: Informing to build knowledge on avalanches, on risks and on how to act. Communication to raise awareness, trigger protective behaviour and facilitate training.

Actors in communication: Experts to general public at national level

Communication tools, channels and time dimension of communication: Website, risk map at national and regional level. Information on risk levels is disseminated via internet, e-mail, telephone, radio (national and local channels, daily), TV (national channel), teletext, press (national and regional papers).

Appraisal of good and/or poor aspects of practice: Information is updated daily, available for the national and regional level, disseminated via different channels and tools and offers not only information but also individual advice (in special cases). The bulletin icons used are harmonized across the European Avalanche Warning Services which increases the understanding of these icons across a number of European States (this is important e.g. for countries with a big touristic share).

Contribution to social capacity building: Depends on the personal interest, motivation and need of individual users to learn about avalanches. The bulletin presumably builds knowledge capacities, from knowledge of risk zones and how to determine local risks to how to behave when an avalanche hits.

Relationship to social vulnerability: The bulletins are available in German and English. Information is disseminated via different channels and tools.

National setting: The bulletin embodies national practice for snow avalanche preparation and warning. The bulletin shares many similar aspects with the Swiss SLF snow avalanche bulletin.

General reflection: The bulletin has not been evaluated with respect to its purposes and capacity building.

Practice #4 (by Andreas Pichler)

Title/location/time: "Flood risk zoning in Austria – HORA"/ Austria/ continuous

Type of hazards and the risks involved: risk due to floods and earthquakes

Position in the risk cycle and measures: Prevention. Implementation of non-structural measures, risk maps.

Purposes/functions of communication, content of communication and specific challenges: Informing, triggering awareness; internet-based Austria-wide risk zoning system for natural disasters which focuses on floods and earthquakes.

Actors in communication: Experts to general public at national level.

Communication tools, channels and time dimension of communication: Internet platform; ongoing.

Appraisal of good and/or poor aspects of practice: For many reasons sustainable and successful future risk management strategies will require an intensified risk sharing between the state, insurance companies and the public. The project "HORA" plays an important part in this interaction and aims to improve cooperation between the state and the private sector. Austrian citizens are to benefit from this cooperation for example when it comes to the provision of important information about the flooding or earthquake risk to which their flats, industrial enterprises or infrastructural facilities are exposed. Apart from the easy and quick retrieval of information about potential flooding and earthquake risks from a digital risk map provided on the internet, which permits a first risk assessment, the instrument also allows an optimisation and the setting of priorities in the flood control measures required for communities, national and provincial governments.

Contribution to social capacity building: The practice is expected to enhance people's hazard awareness, informing about the limits of active control measures and the need for an appropriate use of areas at risk.

Relationship to social vulnerability: Risk information is provided in an easy to understand (visual) form and can be accessed for free via the internet.

National setting: Contribution to increasing people's hazard awareness, contribution towards implementing the EU Floods Directive in Austria.

General reflection: The impact of the information provided by the internet platform "HORA" has not been evaluated with respect to its contribution to capacity building.

Practice #5 (by Andreas Pichler)

Title/location/time: Peak discharge information system / Austria (provinces) / continuous.

Type of hazards and the risks involved: Floods.

Position in the risk cycle and measures: Forecast and warning.

Purposes/functions of communication, content of communication and specific challenges: To inform and to trigger preparatory/protective behaviour.

Actors in communication: Experts/Authorities from the provinces to general public.

Communication tools, channels and time dimension of communication: Websites (related to each of the hydrographical services in Austria), risk maps at provincial and regional levels. Information on discharge levels is disseminated via the internet and in hazardous moments, also via the radio (national and local channels, daily), TV (national/regional channel) and teletext.

Appraisal of good and/or poor aspects of practice: Information is updated on-time, available for the national and regional level, disseminated via different channels and tools and offers not only information but also individual advice (in special cases). The information icons used are easily understandable. A negative aspect is the missing translation of information into foreign languages.

Contribution to social capacity building: The practice is expected to support actions to prepare (at the individual and community level) for floods, and to support awareness building and perception.

Relationship to social vulnerability: The information is only available in German. Information is disseminated via different channels and tools.

National setting: The system embodies national practice.

General reflections: The practice has not been evaluated with respect to the purposes of communication and capacity building.

Practice #6 (by Annett Steinführer)

Title/location/time: Flood Forecasting System, Czech Republic (national, regional, local scale – gauge specific); <http://hydro.chmi.cz/hpps/> (HPPS = Hlásná povodňová a předpovědní služba/Flood forecasting service, run by Czech Hydrometeorological Institute ČHMÚ/CHMI); including links and information with regard to the situation in neighbouring countries

Type of hazards and the risks involved: flooding (+ drought, i.e. very low water level of rivers); is part of Integrated Warning Service System (Systém integrované výstražné služby; SIVS) of the Czech Republic issuing warning information for the territory of Czech Republic for meteorological and hydrological hazards (heavy rain, wind, frost, snow)

Position in the risk cycle and measures: Prevention/preparation, warning.

Purposes/functions of communication, content of communication and specific challenges/difficulties: to provide information on water levels and flow (one measurement per hour + forecasts); to provide information on warning levels (normal – flood watch – flood warning – flooding – extreme flooding); to provide small-scale specific and long-term hydrometeorological data.

Actors in communication: Czech national hydrometeorological institute and its regional branches; information available for professionals and the general public.

Communication tools, channels and time dimension of communication: Internet platform (run in Czech and to most parts also in English); map design (national, regional and river-basin scale).

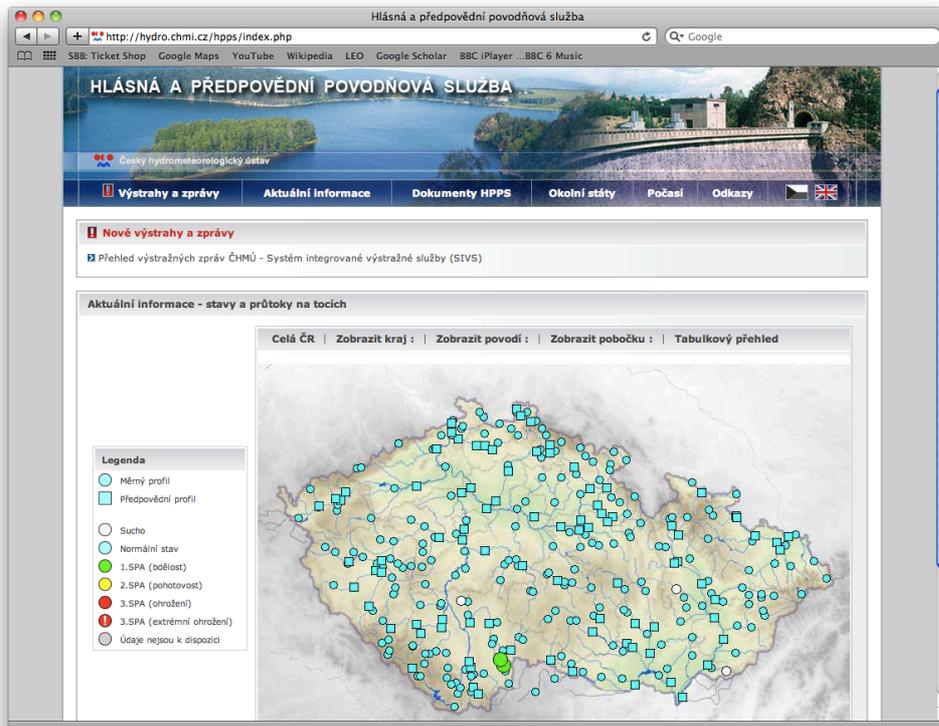
Appraisal good or/and poor aspects of practice: easy to use, comprehensible; due to internet-based technology: restricted to people using the Internet¹⁰

Contribution to social capacity building: nothing can be said about actual use and comprehensibility.

Relationship to social vulnerability: important module to decrease vulnerabilities but dependent upon actual use and comprehensibility.

National setting: large 1997 and 2002 floods, as well as 2009 flash floods; existence of such a national warning system is certainly an improvement in comparison with the situation before the last major floods.

General reflection: The practice has not been evaluated with respect to the purposes of communication and capacity building. The description is based on the author's own assessment of the internet platform.



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Practice #7 (by Christian Kuhlicke)

Title/location/time: Kokkola, Finland (Coastal Region)

Type of hazards and the risks involved: Storm Surges, Storms, Heat waves

Position in the risk cycle and measures: Prevention

Purposes/functions of communication, content of communication and specific challenges/difficulties: It is focused on an island which is occupied with summer cabins. Citizens wanted to change the land-use pattern to a permanent usage which would allow them to build permanent residences. However, the city government rejected the demand, since they expect a sea-level rise due to climate change. However, since uncertainties are high and models are not very accurate the decision is not ultimate but only postponed. If more valid knowledge is available the city government may be able to make a decision in favor of using the island as a housing area.

Actors in communication: City government (making decisions), scientists (giving advice) and citizens (asking for conversion of the island).

Communication tools, channels and time dimension of communication: Classical one-way communication was taking place: the city government took the decision and communicated it to the citizens. It is important to understand that the local government is also responsible for its citizens and if the conversion was allowed and sea level rise or storm surges took place in several years' time, the city government could have been blamed for taking a wrong decision.

Appraisal of good and/or poor aspects of the practice: The decision may be considered as good, since it takes a preventive approach to climate change while also finding a way of postponing the decision in such a manner that it can be adapted to new and more valid knowledge in future. Citizens seemed to be largely in accordance with the decision made by the local government. Apart from that, such a one-way, top-down communication has also an advantage: The actor who takes the decision (in this case the community) is by law also responsible for the consequences of this decision.

Contribution to social capacity building: No direct link

Relationship to social vulnerability: The overall vulnerability of the island was not increased, since the construction of new buildings was prevented.

National setting: One of the few examples where national guidelines were implemented and considered by a local government.

General reflection: The description of the case-study is based on a telephone interview with someone familiar with the case presented.

Practice #8 (by Chiara Bianchizza)

Location/time frame: National communication about natural hazards, France; information available and updated on the website of the Ministère de l'écologie, de l'énergie, du développement durable et de la mer. <http://www.risquesmajeurs.fr>

Hazards/risks involved: floods, forest fires, hard storms, landslides, cyclones

Position within risk cycle: Prevention (information about: prevention/mitigation behaviours; relevant literature/conferences on certain hazards; national/legal actions for prevention and management of natural hazards)

Purpose/function-content: On the website of the French Ministry of Environment, the section "Prevention de Risques Majeurs" (prevention of major risks), natural hazards of different nature (from floods to forest fires) are dealt with. Explanations, recurrence and good behaviours in case of floods are outlined, together with legal tools that citizens can use for compensation from the damage caused by a natural hazard (in the section "Information des populations"). The website aims at diffusing information about the major causes of hazards in the country, about preventive measures useful to reduce damage, to make the citizens aware of initiatives in this field and to make tools available for the recognition of responsibilities and rights connected to risk management. The website is structured in 7 different sections:

1. Risques majeurs (major risks): an overall informative page on the nature and characteristics of the major hazards in France.

2. Ma commune faces aux risques: this section is closely linked to the Bd-Dicrm.fr section. In the latter, a list of all municipalities, each with a specific code, is available. Using this code on the former section, it is possible to send queries about the risks that a certain municipality faces and to get more detailed information.

3. Catalogue numérique: provides a list of relevant literature/pamphlets/informative material on hazards and their prevention/mitigation.

4. Jurisprudence: all the relevant legal information (texts of laws and explanation of their meaning) in the context of risk prevention (insurance), compensation after hazard etc.

5. Phototeque: pictures related to natural hazards (historical archive of French events, pictures of current events in France and abroad, etc)

6. Aleas.tv: access to videos on the theme of prevention of natural hazards.

7. Bd-Dicrim.fr: an interactive map of the municipalities in France. Clicking on each area, it is possible to access the municipality's webpage. Major natural risks are highlighted and preventative and emergency behaviours are explained.

Actors involved: institutions and the public

Appraisal of good and/or poor aspects of the practice: The website contains clear and precise information for specific behaviours that can be directly implemented by citizens in the case of hazards that might affect their daily lives. Also, explanations are provided about the causes of meteorological phenomena, together with information about conferences and relevant literature concerning hazards that might become particularly dangerous in specific situations (i.e. avalanches in the case of a mountain trip).

This information, although very complete, is available on the Internet and therefore might not be accessible to everyone (elderly people not familiar with this medium, for example). Also, it is general information that might not be accurate in specific local contexts. However, the website in itself is a very complete and updated source of information, easy to navigate and helpful for finding answers to specific, pragmatic behavioural questions. This approach to hazard information, which flows directly from institutions to citizens, implies a direct involvement of the population in both prevention/mitigation practices and emergency situations.

Contribution to social capacity building: The possibility for citizens to access information directly is a first incentive for them to adopt certain behaviours, expand their knowledge on certain subjects, and become more aware of issues related to natural hazards. This incentive to gather knowledge can potentially increase the capacities of individuals, and then communities, to cope with the risk represented by natural hazards.

Communication/social vulnerability: Interestingly, the website also contains a description of different types of 'vulnerability' (to persons and property), (<http://www.risquesmajeurs.fr/comment-reduire-les-risques-le-concept-de-mitigation>) under the heading "How to reduce risks: the concept of mitigation". People's vulnerability is defined as a condition that depends, among other factors, on their information/knowledge about a certain event and on the behaviour enacted prior to the event taking place. The overall message therefore is that being informed and practicing particular behaviours (as provided and described in the website pages) are effective tools for reducing vulnerability.

General reflection: The description is based on the website. To our knowledge, the practice has not been evaluated with respect to the purposes of communication and social capacity building.



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Practice #9 (by Matthias Buchecker)

Title/location/time: Vulnerability reduction in the Loire basin, France

Type of hazards and the risks involved: Flooding of residential areas and trading estates.

Position in the risk cycle and measures: Prevention, risk information, prevention plans for objects.

Purposes/functions of communication, content of communication and specific challenges/difficulties: Increase owners' knowledge and awareness of the vulnerability of their enterprise or house towards flooding by offering a vulnerability analysis. This service is subsidized by the state, but it is optional.

Actors in communication: Regional authorities, national risk foundation, insurances, enterprises, home owners.

Communication tools, channels and time dimension of communication: The initiative has been publicized by the mass media, articles and leaflets. The vulnerability analysis includes a questionnaire, a visit of a building vulnerability expert and a report on the specific vulnerability of the building.

Appraisal of good or/and poor aspects of practice: The innovative aspect of this initiative is that the owners receive specific information on the vulnerability of their building towards flooding including a photomontage illustrating the potential level of water on the building and a list of recommendations to reduce the vulnerability of the building. This specific information allows the owners to assess their individual vulnerability and to take adequate measures.

Contribution to social capacity building: This initiative is likely to raise owners' awareness of flood risk and to motivate them to take individual measures to reduce the vulnerability of their building or enterprise.

Relationship to social vulnerability: This initiative not only motivates home owners and entrepreneurs to reflect on the vulnerability of their buildings, but also the vulnerabilities of the people living and working there. The question of social vulnerability is explicitly addressed in the questionnaire that is part of the vulnerability analysis.

National setting: The initiative is supported by the state and co-financed by EU, but the regional authorities organized the campaign.

General reflection: The practice has so far not been evaluated in terms of capacity building. However, a baseline survey has been conducted.

Practice #10 (by Matthias Buchecker)

Title/location/time: Plan Vidourle, basin of Vidourle, Dep. Gard et Hérault, France

Type of hazard: riverine floods, flash floods

Position in risk cycle and measures: Prevention, planning of large scale structural measures, risk information, emergency plans

Purposes/function of communication, content of communication and specific challenges/difficulties: Sensibilisation for risks and keep memories alive using a 3-D-model of the basin and provoking virtual flooding events to show processes and make aware of possible damages. Furthermore, information is provided on the river of Vidourle (ecology, history, hydraulics, prevention strategies).

Actors in communication: wider public of the affected municipalities, schools, authorities.

Communication tools: Travel exhibition, book, video, 3-D-model of basin, information box. Furthermore, a journal on the management of the river Vidourle is sent twice a year to the affected population of the river basin.

Appraisal of good or/and poor aspects of practice: Efforts have been taken to transform the risk information on the river Vidourle into pedagogical tools that address the interest of the wider population and in particular the school children. This form of information is made accessible through travel exhibitions, but it can also be downloaded from the internet. Regular journals on the activities along the river Vidourle keep the wider public informed and make them aware of the risks and the prevention measures taken. **Contribution to social capacity building:** This risk communication practice mainly contributes to raise the public's risk awareness and risk knowledge in a wider sense. The regular information provided through the journal might also have a trust-building component.

Relationship to social vulnerability: The travel exhibition might encourage the public to reflect on the vulnerability of the region in terms of natural disasters, and to think about adequate measures.

National setting: The communication practice was financially supported by the national and regional administrations, but it was based on a regional initiative.

General reflection: The practice has not been evaluated with respect to the purposes of communication and capacity building. The description is based on a small article in the journal Risques Infos (June 2010).

Practice #11 (by Matthias Buchecker)

Title/location/time: Potential damage reduction, Communauté du Pays d'Aix, France

Type of hazards and the risks involved: Forest fires, earthquakes, floods, technological risks

Position in the risk cycle and measures: Prevention, elaboration of inter-municipal emergency plans, emergency training

Purposes/functions of communication, content of communication and specific challenges/difficulties: Develop shared plans among neighboring municipalities as to how to proceed in the case of hazards in order to reduce damages. This also includes a shared data basis and a shared warning system, shared emergency training, shared seminars on risks and shared practice guidelines for the public.

Actors in communication: Authorities of the municipalities, regional organizations, public

Communication tools, channels and time dimension of communication: The municipalities of the region have agreed on a shared programme to reduce damages based on a guideline provided by the national service of major risks. Besides elaborating shared emergency plans and organizing shared emergency trainings, they also developed a shared warning system and a guideline of being prepared for major risks.

Appraisal of good or/and poor aspects of practice: The innovative aspect of this practice is that the municipalities of a region decided to collaborate in the field of damage reduction and elaborating emergency plans, and in particular to make damage reduction an issue. This bottom-up initiative combining emergency management and risk communication has a strong potential to really make the public aware of the regional risks and to encourage them to improve their preparedness in terms of regional risks.

Contribution to social capacity building: This initiative is likely to improve the organizational capacities of the region and the preparedness of the public in terms of regional risks.

Relationship to social vulnerability: This bottom-up initiative stimulates reflection on the social vulnerability in the region, and a requirement to rescue vulnerable groups is included in the emergency plans.

National setting: The initiative was supported by the national service "risques majeurs", but it was based on a regional initiative.

General reflection: The practice has not been evaluated with respect to the purposes of communication and capacity building. The description is based on a small article in the journal Risques Infos (June 2010).

Practice #12 (by Corina Höppner)

Title/location/time: Flood hazard maps (in print and web mapping services), the example of IÜG in Bavaria. www.lfu.bayern.de/wasser/fachinformationen/iueg.index.htm

Type of hazards and the risks involved: Flooding.

Position in the risk cycle and measures: Prevention. Implementation of non-structural measures, risk maps.

Purposes/functions of communication, content of communication and specific challenges/difficulties: Informing the public of the hazard situation, the extent of the designated flood plain and the resulting restrictions. Raising awareness for flood risk. The maps usually show the spatial extent of floods and different flood scenarios: flood event with a high probability, with a medium probability and a rare or extreme flood event with low probability.

Actors in communication: Those developing maps to the general public.

Communication tools, channels and time dimension of communication: Maps are available in print and via web services.

Appraisal of good and/or poor aspects of the practice: The elaboration and dissemination of these maps is a requirement of the EU Flood Directive. However, as an evaluation of the IÜG showed, for them to be effective communication tools more attention needs to be paid to their design (Hagemeier-Klose 2009; Hagemeier-Klose and Wagner 2009). Evaluators identified a number of shortcomings in the current design and presentation of these maps (content, readability, usability) and gave a number of recommendations for the improvement of flood hazard maps (see box below).

Contribution to social capacity building: There is potential for the public to learn about the spatial extent of different flood events, the risks involved and the restrictions that come with flood risk zoning.

Relationship to social vulnerability: It is expected that raised awareness and personal preventative measures reduce people's vulnerability to hazard events.

National setting: Hazard maps are required by the EU Floods Directive and exist in other German federal states as well as in other countries from the national to the local level (e.g. HORA Austria see below, UK, Slovenia etc.) though with similar design issues. We chose the case presented as it has been evaluated and is being improved on the basis of the evaluation.

General reflection: The practice has been evaluated within the EU funded project FloodScan. The description is based on related publications (Hagemeier-Klose 2009; Hagemeier-Klose and Wagner 2009). Hazard zone maps are an emerging research topic in the social sciences. Scientists have recently started to investigate the ways these maps are developed and implemented and, most importantly, underlying and emerging socio-political interests and conflicts (e.g. Schmid 2009).

Recommendations for designing of flood hazard maps in print and web mapping services (Hagemeier-Klose and Wagner 2009):

- Maps should create emotional empathy and refer to local situations.
- They should be easy to understand and be clearly arranged with simple explanations.
- Technical terminology should be avoided where possible.
- The legend and category classes should be comprehensible and readable at first glance.
- Flood hazard maps should be combined with past local flood events.
- Illustrated maps of flood plains or flood risk zones should be linked with real time information (e.g. water levels).
- The maps should indicate water depths for flood events with different occurrence probabilities.
- The flood maps should be blue-coloured to intuitively associate them with water. Clear colours and contrasts should be used.
- Flood plains of flood events with high, medium and low probability should be depicted rather than only the flood plain of the one hundred year flood.
- The legally protected area should be presented on the land register map so that landowners can easily recognise their grounds.
- To show the extent of flood events a city plan or an orthophoto should be used to make orientation for residents easier.
- To raise awareness of extreme flood events a combination of legally protected flood plains and maps showing flood events of different frequency and magnitude is useful.
- To prevent technical terminology, labels such as 'very frequent flood events' and 'very rare (or extreme) flood events' should be used (Labels developed by the Germans for flood events designed by the German Working Group of the Federal States on Water Issues LAWA 2007).
- Use gauge levels as people can compare these water levels to flood situations in the past or to actual water levels.
- Print maps and web mapping need to be promoted among the public through for example installations in towns or the countryside such as flood tables or 'flood phone booths'. Maps must thus be used in tandem with other communication measures.

Practice #13 (by Gisela Wachinger and Christine Kehl)

Title/location/time: Spree Forest watercourse margin project in Brandenburg (region in the east of Germany). Funding period: 2001 to 2013. Core area: 8,450 ha

Type of hazards: Droughts, water shortages due to the reduction of water flow under conditions of dam operations and climate change especially in summer in the Biosphere Reserve Spree Forest. Occasional man made flooding as a prevention measure.

Position in the risk cycle and measures: Conservation and restoration of natural and near-natural components (such as damp forests, flowing and standing water, reedbeds and damp grassland) of the Spree Forest lowland landscape, particularly by stabilizing the water regime. This large scale conservation project is the first in Germany, which is composed of two phases: Phase 1: Setting of a "Maintenance and Development Plan" by a regional participation process: the expert planning is supported by a moderation procedure commissioned separately. Phase 2: Presentation and examination of the "Maintenance and Development Plan", implementation of the plans and measures which have been the outcomes of the project.

Purposes/functions of communication, content of communication and specific challenges/difficulties: The main focus of the communication process lies on the transmission of ideas of nature conservation in accordance with constraints of water management and semi-natural water structures. Target groups are: Voluntary nature conservation groups, farmers, representatives of the travel industry, fishermen, hunters, land owners and water authorities. All groups have different claims on water management.

Actors in communication: Project office of the Zweckverband Gewässerrandstreifenprojekt Spreewald, a special purpose association (which was founded by a group of regional administrative districts), interdisciplinary moderation team, representatives of all involved groups (see above).

Communication tools, channels and time dimension of communication: Phase 1 (2001 – 2003) was accompanied by a moderation procedure which included the following components:

- situation analysis: understanding the initial situation, conflict analysis, interviews with representatives of interest groups, summary of the results, agreement on rules of cooperation
- process management: setting up a strategy group, agreement on the overall strategy between representatives of the special purpose association, the planners, the project management and the moderators
- public relation work: information events, exhibition, development of a project logo, contact with press and media
- working groups: setting up regional or area-specific working groups for information exchange and also mediation; technical working groups to discuss the expert-recommendations
- moderation plenary with all participants of the project: the advisory council of the special purpose association, the supporting working group, the financial contributors and the speakers for the working groups. At the end of phase one 43 meetings with 1,600 participants had been accomplished in the region of Spreewald.

Phase two (2004 – 2013) is accompanied by working groups, the moderation plenary, public relations work and a homepage (www.grps.info).

Appraisal of good and/or poor aspects of the practice: Several hundred people from the Biosphere Reserve administration, regional offices, associations and organisations and the concerned land users have worked together on the large conservation project. Without the intensive cooperation in the strategy group, the organisational support of the employees in the project office and the commitment of the Spree Forest population, the moderation procedure to support the Maintenance and Development Plan would not have been feasible.

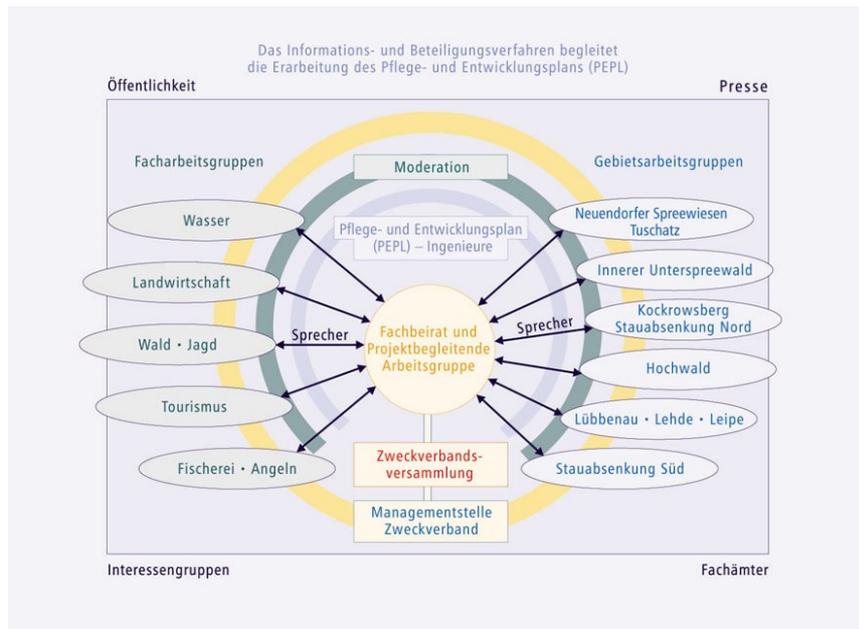
Contribution to social capacity building: The Spree Project contributes to social capacity-building through the way in which it distributes and exchanges expert knowledge to the public. Information events bring interesting and important themes like climate change, biodiversity or water management to inhabitants of the region.

Relationship with social vulnerability: Measures of habitat creation and restoration like the revitalisation of 25 km of running water, the connection of oxbow lakes or a better water management process in times of low water reduces the vulnerability of land users like farmers and tourists.

National setting: Besides Spreewald, other large-scale conservation projects of the German Federal Agency for Nature Conservation (BfN) have the two phases and are accompanied by professional moderators.

General reflection: The project is a rare best practice example of two-way communication in the field of natural hazards: The exchange of information between experts and the concerned public – and even more the chance to take part in decisions about the measures adopted in the region – has led to a better understanding of the interests of the different stakeholder groups and also of the implications of climate change.

To have a direct contact to a contact person and to experts has led to a behavioural change among the people involved in the project: they now support the regional preventive measures against droughts and for nature conservation.



Organisation of stakeholder and public engagement in the Spree Forest watercourse margin project
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Practice #14 (by Corina Höppner)

Title/location/time: Flood Risk Communication 'Blauer Plan', City of Regensburg, Germany.

Type of hazards and the risks involved: River Donau Floods, inundation of historical downtown and residential areas.

Position in the risk cycle and measures: Structural and non-structural prevention/preparation measures

Purposes/functions of communication, content of communication/challenges: Raising awareness of flood risks, informing about probability and spatial extent of flood events, triggering demand for further information and providing information to stimulate acceptance of structural prevention measures.

Actors in communication: Mainly from local authorities towards the local public.

Communication tools, channels and time dimension of communication: A combination of maps, public events, visual flood representations and participatory formats was used: flood information tables, flood marks, flood columns, an infobox on flood protection, public events such as flood festivals, regular press conferences and reports, Round Tables for residents, authorities and experts, a number of information brochures (e.g. with information on the 100-year flood, on the results of the Round Tables and on local flood protection plans), an internet portal 'Hochwasserinformationsdienst Regensburg' with a map showing the spatial extent of the 100 year flood and general flood information, two 3-D videos, and historical high water marks. Some communication tools were one-off or episodic (e.g. Round Tables, flood festivals), whereas others are permanent (e.g. flood columns).

Appraisal of good and/or poor aspects of practice: A variety of communication channels and tools were used. Overall, they seem to match with the purposes of communication. The practice combines permanent and one-off communication. There has also been an empirical evaluation of the design of the flood marks and columns (see references below). This research revealed weaknesses: columns and marks were not visible enough, they use the expression '100 year flood' which is not well understood by the public and which stimulates a false sense of security. Evaluators note that there is a wide gap between what communicators tried to convey and what people's actual information intake was. Several aspects of the design were open to improvement. The evaluating researchers support the idea of involving the target audience when designing communication tools.

Contribution to social capacity building: Evaluators suppose that there has been an increase in flood risk awareness though this has not actually been investigated.

Relationship to social vulnerability: Higher levels of awareness and knowledge are expected to trigger protective behaviour and to reduce vulnerability.

National setting: There is no country-wide praxis in cities and towns at risk from flooding. Arguably, it is the exception rather than the mainstream to use such a variety of communication channels and tools.

Experiments with the design and presentation of flood marks and flood pipes have also been undertaken within the EU funded project FLOWS in the City of Hamburg (www.flows.nu).

General reflection: The practice has been evaluated within the EU funded project FloodScan. The description is based on related reports (Hagemeier-Klose 2007; Hagemeier-Klose 2009).

Practice #15 (by Gisela Wachinger)

Title/location/time: Flood Partnerships in Baden-Württemberg (region in the south-west of Germany).

The flood-partnerships have existed since 2003 and their number has increased up to 21 in the whole region.

Type of hazards: Flooding (river-systems of Baden-Wuerttemberg)

Position in the risk cycle and measures: Prevention and preparation measures

Purposes/functions of communication, content of communication and specific challenges/difficulties: The main functions of communication are the transmission of experiences and knowledge of different communities on flood prevention; raising sustainable awareness of flood danger and informing about prevention measures (especially citizens, industry and trade) and most notably the construction of a sustainable communication network of all communities (actors and persons) in the same catchment area. The aim is to attain a better communication and coordination of prevention measures and the actions in the case of an emergency. A common action of upstream and downstream activities is intended.

Actors in communication: A flood-partnership is an association of local authorities, administrations and other institutions within a catchment area. In the broader sense the following actors participate in flood communication and prevention: ministry of the environment of Baden-Württemberg, Rural District Offices, Regional Councils, Local Authorities (Mayor, fire brigade, civil protection etc.), water authorities, industrial establishments, agriculture, insurance business and other associations.

Communication tools, channels and time dimension of communication:

1. Communication between experts: Communication, information and exchange of experiences between experts concerning issues about flood prevention. Special importance is attached to the elaboration of flood maps to inform the public about dangerous areas, alarm and applications planning, precaution with respect to regional planning and architecture and the stocking of dangerous materials near a river. A precautionary approach is taken to all these activities. These topics are discussed in regular meetings and informative events of local and technical authorities. Every year a meeting to exchange experiences within a catchment area takes place.

2. Communication to the public: To provide the opportunity for the communities to inform their fellow citizens materials about flood prevention (for example films or expositions) are allocated. On the internet homepage of the "WBW Fortbildungsgesellschaft für Gewässerentwicklung mbH" (organizer of the Flood Partnerships) you can find information for the public: a flood lexicon (from the flood news service (Hochwassernachrichtendienst) of Bavaria) that informs about all aspects of floods; flood maps and other free publications. For every single flood partnership, one or more contact persons are presented on the homepage.

Good/poor aspects of practice:

An innovative aspect is the building of a network to avoid single and uncoordinated actions of actors with different locations along the river. A flood does not concern just one community, the imprudent operations of one community can endanger others. For this reason it is important to attain a coordination between all those concerned. In this case, the aim of the communication is to build a network to encourage flood prevention, awareness and information between decision-makers and concerned people. The public will have the opportunity to participate in the communication process at a later stage.

Contribution to social capacity building: The flood-partnerships contribute to social capacity-building because they distribute and exchange expert knowledge to/with the public. In addition, they tend to increase solidarity between communities and the comprehension of overall measures.

Relationship with social vulnerability: With the help of flood maps, a better coordination of prevention measures and the regular examination of topics like reasonable land use management social vulnerability of both people and communities can be reduced.

National setting: Beside Baden-Württemberg other parts of Germany (Rheinland-Pfalz, Bavaria) plan to set up flood partnerships.

General reflection: This description is based on information found in brochures, activity reports and an expert interview.

Practice #16 (by Matthias Buchecker)

Title/location/time: Flood animation centre, island of Wilhelmsburg, Hamburg, Germany.

Type of hazards and the risks involved: Storm surges

Purposes/functions of communication, content of communication and specific challenges/difficulties: Raise risk awareness. Motivate people to participate in an integrated capacity building process and to extend their knowledge, skills and abilities through a virtual experience with a flooding situation.

Actors in communication: HafenCity University of Hamburg, authorities of the city of Hamburg, local stakeholders.

Communication tools, channels and time dimension of communication: Flood animation box (2x2x2m, decorated as a living room) as a tool for flood training. Further tools used are flood cylinders, videos of historic flood events and digital GIS flood maps. These tools should facilitate the stakeholders to have an emotional experience of flooding and thus motivate them to reflect on the situation. Each individual flood training or experiment takes about 15 minutes (introduction, entering the box, warning, time to solve tasks, getting the all-clear) including an analysis of the training through a short interview. Stakeholders can participate in this training either actively or as observers.

Appraisal of good or/and poor aspects of practice: The strength of this practice is that it tries to enhance risk awareness not through cognitive information, but through emotional experiences. This experience allows the involved stakeholders to personally reflect on the risk situation and thus raises his or her motivation to assume more personal responsibility in facing the risk. A poor aspect of the tool might be that its reach is limited because the training is time consuming and tied to the physical tool.

Contribution to social capacity building: This tool is likely to raise stakeholders' risk awareness and their motivation to take action to actively face this risk.

Relationship to social vulnerability: The flood training allows the stakeholders to reflect their own vulnerability in terms of flood situation, but also enables them to think about the more vulnerable members of their community.

National setting: The communication practice is still in the pilot study phase and has been applied in a few case studies.

General reflection: Part of the flood training is a reflection on the training through an interview or group discussions. A comprehensive evaluation of the tool has so far not been conducted. The practice is described in detail in the CRUE research report No 1-4 (Pasche et al., 2008).

Practice #17 (by Corina Höppner)

Title/location/time: Flood Art, examples of Flood Sculptures 'River Work' in Moosburg (Isar), Germany, Sneek in the Netherlands and in Åsnes in Norway.

Type of hazards and the risks involved: Floods.

Position in the risk cycle and measures: Prevention, non-structural measures.

Purposes/functions of communication, content of communication and specific challenges/difficulties: Raise awareness of the risk of flooding. Keeping memories of past floods alive.

Actors in communication: Artists to the public.

Communication tools, channels and time dimension of communication: Sculptures, e.g. 'Gate to the River', 'Isar Bow' (Moosburg, Germany), 'Flood Stone' (Åsnes, Norway), 'Wavebreaker' (Sneek, The Netherlands). Most of the installations are permanent and are intended to pass on the message to future generations.

Appraisal of good and/or poor aspects of practice: Innovative way of engaging people with the issue. Might raise curiosity and positive emotions. This communication practice develops a language which is not reliant on experts.

Contribution to social capacity building: The contribution to capacity building has not been evaluated to our knowledge. The practice potentially raises interest, curiosity and hence awareness of the issue. It also fosters further information seeking and potentially creates positive emotions rather than fear and powerlessness.

Relationship to social vulnerability: Can express/symbolise vulnerability though this has not been investigated in detail.

National setting: There are art projects elsewhere too (e.g., along the River Passer in Meran, South Tirol). However, there is no systematic overview or research being done. There seems to be no national or international mainstream. Each project is unique.

General reflection: The Flood Sculpture in Moosburg has been evaluated with respect to its general impression on visitors (Hagemeier-Klose 2009). The art sculptures in the Netherlands and Norway were developed within the EU funded project FLOWS. Some descriptions are found in related reports and fact sheets (www.flows.nu). Hardly any research has been done on art in the natural hazards, resource management, and landscape fields. Communication via art is an emerging research topic in the climate change community (e.g. Gormley 2010; Liverman 2010)



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Practice #18 (by Edda Bergner and Gisela Wachinger)

Title/location/time: Hochwasserschutzkonzept HSK Köln, Flood protection centre Cologne, local action plan since 01 february 1996; city of Cologne (Germany). www.steb-koeln.de/hskkln.html

Type of hazards: River Rhine Flooding (floods in 1993 and 1995)

Position in the risk cycle and measures: Prevention and preparation measures (warning), risk maps, risk management

Purposes/functions of communication, content of communication and specific challenges/difficulties: sensitisation and information of the public about flood control measures, flood management and possibilities for “do-it-yourself”- precaution (insurances, regional planning, architecture, personal behaviour); permanent updates of the water level and rising and falling tendencies, information about historical and recent floods; raising awareness of danger of flooding, possibilities for precaution; risk maps to inform about individual danger, providing contact persons.

Actors in communication: Colonian urban drainage company, FLOOD PROTECTION CENTRE COLOGNE, Hochwasser Kompetenz Centrum Köln (HKC).

Communication tools, channels and time dimension of communication: 1. Communication to the public: a) precautionary communication: There is some general information provided on the internet homepage of the Urban Drainage Company. A Tide-Gauge-Tower at the river side and an effect lighting system show people the current water level that is also provided by a telephone answering machine. Besides there are some interactive ways used to communicate flood risk: for example a permanent exhibition about floods, a film, a “flooding promenade and cycle way”, information events for students etc. b) Communication during a flood: Important information is conveyed to all citizens via internet, radio and telephone; 2. Communication between authorities: FLIWAS (Flood Information and Warning System). This system consists of the following elements: level, communication, organisation, resources, operation schedule, evaluation, test and training since 09/2009

Appraisal of good and/or poor aspects of practice: The River Rhine is the river most affected by floods in Germany and after the two big floods in Cologne in 1993 and 1995 a local action plan was developed. Because of the economic development and the urbanization of flood plains more and more people are threatened by floods. Benefits of the flood prevention system in Cologne: First of all the communication to the public does not depend on individual equipment or technical know-how. Everybody has at every moment the possibility to get information due to a system consisting of an internet homepage, a telephone answering machine, a Tide-Gauge-Tower, bulletins for behavioural advice and risk maps. Secondly, on the internet homepage information for the public is instructive, visualised with lots of pictures and therefore easy to understand. Most asked questions are collected and answers given. An innovative aspect is the lighting as a special visual effect: a pumping station in the city changes its colour depending on the water level. The FLIWAS system is common to the authorities all over Germany but only in parts accessible to the public. The communication is one way and depends on the action of the concerned persons. There is no direct contact with the public through information events or trainings is not given.

Contribution to social capacity building: The FLOOD PROTECTION CENTRE COLOGNE enforces the public and helps to raise awareness for flood danger. It distributes expert knowledge and advice in a transparent way.

Relationship with social vulnerability: Some precaution measures are explained on the website that help to reduce social vulnerability. People are given advice about insurance (“Erweiterte Elementarschadenversicherung”), for architectural precaution, as well as simple behavioural precaution advice, which could help to prevent personal danger.

Practice #19 (by Fiona Tweed)

Title/location/time: Katla eruption - evacuation simulation exercise, southern Iceland, 2006

Type of hazards and the risks involved: Subglacial volcanic eruption: historical precedents indicate ashfall, glacier outburst flooding (jökulhlaups), debris flows and lightning are all likely.

Position in the risk cycle and measures: Prevention/preparation

Purposes/functions of communication, content of communication and specific challenges/

difficulties: The Katla subglacial volcano lies under the Mýrdalsjökull ice cap and last erupted in 1918. Data on the periodicity of Katla eruptions indicates that an eruption is overdue. The 1918 eruption melted through 400m of ice in 2 hours, generated a $300,000\text{m}^3\text{s}^{-1}$ flood peak, heavy ash fall over 30km from eruption and lightning from the eruption column. Dykes have been built to protect roads in areas subject to inundation, but these were not built to withstand catastrophic flooding. The Icelandic Civil Protection (ICP), in conjunction with scientists, local police and emergency managers, had developed mitigation strategies for possible flooding produced during future Katla eruptions. Communication sessions were held with residents from communities located within the hazard zone; these sessions consisted of information meetings in 2005 and 2006 regarding the possibility of a future Katla eruption and the proposed evacuation plan for flooding. A full-scale evacuation exercise took place in March 2006 to test procedure, public response and interpretation. Evacuation warning was by text message to mobile phones. If residents did not have mobile phone number, a recorded message was dialed through to their landline. Upon receiving this message, residents had 30 minutes to prepare to evacuate. Some residents acted as volunteer ‘sweepers’ in their local area to ensure their neighbours had left for the designated evacuation centres.

Actors in communication: Chief actors were the Icelandic Civil Protection Agency (ICP), the Icelandic Association for Search and Rescue (ICE-SAR), local police, the Red Cross (making decisions), research scientists (developing and communicating hazard assessment) and citizens (responding to warning). Researchers observed the simulation exercise and evaluated its effectiveness.

Communication tools, channels and time dimension of communication: Prior to and during the evacuation exercise, it seemed that one-way communication was dominant; this constituted information flow from the ICP, police, researchers and ICE-SAR to the local residents. There was some dialogue between agencies developing and implementing the evacuation exercise but little dialogue between those at risk and the agencies managing the situation.

Appraisal of good and/or poor aspects of the practice:

1200 residents (65% of those predicted to be affected by a real event) participated in the simulated evacuation. Most residents were positive about the exercise; they felt that the displays in the evacuation centres were ‘informative’, they ‘felt more aware, less afraid’, and were more likely to seek further hazard and risk information. During the exercise, however, some aspects of the communication system failed, inhibiting successful response to the evacuation warning. Volunteer sweepers rescued people that did not get the evacuation message and one family was rescued by helicopter. Several people/family groups were late to evacuation centres and one evacuation centre was not adequately signposted. Several residents were reluctant to evacuate; for some leaving livestock was a problem due to strong socio-economic bonds and 30 minutes was considered insufficient time to prepare to leave. Residents had not been consulted in the development of the evacuation plan, but were told that they had to follow it or be arrested. The reliance on mobile phone technology for the warning phase was controversial; the at risk area is largely rural and many farmers either a) do not own a mobile phone or b) do not carry mobile phones when out working in the fields. The ICP did not provide feedback to the residents during the time set aside for them to follow-up on the evacuation exercise.

Contribution to social capacity building: This has not yet been fully evaluated, but the fact that there was some communication failure, that residents felt disempowered and that the ICP failed to give feedback to residents during the follow-up period actually prompted residents to lobby for change that has resulted in increased social capacity building. A key outcome of the exercise was that, on the basis of resident feedback, an integrated approach to ‘encourage and support personal and community preparedness measures’ was developed. Residents were subsequently empowered through direct involvement in developing a risk communication and evacuation strategy, with continued provision of hazard and risk information planned via participatory ‘town meetings’. Resident feedback continues to contribute to the

improvement and periodic testing of communication processes and the clarification of the role of 'volunteer sweepers'. Consultation took place to ensure realistic timings during evacuation and the ICP promised to provide timely feedback to residents in future. Despite elements of communication failure, notably in the simulated warning phase, the exercise raised awareness of risk and improved knowledge of how to behave before and during a Katla eruption. It also permitted sharing of knowledge and experience between residents, some of whom had inherited memory of the impacts of the 1918 Katla eruption; it appeared, however, that this inherited memory had filtered down one generation only.

Relationship to social vulnerability: Again, this has not yet been formally evaluated, but the practice identifies the residents at risk according to spatial location and targets them for communication and mitigation measures. However, there were no specific communication activities explicitly aimed at reducing social vulnerability within the 'at risk' locations.

National setting: This is one of the few examples where researchers have examined the social dimensions of risk from natural hazards in Iceland.

General reflection: The description of this case-study is largely based on work by Bird et al. (2009).

Practice #20 (by Chiara Bianchizza and Anna Scolobig)

Location/time frame: Information flow between meteorological centers (national and regional) to local units of civil protection; national level

Hazards/risks involved: Heavy rainfall events and storms, causing floods, snow avalanches, debris flows, landslides, etc. according to the different hydro-geological characteristics of the territory

Position within risk cycle: Prevention, implementation non-structural measures: information from meteorological centres to local units of civil protection and warning.

Purpose/function-content, main challenges: Information and facilitating decision-making between actors at the national and local level.

Actors involved:

Military Air force, Regional Agencies for Environmental Protection, local functional units of civil protections, mayors, citizens

Communication tools, channels and time dimension of communication: Warning information diffused via bulletins

Good/poor aspects of practice:

One of the main issues in the communication of meteorological risk in Italy is the fragmentation and overlapping of competences. The official service for meteorological forecasting is provided by the Military Air force (Aeronautica Militare), which is highly centralized and therefore not always able to address local territorial specificity. The Regional Agencies for Environmental Protection (ARPA) instead, are more rooted in the territory of the regions and can connect the meteorological data to the local hydro-geologic situation. The Military Air force meteorological service, not knowing the local areas in depth, tends to send out alarm bulletins regularly, in order to keep on the safe side in case of exceptional events. The local units of civil protection, after a certain number of false alarms, will tend to underestimate the information from this source. A vicious cycle of mistrust then takes place.

Also the local ARPA system of meteorological data diffusion has its downsides. On the one hand, the bulletins, available also to the population through the ARPA websites, are written in a very complex, technical language, that does not talk effectively to the lay person. On the other hand, the interpretation of data emerging from meteorological models used by the agency is, for bureaucratic reasons of responsibility, standardized. This allows for the application of protocols and procedures, therefore reducing the personal responsibility of the meteorologist. However, it also limits the accuracy of forecasting, which would benefit from personal and specific interpretations, as not all situations can be included in the protocol.

Between the AM and ARPA, the service that seems to be closest to the specific local realities is the regional one; for its development, two improvements would seem appropriate. On the one hand, the language of the public bulletins should be translated into a language immediately understandable and related to the everyday reality of the citizens who can consult it on the web.

The bureaucratic 'cage' which limits the power of interpretation and specific study of each meteorological situation should also be opened, so as to allow for more reliable forecasts.

Another issue in risk communication is the fact that the official chain of forecasting data starts from the top of the social pyramid (the National Civil Protection) and does not reach the bottom (the citizens) because it generally stops at the level of municipalities (majors).

Contribution to social capacity building:

The fact that citizens are not the receivers of sound and accurate meteorological information about hazards puts them in a position of vulnerability. The operators are warned by national civil service or by the ARPAs, but sometimes the population has been completely unaware of the imminent flood (see floods in Piedmont, 1994). The population is not always directly addressed and promptly informed (through radio or

TV) about the critical meteorological conditions and about the simple behaviours that could save life or property. Without this approach, the intervention of civil protection runs the risk of being a last minute effort to save survivors, when it could be a coordinated effort which works with citizens to reduce the damages.

Communication/social vulnerability:

National setting: The practice embodies national practice.

General reflection: The description of the practice is based on an interview with Dr Luca Mercalli, the Head of the Italian Meteorological Society. Critical remarks derive from his work experiences and expertise in the field of meteorological forecasting. The Nimbus Journal of the Italian Meteorological Society has also been consulted, as well as the website of National Civil Protection and the “Ecosistema Rischio 2008” report by Legambiente and Civil Protection on the actions taken by Italian municipalities to prevent and act during hydro-geological hazards. (http://www.legambiente.eu/documenti/2008/0923_operazione_fiumi/Ecosistema_Rischio_2008.pdf).

Practice #21 (by Corina Höppner)

Title/location/time: Etsch-Dialog, South Tyrol, Italy. www.etschdialog.it

Type of hazards and the risks involved: Flooding and debris flows in built-up areas and residential areas.

Position in the risk cycle and measures: Planning of structural and non-structural prevention measures. More specifically, the aim is to come up with a development plan for the region ‘Oberer Vinschgau’ consisting of 6 municipalities. This plan should integrate spatial development, local land use, water resource management, water power issues, flood protection, ecology and life quality aspects.

Purposes/functions of communication, content of communication and specific challenges/difficulties: 1) To facilitate mutual exchange and dialogue between authorities, stakeholders and experts to jointly plan future developments and to promote acceptance for measures. Consulting stakeholders’ opinions, needs and knowledge. Facilitating participation in decision-making and increasing the knowledge of stakeholders on local technical issues. 2) With respect to the general public in the 6 involved municipalities: To trigger awareness and interest in natural hazard protection and their physical everyday landscape and its development in general. Information on the project, progress, floods, protection measures, ecology etc. is disseminated.

Actors in communication: 1) Communication between 50 to 60 representatives from around 45 organisations, interest groups, province authorities, and technical experts. 2) From authorities and project leaders and a pr-agency to the general public in 6 municipalities.

Communication tools, channels and time dimension of communication: 1) To involve stakeholders: 8 Flussraumforen (Riverfora) were held between April 2008 and April 2010 (between half a day and a full day) and were attended by an average of 50 stakeholders. Plenary discussions, presentations and some group discussions were the formats used in the Riverfora. There were also field trips for stakeholders. 2) To the public: Information folders for households, evening events with presentations and podium discussions, Web homepage in 3 languages, information stations with documentary movie and slides in all municipalities, Fluss-Bus (River-Bus) for school children, Fest am Fluss (River party) with miniature protection structures, and an exhibition touring through the municipalities. Continuous work with the media (local, regional) through press releases and ‘Kamingespräche’ (fireplace chats).

Appraisal of good and/or poor aspects of practice: There was a two-fold communication strategy (informing the general public and the interactive involvement of stakeholders) from the outset of the project. The information for the public was extensive, continuous, and professionally developed by a pr-agency. It combined a number of communication channels and tools. Interestingly, they replaced the word ‘hazard’ and its negative emotional connotations with a more positive language and the word ‘safety’. They did not, however, communicate total safety but acknowledged limits and residual risks. Communication of natural hazards was combined with information on other local/regional issues to make people curious and engage them with the development of their landscape. With respect to the River-Fora, the chance to actually influence final decisions and developments was clearly communicated from the beginning. It should be noted that at the beginning of the process stakeholders requested that, within the Flussraum, plans must not be prepared for the single property level as they could not yet represent every single property owner. Interest and commitment to attend stayed high throughout the 2 years. After each meeting the media was informed of the results.

Contribution to social capacity building: Although not empirically evaluated, the River-Fora as a regular platform has arguably facilitated the exchange and networking between stakeholders, authorities, municipal bodies and experts. It seems that the project has had a lasting effect on their relationships beyond the planning phase as stakeholders have committed to meet in the future, to establish working groups and thus to cooperate in the implementation of measures. Stakeholders had two years to learn about each

other's opinions and to learn in exchange with scientists. They might also have practiced their abilities to speak out in plenary discussions and to engage in group discussions, which was a new skill for some of them. The practice might also increase awareness of, interest in, and knowledge about issues concerning the spatial development of the area among the general public.

Relationship to social vulnerability: There is the idea to establish a 'Grundstücksbörse' (property exchange market to gather the land for measures without compromising the owners, financially or otherwise). The project potentially helps municipalities to enter into a dialogue with the water industry to negotiate for a share of the industry's profits. The prospective protection measures are expected to reduce the vulnerability of the municipalities to hazard events.

National setting: With this project the province implements the EU Water Framework Directive. For the first two years it hence receives financial support from the EU. There are similar projects underway in Southern Tyrol, e.g. 'StadtLandFluss' in Brixen (www.stadtlandfluss.it), the River Passer/Meran and the River Drau (www.prodrau.it).

General reflection: The project has not been evaluated with respect to the purposes of communication and capacity building. The description is based on personal communication with 3 project experts and on very detailed documentations of the project and of the communication efforts (www.etschdialog.it).



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Practice #22 (by Chiara Bianchizza and Anna Scolobig)

Location/time frame: Alba municipality, Piedmont region, North-western Italy. From 2002 onwards

Hazards/risks involved: Floods. In November 1994, Northern Italy was affected by heavy rainfall episodes in rapid succession. The region of Piedmont and especially the provinces of Alessandria, Cuneo and Asti were severely damaged by the floods that followed as a consequence. Alba, a municipality of the province of Cuneo, was no exception. The town was taken by surprise by the massive floods and this resulted in human casualties and material losses.

Position within risk cycle: Prevention/preparation, non-structural measures

1. Emergency training (for both citizens and schools)
2. Information
3. Planning and implementation of land-use/environmental planning

Purpose/function/content, main challenges and tools

3 main streams have been chosen to exemplify changing tendencies in this town since the events of 1994.

1. Emergency training to trigger specific emergency behaviours: After the flood of 1994, it was very difficult to talk to the population about emergency training, in case of a similar event. The episode had shocked people, who refused to talk about it and were mainly concerned with the reconstruction of their houses

and their lives. Only in 2002 was it possible for the municipality branch of the civil protection to organize an emergency simulation. This was done through the involvement of neighborhood committees (comitati di quartiere) of the most affected areas during the flood of 1994. These committees, formed by representatives of the neighborhoods, were convinced of the need to 'prepare' in case of another such emergency and agreed to spread the idea among the rest of the population. This, and an invitation letter sent to each household by the mayor, allowed for the preventive initiatives to take place. Two meetings were organized, during which the population was presented with an explanation of the hydro-geologic situation of the area. After these two introductory meetings, an evacuation simulation took place. This also involved the main industry in the area (Ferrero) that supported the organization of the preparatory meetings. Signs were placed in the neighborhood to indicate the nearest meeting points in case of emergency, where all the population gathered. The event involved the participation of the whole neighborhood and was appreciated as a good method of learning how to behave during an emergency. The high level of participation was determined by the involvement of the neighborhood committees, whose members got directly in contact with citizens, and also by the coincidence of a plane crash against a building in Milan, happening at the same time, which increased people's willingness to learn about preparation measures. Due to the huge amount of time and resources needed for this simulation, since 2002 it has not been possible to organize another such event. However, the municipality's civil protection recognizes that the memory needs to be kept alive, so that past experiences can help improve behaviors in the future. Evacuation simulations have been organized in the schools of the municipality, so as to keep the younger population aware and informed.

2. Information to facilitate better decisions through the meteorological bulletin: In 1994, when the constant, heavy rainfall caused such damage to the population and human settlements in Piedmont, the local municipalities were taken by surprise. The exceptional precipitation was observed as an unusual phenomenon, but it was not expected to cause the major floods that affected the area. This happened because no specific meteorological forecast was available for the municipality.

Since 1994 things have changed, thanks to the establishment of local functional units of civil protection for each municipality of the region. Furthermore, an effective communication tool was established, to connect the Regional Agency for Environmental Protection (hereafter ARPA) (created with the regional law 60/1995) and the local units of civil protection. This consists of several updated bulletins that are sent out from the ARPA to the local units of civil protection (hereafter CPU), containing area-specific information, different alarm codes according to the expected potential threat represented by a certain meteorological event and potential scenarios of development if no action is taken. Based on this information, the CPU can make informed decisions on how to act.

Communication and prevention are activities that the law 225 /1992 assigns to the competence of the Civil protection (article 3). However, even if this is the legal distribution of responsibility in hazard management, the case of the 1994 Piedmont flood shows not only that rules and norms have to be settled by law, but also that the tools need to be in place to allow such actions to take place. Neither the local functional units of civil protection nor the ARPA existed in Piedmont in 1994 and the municipality did not have any tools to foresee the potential development of the heavy rainfall. Only after the creation of these new local actors and tools for hazard management, were the conditions ready to allow for:

1. A flow of constantly updated meteorological information from scientists (meteorologists) to operators (civil protection units);
2. Local operators to be prepared, so as to understand such data and act accordingly.
3. Raised risk awareness and the facilitation of participation in land-use and environmental planning: In the year 2004/2005, the high school of Alba (Liceo scientifico) has been involved in a project called "L'acqua della collina" (the water of the hill), to study the minor rivers and the specific hydro-geological structure of the area. The study has then been published in the local magazine and spread through the local press, to be made available to all the citizens. A pilot project, involving secondary schools of the municipality, is now in preparation. This project will focus on hydro-geological risk. After the identification, done by the municipality together with the 'comitati di quartiere', of the risky areas, the work with the students will be aimed at defining more accurate maps for planning activities in the town.

Actors involved:

1. Civil protection and population
2. Regional Agency for Environmental Protection and Civil Protection Units
3. Institutions, school students and citizens

Good/poor aspects of practice:

Currently, the municipality of Alba is recognized as an example of risk communication strategies that involve the civil protection, citizens, students, journalists and local authorities. The municipality of Alba designed an integrated approach to risk communication. However, it can be observed that the evacuation simulation for the population took place only in 2002, due to the high costs and need for time and energy

to be invested in such a practice. It is recognized by the responsible authorities for civil protection in the municipality that such practice should be more frequent, in order to be really effective.

Contribution to social capacity building:

The participatory process that saw the students working together with the local administration for the development of research on the hydro-geological situation of the area increased the understanding of the importance of an informed environmental management system to prevent natural hazards. The exchange of knowledge (human capital) and the creation of social networks (social capital) between schools and institutions could enhance the social resilience of the community in the future.

Communication/social vulnerability:

Potentially, the constant communication of meteorological data helps the authorities to prepare in advance and to take the adequate steps to warn the population, evacuate areas etc. Citizens have been made aware of the danger involved in certain behaviours and the benefit of other actions. They therefore have gained awareness of how to manage an emergency situation. It has contributed to raising awareness in the population on the specificity of their territory and has helped people's environmental management of their own properties.

National setting: As the ARPA system and the management of civil protection units is left to the regions, the system does not have a uniform identity in the whole State. Furthermore, differences are even greater from region to region, province to province and municipality to municipality, as majors are the first responsible authorities for civil protection. The practices of risk communication in Alba have been underlined as an example of a good, constant work in progress by Prof. Roberto Cavallo, President of the International Association for Environmental Communication (AICA- www.assaica.org) and of the Cooperative of Environmental Education, Research, Information and Communication (ERICA – www.cooperica.it). Prof. Cavallo stresses the fact that such practices are significantly different from mainstream practice in Italy, where only 57% of the municipalities that have an emergency plan in case of natural hazard update this plan and share it with the citizens (source of these data: "Ecosistema Rischio 2008", a report of Legambiente (a national environmental association) and the Civil Protection on the state of Italian municipalities in terms of prevention and emergency plans. http://www.legambiente.eu/documenti/2008/0923_operazione_fiumi/Ecosistema_Rischio_2008.pdf).

General consideration: Laura Campigotto, responsible for Environment and Civil Protection in the municipality of Alba, feels that a lot has been done on awareness raising among the population, but also acknowledges that more work needs to be done in the field of risk communication. New initiatives are thus now being piloted, such as the project with the secondary schools for a new urban planning map, and the idea of neighbourhood teams of "citizens' civil protection" is being evaluated. Overall, the work done by the municipality is a good example of a long term practice of risk communication that involves different actors and sectors of the population in a collective effort. The potential impacts of these activities on the reduction of social vulnerability and on capacity building, listed in the previous paragraphs, will only be possible to evaluate in the long run.

Practice #23 (by Anna Scolobig)

Title/location/time: A case study of stakeholders' participation in dissemination activities/ Malborghetto-Valbruna (Valcanale valley, Friuli Venezia Giulia region, North eastern Italy)/ 2008

Type of hazards and the risks involved: Flash floods and debris flows in an Alpine area. The communication activities relate to a severe flash flood which hit the municipality of Malborghetto-Valbruna on the 29th of August 2003

Position in the risk cycle and measures: Prevention and implementation of new structural and non structural mitigation measures after the event to prevent future damage.

Purposes/functions of communication:

- to inform local stakeholders about: i) the future projects for risk mitigation and management (structural and non structural risk mitigation measures); ii) the activities undertaken by local authorities during the reconstruction phase; iii) the damage evaluation and the distribution of compensation payments;
- presenting data, information, images and videos of the 2003 event
- to preserve the historical memory of the event

Actors in communication: the municipality of Malborghetto-Valbruna, the Videomante NGO (producer of documentaries), residents, local services and agencies (regional and municipal civil protection services, voluntary fire brigades corps, environmental protection service etc.). The main target of the communication activities were local residents, services and agencies and also voluntary associations dealing with disaster relief.

Communication tools, channels and time dimension of communication: Public hearings and meetings, a DVD with documentary footage, video-interviews, images and texts about the event. The DVD is a

production of the municipality of Malborghetto-Valbruna, made by the Videomante NGO in the year 2008. The DVD is entitled 'The flood: Five years later' and its content is divided into 4 main sections: 1. Documentary footage based on video-interviews with the mayor, the heads of the municipal civil protection services, regional civil protection services, municipal and regional fire brigades; residents (subsections: event, causes, church and bell tower, help and support, reconstruction); 2. Images, collected by the regional civil protection service, municipal offices and authorities, the documentary centre of the provincial fire brigades, photographers and journalists (subsections: the flood, damages, help and support, the territory, protection and mitigation measures); 3. 'The Flood in Figures' (Power Point Presentation/ subsections: characteristics of the event, damages, by-laws after the event, flood office, compensation payments, municipal, regional and national interventions and contributions); 4. 'The Destruction and the Rehabilitation' (text), (subsections: the event, the reconstruction). [more info: www.videomante.it; www.malborghetto-valbruna.com]

Appraisal of good and/or poor aspects of the practice: The mayor of Malborghetto-Valbruna decided to undertake these communication activities also because of conflicts arising in the reconstruction phase. Some residents were claiming that the local authorities had not consulted the relevant interest-groups during the decision making process. They contested the decisions about the localisation and the quantity of structural devices based on equity claims about hydro-geological risk distribution among residents. Other conflicts which arose included disagreements among local people about the reconstruction process and the distribution of compensation payments. The requests of some residents were taken into account by the municipality. More precisely, a group of residents concerned with the safety of their properties established a Local Committee for Safety and demanded the construction of new hydraulic works to ensure more protection. The regional Civil Protection joined the Local Committee for Safety in their claims to the municipal authorities and built up the new structural devices.

Contribution to social capacity building: The communication activities undertaken increased residents' risk awareness, transparency about both the distribution of compensation payments and the decisions about new protection measures, and information about the reconstruction process. A main aspect of the communication process was the learning about the new structural and non structural risk mitigation measures. The dialogue between the stakeholders involved in the process enhanced mutual understanding and knowledge exchange.

Relationship with social vulnerability: There were no specific communication activities explicitly aimed at reducing social vulnerability.

National setting: Communication activities in this case differed from mainstream practices in the country mainly in terms of the intensity and length of the communication process (2003-2008). In particular, the idea of systematically collecting information to preserve the historical memory of the event (e.g. through the DVD) filmed immediately afterwards does not represent a common practice.

General consideration: The communication process has not been evaluated so far. The description of the practice is based on interviews with local stakeholders.

Practice #24 (by Anna Scolobig)

Title/location/time: Communication activities to discuss and decide about different flood mitigation and river management alternatives with the local population of Vipiteno-Sterzing and Val di Vizze - (two medium-sized towns at the confluence of the Rio Ridanna/Ridnaunerbach Torrent with the Isarco/Eisack River, near the border with Austria Trentino Alto Adige Region, Northern Italy)/ 2008-2010

Type of hazards and the risks involved: Flood (30 year return period) - Risk analysis and assessment reveal that the two towns, and especially Vipiteno/Sterzing, are highly at risk from flooding, as confirmed also by the results of an INTERREG project (INTERREG IIIB Alpine Space Programme <http://www.flussraumagenda.de>; may 2003-February 2006)

Position in the risk cycle and measures: Prevention/preparation, planning of structural and non-structural flood mitigation measures.

Purposes/functions of communication: Vipiteno/Sterzing and Val di Vizze have often been flooded in recent years (1998, 1997), but without severe consequences. Major events happened in 1956 and 1987. Local authorities are convinced that the local population is not aware about the risk and this increases their worries regarding future events. The two municipalities together with the provincial services in charge of risk mitigation started a process to discuss and decide about different flood mitigation and river management alternatives with the local population (<http://www.hochwasserschutzsterzing.it/>). The purposes of communication may be synthesized as follows: Raise residents' risk awareness; Facilitate mutual exchange/understanding between local authorities and population; improve relationships and coordination (build mutual trust and cooperation); facilitate participation in decision making; choose an alternative for risk mitigation which does not encounter residents' opposition.

Communication tools, channels and time dimension of communication: Public meetings, face-to-face information involving stakeholders, provision of written information (concepts, plans). The whole communication process lasted nearly 2 years.

The process has been articulated in several phases, including meetings with the residents aimed at collecting their opinions and observations about the alternatives for flood mitigation. At the beginning of the process three alternatives have been presented together with the criteria (e.g. total cost, ecological impact, building constraints, etc.) to evaluate them. Environmental protection, leisure activities along the river, socio-economic and touristic development have also been considered in the design of each alternative. Thanks to the observations of the residents, a fourth alternative has been singled out, which represents a compromise between medium-high safety standards and economic development needs. The municipal councils of Vipiteno/Sterzing and Val di Vizze, together with the Flussraumforum Alto Isarco/Eisack voted in favour of the fourth alternative and implemented it. The project based on this alternative will be financed by the European Fund for Regional Development (Programma Operativo "Competitività Regionale ed Occupazione FESR 2007 – 2013).

Appraisal of good and/or poor aspects of practice: Local stakeholders were actively involved in the decisions about flood mitigation and river management alternatives. Their concerns and requests were taken into account and their suggestions and observations allowed the identification of a new alternative. This may be considered a good example of communication in public participation processes.

Contribution to social capacity building: The communication activities organized during the process contributed to raising local stakeholders' and residents' risk awareness. It seems quite interesting that a mutual learning process took place: local authorities were open to residents' criticism and their proposals. The bottom up approach adopted for the participatory process favored the creation of an open dialogue among the various stakeholders involved.

Relationship with social vulnerability: There were no specific communication activities explicitly aimed at reducing social vulnerability. Of course raising residents' risk awareness and involving them in the decisions about the mitigation measures to be adopted along the entire river represent a contribution to reducing community vulnerability.

National setting: Public participation processes to decide about risk mitigation measures are not the mainstream in Italy, especially with regard to natural hazards.

General consideration: The communication process has not been evaluated so far. The description of the practice is based on an interview with an officer of the Hydraulic Protection Works Service of the province of Bolzano/Bozen who was involved in the organisation of the process, as well as information from the website <http://www.hochwasserschutzsterzing.it/>.

Practice #25 (by Teun Terpstra)

Title and location: National risk communication campaigns in the Netherlands.

Type of hazards and the risks involved: Floods.

Position in the risk cycle: Prevention/preparation. Structural and non-structural measures.

Purposes/functions of communication: 'The Netherlands lives with water': The campaign is targeted on gaining acceptance for structural measures such as beach nourishment, making space for rivers, etc, but also informs about water quality and the daily use of water for different purposes. <http://www.nederlandleeftmetwater.nl/> The campaign 'Think Ahead' aims at raising awareness for risks in general (an all-hazard approach including floods) and motivates general preparedness among citizens (e.g., to adopt an emergency kit) <http://denkvooruit.nl/>. Both campaigns have also local counterparts (initiative of local authorities).

Actors in communication: National authorities to the public at national level.

Communication tools, channels and time dimension of communication: Mainly radio, television, and internet. The 'Netherlands lives with water' campaign is ongoing and changes its focus periodically to address different topics in water management. The 'Think Ahead' campaign is ongoing on the Internet, but on radio and television the campaign is intensified during November (usually).

Appraisal of good and/or poor aspects of practice: The campaigns draw attention to water management and preparedness, but little effects on citizens' attitudes and behaviour are found. 'The Netherlands lives with water' campaign gives only very general recommendations which may or may not apply to specific local contexts. A positive aspect is the usage of a range of channels and tools such as the radio, tv, newsletter, information booklets and events and a website.

Contribution to social capacity building: These campaigns could help people coping with natural and manmade hazards in the Netherlands, but adjustments are necessary to increase their effectiveness.

Relationship to social vulnerability: Not known.

ES DE MAOS OETKUMP....

ALS DE MAAS BEGINT TE STIJGEN.....

Instructiefolder

Wat moet u doen als het water van de Maas begint te stijgen

Actiepunten en maatregelen bij hoge waterstanden

BEWAARBOEKJE

National setting: These are ongoing campaigns at the national level. At the local level there are other good practices such as the “Es de Moas utkomp...” (when the Meuse rises). It is a brochure that explains what to do in case of imminent flooding of the Meuse river. Local television also broadcasts the information on a yearly basis to keep people aware and informed. The brochure is well tailored to the local situation. The general message to the public is “... when we give the sign, you need to leave, or you are on your own”. The message may sound a bit rude, but it is very clear on what people need to do in case of a threat. Vulnerable people (e.g. the elderly or people who need extra or daily care) are helped by activating local social networks (e.g., neighbourhoods and local representatives).

The EU floods directive will be the most important legal requirement with respect to risk communication. The Seveso II directive (<http://ec.europa.eu/environment/seveso/index.htm>) on industrial safety already requires that municipalities inform their citizens about safety risks. In the Netherlands the www.risicokaart.nl (risk maps) has been produced to meet public information requirements. Flood risks are now also being included.

General reflection: The description is based on the campaign materials, the results of a PhD thesis (Terpstra 2009) and the final report to the INTERREG IIB project SAFECOAST (Knolle et al. 2007).

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Practice #26 (by Michael Bründl)

Title/location/time: Åknes rock slope early warning system, Western Norway, permanently.

Type of hazards and the risks involved: Rock fall with an estimated volume of up to 70 million m³, and moving rates of 8 – 15 cm / year potentially initiating tsunamis in a fjord with high damage potential. Risk to persons, buildings, infrastructure and traffic connections including tourist boats to Geirangerfjord. At certain locations, like e.g. Hellesylt, the run-up height of the tsunami wave is expected to reach 25 to 35 m above sea level.

Position in the risk cycle and measures: Non structural measures, warning system

Purposes/functions of communication: The Åknes rock slope poses a severe threat for the people living in the inner Storfjord region, which includes Tafjord, Norddals fjord, Sunnylvsfjord and Geirangerfjord in Western Norway. A highly sophisticated monitoring system has been established for several years which has been further developed to an early warning system at the Åknes-Tafjord early warning centre at Stranda. In 2007 a workshop with an interdisciplinary group including experts, the manager for the Åknes/Tafjord project, the mayor, a social scientist and the city planner of the community, the policeman working on emergency plans and evacuation, local politicians, a representative from the community office etc. was conducted. This workshop aimed at: (1) bringing all stakeholders into the discussion of hazard and risk at Åknes, (2) reaching a consensus on the hazard and risk associated with a rockslide triggered-tsunami, (3) discussing and evaluating mitigation measures, and (4) experimenting with an event-tree-analysis (ETA) as a communication tool. The early warning system is based on five defined alarm thresholds (green – blue – yellow – orange – red) defined by the criteria of total displacement, velocity in defined time periods, and acceleration of the rock. For each of the alarm levels the tasks of experts and the information given to the public is defined. At “yellow” the general public is informed directly, from “orange” onwards people are evacuated. The public were informed about the system in several meetings in the villages.

Actors in communication: Warning experts, local communal authorities and the affected population.

Communication tools: Website www.aknes-tafjord.no, public meetings, newspapers, television, radio, training exercises (among them, one involving all four municipalities). The warning system itself consists of 26 sirens with sound signals and messages given in Norwegian, English, and German and automatic

phone calls to all registered phones. A system, which generates phone messages to all mobile phones located inside a defined geographic area, is under development.

Time dimension of communication: The system has been operating for several years.

Appraisal of good and/or poor aspects of practice: Experiences during training exercises revealed weak points, which were addressed afterwards. People are sensitized about the hazard. Large efforts were made in creating confidence for the warning system. A real-case test has never happened so far.

Contribution to social capacity building: An intense communication and information campaign as well as training exercises has increased social capacity.

Relationship to social vulnerability: The hazard cannot be eliminated by the warning system. However, social vulnerability could be considerably reduced.

National setting: The system is well known at the national and international level but is only locally relevant.

General reflection:

Practice #27 (by Jarek Dzialek)

Title/location/time: IMGW (Polish Institute of Meteorology and Water Management) forecast and warning system/Poland/continuous. www.imgw.pl

Type of hazards and the risks involved: 16 categories of hazards, eg. strong winds, heavy rainfall, heavy snowfall, snowstorms, heavy fog, meltwaters, heat, frost, thunderstorms, hailstorms, etc.

Position in the risk cycle and measures: Warning

Purposes/functions of communication; content of communication and specific challenges/difficulties: To alert services and people at-risk about the risk and its possible consequences

Actors in communication: IMGW (Polish Institute of Meteorology and Water Management) to government, local governments (risk management centers), water management bodies, mass media, people at-risk (via Internet, media and local authorities communication)

Communication tools, channels and time dimension of communication: Information about meteorological and hydrological warnings is continuously issued and published on-line on the IMGW dedicated site <http://www.pogodynka.pl/>. It provides information about the nature of risk, areas/regions that could be affected and its estimated size on a three-point scale. IMGW distributes messages to the media, but there are no clear rules as to whether the information about risks should be always transmitted further to citizens. IMGW warnings are mainly a source of knowledge for the regional and local risk management centers, that are responsible for handling the situation in affected areas, and thus for further communication with the local population.

Appraisal of good or/and poor aspects of practice: The warning system is generally a well designed tool with a complex classification, but it is used mostly in communication between IMGW and government, and regional and local authorities. Although the warnings are available online to the general public, there was no nation-wide information campaign about the site that could explain the meaning of each category and scale of risk and build knowledge about the proper response to each of them. During the 2010 flood there were reports of a failure in communication between IMGW and the government. There was also a debate as to whether the same scale should be used for various hazards, that may bring different consequences (eg. heavy fog and heavy rainfall). Another issue of debate was whether warnings with the highest 3-point alerts may have been issued too often and thus have weakened vigilance.

Contribution to social capacity building: It provides useful information, but no further knowledge on how to behave when confronted with various risks

Relationship to social vulnerability: The internet was not available to 42 per cent of the Polish population (according to 2009 data), so online communication may increase vulnerability, especially in the countryside.

National setting: This warning system is the only one nation-wide risk communication tool in Poland.

Practice #28 (by Wojciech Biernacki)

Title/location/time: Flood Prevention Coordination and Information Centre/ Poland

Type of hazards and the risks involved: Floods, droughts

Position in the risk cycle and measures: Preparation

Purposes/functions of communication; content of communication and specific challenges/difficulties: to build up knowledge on risks and inform on how to behave during events

Actors in communication: specialized water management agencies in Poland, Internet users

Communication tools, channels and time dimension of communication:

Information about current water levels in Polish rivers and water basins is continuously published on websites, along with educational materials with practical advice on how to act during or after floods. Materials to be used by teachers can also be found on the websites.

Appraisal of good or/and poor aspects of practice: Although the agencies gather experience and initiate preparation of useful materials and catalogues which are later accessible for free, they do not distribute information actively. Their websites are visited only by those who are interested in the subject matter.

Contribution to social capacity building: This practice is national and has an informational character. It does not have a direct impact on people's social capacity. However, information on how to act in case of risk which is found on the websites is referred to both individuals and communities.

Relationship to social vulnerability: Receivers of communication practice should mostly be adults as they have a real influence on reacting to danger. However, the fact that information is accessed mainly via the Internet reduces the target audience to mainly young people in towns and cities.

National setting: Flood Prevention Coordination and Information Centres play a significant role in informing and educating society as part of the National Water Management Governing Council in Poland.

Practice #29 (by Jarek Dzialek)

Title/location/time: Local Flood Protection System (Lokalny System Osłony Przeciwpowodziowej, LSOP) in Kłodzko valley, Kłodzko valley (SW Poland)/continuous

Type of hazards and the risks involved: (flash) floods

Position in the risk cycle and measures: Warning

Purposes/functions of communication; content of communication and specific challenges/difficulties: To inform and alert local authorities, firefighters and people in flood-prone areas about the flood risk

Actors in communication: Communication with local authorities, risk management centres, firefighters and local population

Communication tools, channels and time dimension of communication: The system was established in 2002 after the experience of the 1997 flood, when catastrophic flooding destroyed Kłodzko and other localities in the Kłodzko valley. The reason for establishing this service was that nationwide warning systems do not always provide appropriate information at the local scale, especially on flash flood risks. It automatically gathers water levels at 21 gauge points and the amount of rain in another 18 points every 15 minutes. It provides a visual representation of all information online <http://www.lsop.powiat.klodzko.pl> and alerts when necessary county and commune authorities, firefighters, etc.

Appraisal of good or/and poor aspects of practice: The LSOP system provides useful information in this flood-prone area, which wasn't available earlier. Although it was a separate project, it was accompanied in many cases with the establishment of evacuation plans in some of the communes (eg. Local Flood Damage Mitigation Plan in Gorzanów). Information about water level and rainfall is visualized with graphics, but it still seems to be still "too scientific" and difficult to apprehend.

Contribution to social capacity building: It provides useful information, but it needs to be complemented with continuous communication about how to prepare before and behave during the flash flood.

Relationship to social vulnerability: The internet was not available to 42 per cent of the Polish population (according to 2009 data), so online communication may increase social vulnerability.

National setting: This was a pilot project introduced after the 1997 flood, but it wasn't followed by similar solutions in other parts of the country. [more information in English available on http://www.apfm.info/pdf/pilot_projects/Flash_Floods_Poland_Pilot.pdf]

Practice #30 (by Wojciech Biernacki)

Title/location/time: Local Flood Damage Mitigation Plan in Gorzanów (SW Poland)/2008

Type of hazards and the risks involved: (Flash) floods

Position in the risk cycle and measures: Preparation

Purposes/functions of communication; content of communication and specific challenges/difficulties: to improve local authorities and citizens' preparation and to improve the reaction capacities of services

Actors in communication: planning team (Gorzanów village head, members of local associations, firefighters, local authorities, Polish Institute for Meteorology and Water Management employees)

Communication tools, channels and time dimension of communication:

Citizens' knowledge on flood prevention and preferred channels of communication were estimated using the results of a questionnaire survey. 1997-year-flood range maps were passed to schools, the community centre, and the local website and leaflet versions were distributed among citizens. School was used as a communication channel through the organization of special lectures and competitions. Teachers received carefully prepared educational materials.

Appraisal of good or/and poor aspects of practice: An evacuation and education plan was formulated thanks to societal consultations. However, the number of citizens actively taking part in this process was rather low especially among young people.

Contribution to social capacity building: The project contributed to knowledge building mostly by means of schools. Students became deliverers of information to their parents.

Relationship to social vulnerability: This program enabled the gathering of information about the best channels of communication with citizens and their needs at times of crisis.

National setting: This is a pilot project that is working out scenarios for dealing with floods with the help of local communities. Experiences gained in Gorzanów can be used in similar practices in other parts of the country.

Practice #31 (by Wojciech Biernacki)

Title/location/time: Reduction flood results and flood prevention local plan/Racibórz/ 1997-

Type of hazards and the risks involved: flood

Position in the risk cycle and measures: Warning, preparation

Purposes/functions of communication; content of communication and specific challenges/difficulties: To alert services and people at-risk about the risk and its possible consequences

Actors in communication: Communication with local authorities, risk management centres, firefighters and local population

Communication tools, channels and time dimension of communication: 11 electronic warning horns are installed on the flood plain of the town. Local media (radio and television) will complement the town alarm system in case of imminent danger. Evacuation maps were delivered to citizens in first-aid kits. Specially prepared illustrated cartoons were popularized among primary school pupils. 4 educational films about property protection and evacuation were produced and displayed to the public. A website dedicated to flood prevention and citizen protection is an essential part of the practice.

Appraisal of good or/and poor aspects of practice: Although experiences of risk communication in other flood-prone places were considered during the realisation of the project, there were no social consultations concerning which channels of communication citizens would prefer.

Contribution to social capacity building: As communication on flood risk is continuous, the results of local authorities' actions are much more significant than in the case of one-off actions.

Relationship to social vulnerability: This project decreases social vulnerability by adjusting channels of informing and educating society to the character of the community (for example, by using local television and radio to communicate with town citizens).

National setting: This plan is one of a number of attempts to implement continuous education and warning system in flood endangered areas. The project is still in progress. The 1997-year-flood was its main motive.

Practice #32 (by Alin Maghiar, Irina Stanciugelu and Iuliana Armas)

Title/location/time: "Be prepared. We are" National Awareness Campaign regarding flooding risk/ Romania/ 22-26 September 2008, RO Phare 2005/017-690.01.04 Contributions to Establishment of Local and Regional Administrations for Disaster Management

Type of hazards and the risks involved: Floods. The campaign was a reaction to the massive floods of 2005 - 2006.

Position in the risk cycle and measures: Non-structural prevention/ preparation measures: risk information and emergency training.

Purposes/functions of communication; content of communication and specific challenges/difficulties: 1) Informing – to build up knowledge on flooding, on risks, and how to behave during events; 2) Communication to raise awareness, trigger protective behavior and facilitate training. The main message of the campaign was "All against floods".

Actors in communication: 1) Experts from the General Inspectorate of Emergency Situations and Technisches Hilfswerk to 3,100 students from 8 high schools (the main public of the campaign);

2) Experts from the General Inspectorate of Emergency Situations to high school students (30,000 students and to the general public through the distribution of leaflets)

Communication tools, channels and time dimension of communication: Website: www.fiiipregatit.ro, posters (25,000), leaflets (30,000), brochures (25,000), stickers (20,000), bracelets 3,500, banners (10), training events and courses on main high schools at national level, TV spot (at least 3 per day across 7 television channels at the national level between 1 September and 30 November 2008)

Appraisal of good and/or poor aspects of practice: Positive aspect: the focus on the high school population who could act as message transmitters also to their families and peers; The TV spots have been transmitted with the recommendation of the National Audiovisual Council of Romania as a social campaign, without supplementary costs; the campaign also offered preparation and emergency training.

Contribution to social capacity building: Depends on personal interest and motivation and the need of individuals to learn about flooding and the protective measures; builds up knowledge on how to behave

when a flood hits, and increases information about the Voluntary Based national emergency management system.

National setting: The campaign has been implemented in partnership with the Ministry of Internal Affairs and Administrative Reform, the Ministry of Education and Research, the Romania Rugby Federation, and NGO "O sansa in plus", the National System for One Emergency Calling 112. There have been campaigns before but less complex ones, i.e. mere information campaigns that used flyers or transmitted preparedness information through schools of different grades. Currently this is the only campaign on natural hazards due to a lack of funding.

General reflection: The description is based on investigations done by Captain Alin Maghiar, Director of Communication and Public Relations Department, General Inspectorate for Emergency Situations Romania, Dr. Irina Stanciugelu, NATO civil expert on risk and crisis communication, Prof univ dr. Iuliana Armas, Faculty of Geography, University of Bucharest Romania. The campaign has been evaluated. It was found that the goals have been achieved, as more high school students have been prepared using the materials of the campaign; (the initial target public was 3000 students; the final one 30,000) - there have been preparedness hours in many high schools of the country; every county Inspectorate of Emergency Situations had an agreement with the corresponding county School Inspectorate that preparedness hours had to be kept using the printed materials of the campaign. Also, it was a good opportunity to transmit information about the 112 system and local voluntaries system.

Practice #33 (by Jelena Čalić and Marko V. Milošević)

Title/location/time: Jagodina municipality, central Serbia / continuous in more than one century

Type of hazards and the risks involved: Landslides

Position in the risk cycle and measures: General prevention, non-institutional measures, non-structural measures.

Purposes/functions of communication; content of communication and specific challenges/ difficulties: Perception of risks, mutual exchange of knowledge, facilitation of decision-making. The analysis of toponymes in the territory of Jagodina municipality has shown multiple occurrences of the word (name) Urvina. In the regional dialect, this word means "landslide". The toponyme undoubtedly indicates the activity of the sliding process in these localities. What determined the inhabitants to call these places by this name, is the presence of continuous awareness of landslide activity. This form of non-institutional "monitoring" dates back longer than any institutional measure in Serbia.

Actors in communication: local population (directly among themselves), decision-makers, geo-engineers (indirectly).

Communication tools, channels and time dimension of communication: Verbal communication among the population, from one generation to another. Written communication: topographical maps in the scale 1:25.000 and 1:50.000 contain precisely located toponymes indicating the areas prone to landslides. Time dimension: ongoing.

Appraisal of good or/and poor aspects of practice: The good aspects are obvious – spontaneous, unplanned communication can sometimes have even more efficient results than institutional measures. One of the rare poor aspects is that the word "urvina" is known only regionally, so the geo-engineers and decision-makers (e.g. planners) who come from other areas are sometimes unaware of the useful information offered within the common topographical maps.

Contribution to social capacity building: Raising awareness about the areas which are susceptible to landslides. This indicates that these are the areas where investments and building activities should not be planned.

Relationship to social vulnerability: In this case, the most socially vulnerable group are the people who own land in these localities. Due to landsliding (and continuous awareness of this process regardless of stability periods!), the land value is extremely diminished.

National setting: non-institutional

General reflection: The effects of the practice have been generally positive. Over the centuries, these areas have been used only as pastures. In spite of the fact that in some cases there have been several decades of slope stability, the localities have nonetheless remained without any buildings, thanks to the fact that landslide awareness has been communicated among the people.

Practice #34 (by Jelena Čalić and Marko V. Milošević)

Title/location/time: Potential landslide Ravno Buče, Trgovište municipality, SE Serbia / May-June 2010

Type of hazards and the risks involved: Landslide which could potentially dam the Tripušnica River; threat of natural dam breaching and outburst flood in the downstream settlement of Trgovište and several other settlements

Position in the risk cycle and measures: Prevention/preparation and warning: a) structural measures: building of the artificial dam which would buffer the possible outburst effect (i.e. prevention of the actual event); b) non-structural measures: intensive monitoring of precipitation, regular geodetic measurements of landslide movement, evacuation plan for Trgovište (i.e. prevention of human casualties in case the flood strikes).

Purposes/functions of communication; content of communication and specific challenges/difficulties: Information on the nature of the hazard, calculated risks and performed measures. Announcing the spatial extent of the possible flood. Instructions on how to behave.

Actors in communication: Sector on Emergency Management (highest national body in this field), local authorities and members of the public.

5a) **Communication tools, channels and time dimension of communication:** Direct contact of officials with local inhabitants, leaflets with evacuation plan. The plan allows for the use of a public siren which is sounded for general danger (in case of the worst case scenario occurring), and indicates exact buildings that should be used as shelters (e.g. the local Primary school). Time dimension: one-off activity.

Appraisal of good or/and poor aspects of practice: This is an example of good practice, which puts the priority on prevention, and takes into account both structural and non-structural measures.

Contribution to social capacity building: Awareness of natural hazards in general, as well as of particular hazards in the area. Consideration of the evacuation plan will help with preparedness for other possible cases in future. Awareness that there is the national-level body which takes care of these issues (which was not the case previously).

Relationship to social vulnerability: Face-to-face contact of emergency officials with the local population enabled remote inhabitants (a vulnerable group) to be appropriately informed. This group otherwise struggles to find out about the evacuation plan (e.g. they do not have mobile phone signal, rarely come to the municipal centre and are not in a position to come across the leaflets, etc.). Their vulnerability has therefore been reduced.

National setting: In Serbia, the particular Law on Emergency Situations was only adopted in December 2009. This is therefore one of the first practices organized in accordance with this Law, and one of its first concrete implementations. The Law has established the Sector on Emergency Management, which is the highest national body in the field of emergency situations, organized within the Ministry of the Interior. Previously, the practices in this field were somehow chaotic, rare, and limited to post-event activities dealing only with the consequences of hazard events. The Law is actually the first legal act which gives an important role to risk education and risk communication. We will see in future how well this is implemented and whether it functions appropriately. The main kinds of hazards faced in Serbia are plain floods, flash floods, and landslides.

9a) **General reflection:** People are aware of possible outcomes. Fortunately, the direct threat has declined and there has been no need for evacuation (nor direct evaluation!). However, the infrastructure is prepared for possible cases in future. This description is based on official reports.

Practice #35 (by Corina Höppner)

Title/location/time: National awareness and information on disaster risk reduction, Administration of the Republic of Slovenia for Civil Protection and Disaster Relief, ongoing. www.sos112.si/eng/index.php

Type of hazards and the risks involved: Particularly earthquakes but also flash floods, avalanches and lightning.

Position in the risk cycle and measures: Prevention, implementation of non-structural measures and warning.

Purposes/functions of communication; content of communication and specific challenges/difficulties: Raising awareness, informing on how to behave before, during and after hazard events.

Actors in communication: National administration to the public.

Communication tools, channels and time dimension of communication: Leaflets and brochures to inform about hazards and on the measures that should be taken before, during and after a hazard event. Noteworthy is also the 'Psychological First Aid' leaflet. Procedures and behaviour advice are published on the home page. The public is notified by articles in the printed media and radio broadcasting. Educational activities are also organized for children. Warnings are published via teletext and a poster with graphics showing warning signals and directions is displayed in all multi-residential, public and business buildings. Urgent announcements are disseminated through national and local TV and radio stations. Educational spots for TV broadcasting are in preparation.

Appraisal of good and/or poor aspects of practice: The administration uses different communication channels and tools. Specific behaviour advice is given and attention is paid to the adverse psychological effects of events.

Contribution to social capacity building: Potentially raises awareness and builds knowledge on how to behave before, during and after an event. The practice might build the psychological capacities needed to cope with an event.

Relationship to social vulnerability: Actual and psychological vulnerability might be reduced.

National setting: The administration prepares the material that is used at the national and local level. The administration is responsible for all kinds of hazards. Natural hazards and particularly earthquakes seem to have a high profile.

General reflection: To our knowledge, the communication has not been evaluated with respect to its purposes and social capacity building. The description is based on a MONITOR project report (MONITOR 2008).



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Practice #36 (by Blaž Komac)

Title/location/time: The “Slano Blato” landslide, 2000/Lokavec, SW Slovenia/one event

Type of hazards and the risks involved: landslide (25 ha, triggered on 18.-19. November 2000, after a 100-year stable period) which endangered the nearby Lokavec village (near Ajdovščina in the Vipava valley)

Position in the risk cycle and measures: warning, structural measures

Purposes/functions of communication, content of communication and specific challenges: Communication about the risk to people.

Actors in communication: Government and Governmental-controlled offices, municipality, general public at local level

Communication tools, channels and time dimension of communication: risk map at the local level, TV (national channel), press (national and regional papers), village meetings.

Appraisal of good and/or poor aspects of practice:

At the end of 2000 a landslide was triggered by heavy and long-lasting precipitation. The moving material consisted of slope debris, accumulated below a steep limestone rock face and above the impermeable layers of flysch rocks. The result of this position is the appearance of numerous springs on the contact between the permeable limestone and the underlying rocks. Due to heavy precipitation the springs became active and the risen water table triggered landslides.

The event was expected since structural measures had already been built in the 1880s. The rapid response system was established in similar situations in Slovenia; the system relies on local units of the civil protection agency (Ministry of defence) working closely with local fire brigades and the municipality. The system is organized in a subsidiary manner.

During the first weeks the landslide movement was rather fast (up to 90 m per day). The main effort of the response teams was to observe the movements and to report about the possible need of safety measures. Public safety communications were issued daily, and before and during every heavy rainfall event in the later phases (a few times in the last ten years).

An accumulation reservoir was built in the lower part of the landslide to collect the material. After the landslide movements had slowed to a reasonable speed the material was transported a few kilometers to the bottom of the Vipava valley by trucks. The lower part of the stream which runs through the Lokavec village was reconstructed in order to increase its discharge capacity. In the last phase twelve 30m deep wells were built in the upper part of the landslip in order to collect ground water and divert it from the landslide (some of them were demolished by landslide movements later on). Houses at risk were protected by walls.

The communication to people relied on press conferences, meetings (of state representatives, the civil protection agency and construction experts) with the local people, and news in the media. The communication was top-down in style. Its aim was to direct the activities on the landslide and to talk with people to help them accept and understand the need for structural measures.

The biggest problems were:

- Unclear division of responsibilities between the municipality (major) and the municipality unit of the civil protection agency (representative of the Ministry of defense), which is responsible for safety measures, and the commission for natural hazards at the Ministry of Environment, which is responsible for construction measures;
- communication to people was limited to top-down communication (this is also influenced by the fact that all the work done on the landslide is done according to the State-plan; because of this the usual planning process where the municipality and local community are involved is over-run by the "will" of the state);
- people were not involved in the process of reconstruction (which cost about 8 million Euros in the last 10 years) with the exception of the organized common meetings, press releases and media reports;
- since 2001 a law has been implemented in Slovenia; it enabled reconstruction after big events like this one but also narrowed the communication channels to a top-down approach; therefore, the effectiveness of prevention is only measured by the amount of money put into structural measures while building social capacity does not seem an important issue.

Contribution to social capacity building: The social capacities were built on an informal level (people mostly accepted the construction and preventive measures) and the end result was rather well accepted due to increased communication efforts (press conferences before and after heavy rainfall; such as the one in November 2004).

Relationship to social vulnerability: Information was disseminated via different channels and tools.

National setting: The event has been constantly covered in all the national media.

General reflection: The event has not yet been evaluated with respect to its contribution to capacity building. More effort was made on the structural measures than on risk communication and risk education.

Practice #37 (by Blaž Komac)

Title/location/time: Landslide and debris flow, 2000/Log pod Mangartom, NW Slovenia/one event

Type of hazards and the risksinvolved: landslide, debris flow

Position in the risk cycle and measures: preparation measures and warning, structural reconstruction

Purposes/functions of communication, content of communication and specific challenges: Communication to trigger protective behaviour.

Actors in communication: Governmental-controlled offices, municipality, general public at local level

Communication tools, channels and time dimension of communication: risk map at the local level, TV (national channel), press (national and regional papers), village meetings.

Appraisal of good and/or poor aspects of practice:

From one point of view the debris flow was unexpected since nothing on this scale had happened in Slovenia in the recent decades. But it was expected on the other hand because it followed extensive precipitation events (3/4 of the average yearly precipitation was received in 3 months).

We can distinguish different levels of communication before (15. 11. 2000), during (17. 11. 2000), and after the event (until January 2001).

Before the debris flow which happened on Friday, November 17 (e.g. after the landslide movement on Wednesday, November 15), the rapid response system was established which is usual in situations like this in Slovenia; the system relies on local units of the civil protection agency (Ministry of defence) working in close connection with the local fire brigades. The system is organized in a subsidiary manner.

The fire brigades guarded the landslide site which was about 5 km above the village. The communication to people from the village was limited to informal channels, mostly through their involvement in the fire brigade (observing the level of water in the stream in the village), through local rumours and through visits from journalists asking questions. People from other places were informed about the landslide by the national media. During this time no one could really see the extent of the landslide since a large portion of its upper part was covered by clouds until Saturday (18. 11. 2000).

After 1.5 days the landslide liquified and the debris flow was triggered. Due to the large amount of precipitation a movement of the landslide was expected but not of such dimensions (700.000 m³) or rapidity (10 m/s). Therefore, during the first night some people were advised to move out of their homes by the local civil protection headquarters. Due to the TV communication (16. 11. 2000) which said that the situation had improved, several of the highly endangered people would not move out of their homes the next night. Here there was also a problem of responsibilities and a communication problem – no one was really in charge to communicate to people and to advise (or force) them out of their homes to safer places. People remember a woman's answer ("I am not afraid to die; I am old enough") to a journalist's question: "Will you move out tonight?"

The communication was stopped during the event since the power supply system was down. During the night (the debris flow happened at 00:05) people self-organized and moved to a safe place near the village. Only in the morning could they see the extent of the debris flow. The first news about it was communicated on the morning news on national radio.

People were told to leave; a guard was put on the road about 3 km from the village. In the first weeks access was limited. It was later allowed by special permissions issued by the municipality. People lived in a hotel in Bovec, 10 km from their village. From time to time a communication conference was organized; mainly people were told why they could not return.

During this phase the material was being removed from the river in order to make the water flow freely. This aspect of the recovery was publicly debated later since several building companies tried to get the business and there was a suspicion of corruption, confirmed by a report ordered by the Slovenian parliament; some people had to leave their position because of this.

The villagers finally returned to their homes after almost 3 months. During this time debris flow models had been developed; the results were communicated to people only in the form of a map (with no explanation) showing the location of houses in relation to the risk zones. For several months the landslide area was observed by guards until an alarm system was established on the remaining landslide material; people would have to move to a safe place after a signal was given communicating the landslide/debris flow movement. At the time of writing at least one false automatic communication/alarm has been triggered, thus reducing people's trust and probably influencing their future behaviour.

The reconstruction phase finished in 2010. It was led by the Ministry of environment. On one hand two bridges, several new houses and a new pipeline and sewage system were built. But on the other the process of reconstruction suffered from a lack of communication among the parties. People were more or less told about the reconstruction plans and they were not involved in the preparatory phase. Indeed some of them were actually told not to get involved in the process because all the responsibilities had already been arranged.

The biggest problems were:

- Unclear division of responsibility between the municipality (major), the civil protection agency (representative of the state), the role of the state commission for landslides, and the role of the local ad-hoc commission);
- communication to people was limited to top-down communication;
- the communication was limited to basic information, not speaking about all the aspects (e.g. the models presented were not discussed);
- the difficulty of communicating the risk by an automatic alarm system;
- people were not involved in the process of reconstruction with the exception of top-down organized common meetings.

Contribution to social capacity building: From an overall perspective knowledge capacities were built but, from the perspective of individuals, the cost of capacity building was rather high (learning by experience).

Relationship to social vulnerability: The bulletin and additional products are available in the three major languages spoken in Switzerland. Information is disseminated via different channels and tools.

National setting: The event was covered in all the national media; but the communication-related aspects have never really been discussed.

General reflection: Due to its severity (7 people died in a village with 150 inhabitants) and the involvement of several institutional and non-institutional societies, the event has not yet been evaluated with respect to its contribution to capacity building. We may conclude that although there were several improvements made regarding the structural safety measures in the village there was no real effort made on the non-structural measures, namely risk communication and risk education.

Practice #38 (by Meera Supramaniam)

Title/location/time: Action Plan to prevent the effects of a heat wave on health/Catalonia/Every year since the 2003 heat wave

Type of hazards and the risks involved: Heat waves with the risk of heat strokes, heat stress and premature death due to health complications of the unusually high heat

Position in the risk cycle and measures: Non-structural prevention/preparation measures and warning

Purposes/functions of communication; content of communication and specific challenges/difficulties: Limit and reduce the increased mortality associated with heatwaves, particularly among vulnerable groups, as well as coordinate resources in Catalonia to deal with a heatwave. The content mainly concerns how to protect oneself and the community, as well as vulnerable groups, though the information was stratified, with more detailed health mitigation based information being passed to health care providers and preventative information provided to municipalities.

Actors in communication: Coordination was handled by the Ministry of Public Health through two departments, the Directorate General for Public Health and The Catalan Health Service (CatSalut). There are 18 participant organizations identified within the plan, covering 4 ministries, the meteorological unit, emergency planning unit and emergency medical system of Catalonia, municipalities, hospitals and chemist associations, social services, the red cross and even the institute of legal medicine.

Communication tools, channels and time dimension of communication: Communication changes during the summer months from June to September, with preparatory informative leaflets given to the general public, hospitals, nursing homes and municipalities as well as employees. The leaflets cover precautions, symptoms and mitigation measures. A hotline was set up for queries by the public. During an alert, which is triggered by the meteorological department, the media is informed to then alert the public.

Appraisal of good and/or poor aspects of practice: The whole process has been reviewed every year and improved. The one in 2008 managed to limit the excess mortality to nil, though this would need to be cross-checked with the severity of the heatwave. However it doesn't create a two-way dialogue, and represents a typical top-down approach.

Contribution to social capacity building: Asks for community responsibility in looking out for one's neighbours, particularly the elderly, however the whole process does maintain capacity within the institutions and doesn't seem to promote transference.

Relationship to social vulnerability: Identifies vulnerable groups and targets them for communication and mitigation measures, very strong use of targeted communication and mitigation towards vulnerable groups.

Summer fan 2009



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Practice #39 (by Rebecca Whittle and Gordon Walker)

Title/location/time: Important Public Announcement system/Swedish towns in all areas with populations of over 1,000/During emergencies

Type of hazards and the risks involved: All types of emergency (both natural and non-natural hazards)

Position in the risk cycle and measures: Warning.

Purposes/functions of communication: To alert citizens to danger and encourage them to take preventative action to keep themselves safe.

Actors in communication: Government (specifically MSB – the Swedish Civil Contingencies Agency) to the public. The scheme is nationwide in scope and exists in all towns with a population of over 1,000. However, during emergencies the system is only activated in affected areas.

National setting: The focus is strongly within Catalonia, with a focus on 10 major cities. (Perhaps the strong nationalistic feelings of Catalonia are of relevance here.)

General reflection: The entire plan is extremely comprehensive and understandable given the 2003 scare, and the apparent improvement to mortality rates seems to be a measure of success. However it would be good to compare the severity of the heatwaves and the mortality rates, to have a better ideas of how effective the communication has been (This is not done within the process, where total excess mortality is just compared to a baseline.) It is also questionable how long it will be maintained, particularly if it is seen as a success. It might breed complacency. This description is based on campaign material (SCatSalut and Generalitat de Catalunya 2009).

Communication tools, channels and time dimension of communication: Sweden has a national network of around 4,500 radio-controlled sirens which are sounded in the event of any kind of danger. The siren is then followed by the provision of further information on the radio or TV. The MSB has, or is forming, agreements about broadcasting emergency alerts with both commercial and state radio and TV channels and broadcasting conglomerates which, once they have signed up to the agreement, must always be able to broadcast the messages. Around twenty emergency alerts are broadcast each year in Sweden. In specific areas around nuclear power plants, in addition to receiving warnings via the outdoor sirens, residents receive warnings about nuclear alerts via the RDS system on the free radio receivers that the state provides to each household in these specific areas.

Appraisal of good and/or poor aspects of practice: The control system is radio based and sufficiently specific in application to be able to sound the alert in the exact areas affected. Potential criticisms could include the fact that areas with populations of under 1,000 are not included in the system. The siren itself is also not capable of providing any further information about the hazard itself. In order to get this more specific information, residents must access the TV or radio.

Contribution to social capacity building: Depends on the motivations of residents to learn more about the nature of the hazard behind the warning.

Relationship to social vulnerability: The system does not discriminate between residents, with the exception of those in areas with a population of under 1,000. These people could be left more vulnerable as a result of the fact that they do not receive a warning.

National setting: The Important Public Announcement system represents standard best practice for Sweden.

General reflection: The MSB is now investigating new ways to reach and inform the public via mobile phones and the Internet.

Practice #40 (by Corina Höppner and Michael Bründl)

Title/location/time: Snow avalanche bulletin SLF, education and decision support tools/ Switzerland/ continuous. www.slf.ch

Type of hazards and the risks involved: Snow avalanches.

Position in the risk cycle and measures: Non-structural prevention/preparation measures and warning.

Purposes/functions of communication: Informing the public and experts about the snow and avalanche hazard situation. Raising awareness of the public for avalanche danger and giving advice on how to behave in areas endangered by avalanches (trigger protective behaviour). Providing information for safety services as basis for taking safety measures for settlements and along traffic routes.

Actors in communication: Experts to experts (safety services) and to the general public at national, regional and local level.

Communication tools: Text, graphics, maps at national and regional level indicating the hazard level by colours and icons, maps for snow depth, amount of new snow, snow pack stability, information about snow conditions both for safety services and the public. For sensitization and education of the public: texts, excursions, guided tours, videos, exhibitions (guided and/or interactive at SLF institute), decision support tools for the planning of activities in avalanche terrain, books and brochures, learning-CD, e-Learning, White Risk mobile and avalanche education trail at Sentisch horn near Davos (www.tourenlehrpfad.ch). For safety services: yearly education and training courses at two levels including repetitions courses in the national languages.

Channels: Access restricted information system IFKIS Info Manager for safety services (www.ifkis.ch); website (www.slf.ch), iphone application White Risk mobile, SMS, MMS, WAP, Radio (national and local channels, daily), TV (national channel, at least once a week), teletext, press (national and regional papers) for safety services and the public. Personal information for safety services in critical situations.

Time dimension of communication: updates twice a day during the winter season and spring, irregular publication depending on actual conditions during summer and autumn.

Appraisal of good and/or poor aspects of practice: One positive aspect is that the bulletin is well-known and recognised as the central authority for snow avalanche forecasts and knowledge in Switzerland. Information is updated daily, available for the national and regional level, disseminated via different channels and tools and offers not only information but also hands-on learning and preparation/emergency training. The bulletin designers are aware of the need to tailor hazard maps, texts etc. to the needs of a non-expert audience and they do so by using non-statistical/non-technical language and graphics/maps that are easy to understand, have clear colouring and are visually concise. The bulletin uses risk ladders which are easy to understand. It also offers more specific information and training for those who already have some background knowledge or who have different knowledge needs, e.g. alpinists, winter sport enthusiasts and safety services. The bulletin also points out that it cannot specify the exact location and time of an avalanche event (and that there is hence no absolute security) and that users are self-

responsible to determine the local situation. Similar platforms for snow avalanche information exist in other European countries for national and regional forecasting too (see Austrian practice below). A weak point of the Swiss bulletin is arguably that some terms used in the forecasts (e.g. 'lee slopes', 'wind-loaded slopes') require a certain degree of background knowledge, which is provided in a separate brochure. This brochure is rather long and repetitive, and does not necessarily clarify the differences between different levels and what it means for users.

Contribution to social capacity building: For the public it depends on the personal interest, motivation and need of individual users to learn about avalanches. Potentially the bulletins, and the corresponding maps and tools for education and decision making can build knowledge capacities, including knowledge of hazard levels, how to determine the local hazard level, and how to behave in avalanche endangered terrain. For safety services the additional information and early warnings provided via the information system IFKIS Info Manager help responders to judge the local situation and take prevention measures in advance.

Relationship to social vulnerability: The bulletin and additional products are available in the three major languages spoken in Switzerland. Information is disseminated via different channels and tools.

National setting: The bulletin embodies national practice for snow avalanche preparation and warning.

General reflection: The bulletin has not been systematically evaluated with respect to its actual contribution to capacity building for the whole of Switzerland. However, first investigations are currently being conducted to determine the influence of the bulletin on the personal decisions of mountaineers. There are, to our knowledge, no comparative studies of bulletins in other European countries.

Practice #41 (by Michael Bründl)

Title/location/time: IFKIS-Hydro and GIN (Common Information Platform for Natural Hazards), Switzerland, continuous.

Type of hazards and the risks involved: Flooding, debris flow; risk to settlement, infrastructure and people.

Position in the risk cycle and measures: Non-structural prevention/preparation measures and warning.

Purposes/functions of communication: Informing safety services and intervention forces on the local meteorological and hydrological conditions in local catchments and providing a platform for the exchange of information among experts. Raising awareness for continuous observation of local conditions prior to potential events. Providing a basis for prevention or intervention measures for the protection of buildings, infrastructure and persons, thus facilitating decision-making.

Actors in communication: Experts to safety services at local level, intervention forces and command bodies at regional and national level.

Communication tools: access restricted information platform IFKIS-Hydro (based on IFKIS Info Manager Avalanche); GIN (www.gin-info.ch)

Channels: information system IFKIS-Hydro for various locations, national information platform GIN.

Time dimension of communication: continuous.

Appraisal of good and/or poor aspects of practice: IFKIS-Hydro was first introduced in the canton of Glarus, Switzerland. The goal was to summarize all available data sources of the region into one information system. In the last 5 years IFKIS-Hydro was introduced in several regions of Switzerland. The system is expected to sensitize and encourage local safety services to continuously inform themselves about upcoming severe hydrological events and to help them to prepare and to take protection measures in advance. Analysis of flood events in the canton of Glarus in 2006 when IFKIS-Hydro was already in use demonstrated that the system increased the lead time and helped practitioners take action in advance. The recently established information platform GIN is a logical consequence of IFKIS-Hydro. In the coming years all information currently available on IFKIS-Hydro will be integrated into GIN. First impressions and discussions with end users are very positive which suggests that the system meets the requirements of practitioners and will very likely become a widely accepted and acknowledged tool and practice.

Contribution to social capacity building: Potentially provides up-to-date data in an easy-to-use way to local and regional decision makers which is an essential prerequisite for effective intervention measures. Intervention measures can be put into place at the right time and false alarm rates can be reduced which helps improve the coping capacity of communities and regions.

Relationship to social vulnerability: Correct warning increases the lead time for intervention measures which can considerably reduce damage.

National setting: IFKIS-Hydro is still a regional system. However, GIN is already implemented at the national level since all national warning institutions are integrated in the system.

General reflection: Feedback from regions where IFKIS-Hydro is already implemented is very positive. Every year additional regions are interested enough to establish IFKIS-Hydro in their region. This suggests that the system is well accepted by practitioners. So far, no quantitative cost-benefit analysis or

evaluation with respect to the purpose of communication and capacity building has been conducted (Romang et al. 2009; Heil et al. submitted).

Practice #42 (by Corina Höppner)

Title/location/time: Building Insurance communication, the example of the Swiss umbrella organisation of cantonal building insurers.

Type of hazards and the risks involved: Debris flow and shallow landslides, snow slides, storm, floods and hail.

Position in the risk cycle and measures: Prevention, non-structural measures.

Purposes/functions of communication, content of communication and specific challenges/difficulties: To raise awareness, to inform on how to act and to trigger protective actions.

Actors in communication: Insurer to home owners.

Communication tools, channels and time dimension of communication: Internet, brochure in print and electronic format.

Appraisal of good and/or poor aspects of practice: The brochure stands out for its very clear design which uses a good mix of elaborated and readable graphics, some text and pictures. The brochures are only up to 6 pages in length and the most essential information is highlighted. The brochure not only provides information on hazards in general but also on what people can do to protect their homes and on where to find further information. The content of the communication is restricted to the protection of buildings. Remaining risks are not mentioned.

Contribution to social capacity building: Presumably raises awareness and increases knowledge on protective measures on buildings.

Relationship to social vulnerability: Introducing protective measures to houses potentially reduces their vulnerability.

National setting: The insurer is the national umbrella organisation of the cantonal building insurers. It offers the brochures to the cantons who then decide whether they want to use it.

General reflection: The description is based on personal communication with an expert. The brochures have not been evaluated with respect to the purposes of communication and capacity building. They are available under www.kgvonline.ch.



The image shows a brochure cover on the left and four informational diagrams on the right. The cover features a photograph of a wooden interior with a view of a snowy mountain landscape through an open door. The text on the cover reads: "So schützen Sie Gebäude gegen Überschwemmung, Hochwasser und Oberflächenwasser". The diagrams are as follows:

- ABDICHTUNG:** Bei der Abdichtung wird das Gebäude im Gefahrenbereich wasserdicht ausgehildet. (Illustration of a house with a blue sealant line around the roof edge).
- LICHTSCHÄCHTE ERHÖHEN:** Die Oberkanten der Lichtschächte sind über der Stauebene anzuordnen. Abläufe müssen an die Kanalisation angeschlossen werden. (Illustration of a house with a raised light well and a drainage pipe connected to the sewer).
- NOTWENDIGE ÖFFNUNGEN SCHÜTZEN:** Lichtschächte und Schwellen erhöhen. Türen und Fenster sowie Lüftungsöffnungen und Leitungsdurchführungen wasserdicht ausblenden und verstärken. (Illustration of a house with a raised light well, a door, and a window).
- Hinweis: Auftragskräfte von Fachleuten überprüfen lassen!**
- GEBÄUDEHÜLLE ABDICHTEN:** Zum Beispiel mit wasserdichter Betonkonstruktion oder mit Bitumenabdichtung. Öffnungen im Gefahrenbereich wasserdicht verschließbar ausbilden. (Illustration of a house with a concrete foundation and a door).
- VOR LECKWASSER SCHÜTZEN:** Zum Beispiel mit einer Tauchpumpe mit Notstromanschluss. (Schäden infolge von Leckwasser sind nicht durch die Kantonale Gebäudeversicherung abgedeckt). (Illustration of a house with a sump pump and a power connection).

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Practice #43 (by Christian Willi with contributions by Michael Bründl)

Title/location/time: Assessment of current and future risks from natural and technical hazards in the Canton of Nidwalden (Switzerland) based on the IT-Tool RiskPlan, 2009.

Type of hazards and the risks involved:

Investigated processes: Flooding Engelberger Aa, Flooding Lake Lucerne, Mountain torrents (Stans); Landslide (Buochs); Airplane Crash (Stans)

Investigated municipalities: Buochs, Ennetbürgen, Stans, Stansstad, Dallenwil, Oberdorf.

Risk to persons, buildings, infrastructure, roads and railway.

Position in the risk cycle and measures: Structural prevention measures and property protection without intervention measures (constructional measures - Flooding Engelberger Aa, construction of new weir in Lucerne, measures against mountain torrents).

Purposes/functions of communication: Overview of the risk situation in the different municipalities in the Canton of Nidwalden. Comparison of the risk situation in the municipalities before and after the implementation of hazard protection measures, based on the pragmatic approach of RiskPlan by using the existing and available knowledge and experience of local experts and to start risk dialogue with decision makers. RiskPlan is a tool for pragmatic risk management as a support for decision-making, identification and assessment of possible mitigation measures, prioritizing of concrete actions and for risk dialogue at the strategic level.

Actors in communication: Regional decision maker (Cantonal Engineer), local experts for natural hazards, safety services and intervention forces at local level and insurance experts.

Communication tools: RiskPlan 2.0 (www.riskplan.admin.ch), open access.

Time dimension of communication: continuously

Appraisal of good or/and poor aspects of practice: Risk-based decision making and cost-effective planning and action on the basis of pragmatic risk management is no easy undertaking in terms of either the methodology or the volume of data needing to be processed. Thus, the IT-Tool RiskPlan was developed, which allows data to be entered systematically and the results to be depicted (risks associated with hazards and the cost-effectiveness of measures). In this project a risk dialogue with the involved stakeholders was conducted. With RiskPlan direct consequences of mitigation measures could be visualised, which helped the discussion among workshop participants. The result was that all participants became acquainted with the risk concept and its chances and limitations.

Contribution to social capacity building: With RiskPlan, the costs of hazard prevention measures can be compared with expected damage costs in a pragmatic and participative process based on a risk dialogue. It provides hazard information that makes an important contribution to risk dialogue with decision makers.

Relationship to social vulnerability: Workshop participants learned to assess and to evaluate risk and the effects of mitigation measures. These experiences give them the basis to act as "multipliers" for the society. Taking protection measures in their own field can make a further contribution to social capacity building.

National setting: This is a good and interesting example of best practice with national and international outreach. The investigation in the Canton of Nidwalden was a Contribution to the Interreg III B Project "AdaptAlp –WP 6 'Risk Prevention & Management'" with the partner regions of Vorarlberg, Carinthia, Rhône-Alpes, Valle d' Aosta, Slovenia, Piedmont and South Tyrol.

General reflection: Key references are www.riskplan.admin.ch (case study Nidwalden), 2009. Federal Office for the Environment (FOEN), Documentation for "RiskPlan – Pragmatic Risk Management", 2009 and Tiefbauamt Kanton Nidwalden, RiskPlan – Arguments for an Appropriate and Effective Risk Dialogue, 2009.

Practice #44 (by Michael Bründl)

Title/location/time: Intervention plan, Switzerland, continuously

Type of hazards and the risks involved: Flood risks.

Position in the risk cycle and measures: Non-structural prevention/preparation measures and warning.

Purposes/functions of communication: Support of local intervention forces for concentrating their efforts on locations with the highest damage potential at a river section of some hundred meters in length or even several kilometers, or an alluvial fan of a tributary, or a special object at risk such as an industrial complex during the intervention phase of an event. The plan has a simple design consisting of a water resistant sheet printed on both sides for certain objects and different phases of an event. The front page shows a combination of a hazard map and instructions for intervention measures including points of interest; on the back page there are text lists for materials needed for operation, important phone numbers, and rules for handling an intensification of the situation. The intervention plan provides a basis for intervention measures for protecting buildings, infrastructure and people.

Actors in communication: Safety services and intervention forces at the local level.

Communication tools: Water resistant sheet with information for intervention measures.

Channels: Directly handed and introduced to target persons. Exercise and training for use.

Time dimension of communication: continuous and regularly updated.

Appraisal of good and/or poor aspects of practice: Analyses of past flood events showed that hazard maps were not used as a supporting tool in the intervention phase of an event. The intervention plan should close this gap. First experiences in the community of Klosters, in the canton of Grisons, indicated the usefulness of this tool. It was introduced to the local fire brigades of Klosters in 2006. The fire brigades are the first intervention force to arrive on site and the plan was successfully applied for additional events.

Contribution to social capacity building: The intervention plan supports the local intervention forces in putting temporary mitigation measures in place before the event. It also helps them adapt the measures according to the intensity of the event. This helps to reduce or avoid damages.

Relationship to social vulnerability: Intervention measures reduce social vulnerability by reducing damage.

National setting: Intervention maps are implemented at the local level only at the moment.

General reflection: Feedback from the local intervention forces is positive so far; practical application shows that intervention plans can reduce risk for intervention forces. There is no systematic qualitative or quantitative analysis of the effectiveness of this method (for more information on the intervention plan as a management tool see Romang and Wilhelm 2009).

Practice #45 (by Michael Bründl)

Title/location/time: Hazard map and mitigation measures Glyssibach, Switzerland, permanent

Type of hazards and the risks involved: Debris flow risk to persons, buildings, infrastructure.

Position in the risk cycle and measures: Structural prevention/Non-structural prevention

Purposes/functions of communication: After a disastrous debris flow event in August 2005 a protection concept for the Glyssibach, in the community of Brienz, was developed. Part of this concept consisted of a widening of the torrent bed in the residential area along the Glyssibach. This made a relocation of buildings necessary. However, the concept also included an offer for the affected persons to get an alternative building area within 1 to 2 km distance from the old one. Such a measure had always been unpopular in Switzerland, especially in traditional, rural areas. Just at the beginning of the planning phase a dialogue concept under the lead of the mayor was initiated. This concept included the establishment of a review group under the lead of an independent mediator from a different part of Switzerland. Residents of the community were invited via the local newspaper to participate in this group while politicians were not represented. The role of this group was to critically evaluate the protection concept and to challenge engineers and the cantonal administration with critical questions. The focus during several meetings was to build up an open-minded discussion and present the mitigation concepts in an objective way, which also allowed people to understand the technical details of the alternatives. These meetings had a positive multiplier-effect, which led to a general acceptance of the protection concept. Opponents of the protection concept ceased their critical behavior during the discussion, which also had a positive feedback on the general agreement.

Actors in communication: Planning engineers, local communal authorities, cantonal natural hazard experts, local residents, an external mediator, the media.

Communication tools: Meetings of the dialogue group, public presentations and discussions with the affected community.

Channels: public presentations and discussions, information leaflets.

Time dimension of communication: during several weeks/months.

Appraisal of good and/or poor aspects of practice: The integration of local residents into the planning phase by establishing a review group paved the way for an open-minded and objective discussion. Without this, the engineers and authorities agreed that the project would not have been as successful as it is regarded today. It was essential that residents were also confronted with technical details and the realistic statement of the engineers that a similar event is likely to happen in the future. The intensive discussions provided a general agreement that debris flow risk from the Glyssibach with the realized measures is considerably lower than before. The experts involved maintain that, regardless of unpopular decisions like the relocation of buildings, it was possible to convince people of the positive effects of the measures.

Contribution to social capacity building: The intensive discussions among the population strengthened the capacity to cope with such events in the future. Helping each other in the recovery phase brought people in Brienz closer together. The integration of residents in the planning phase had a multiplier-effect and broadcasted the results of the discussions to the local population, which improved understanding of torrential processes in the area and which contributed to awareness building.

Relationship to social vulnerability: Social vulnerability to Alpine natural hazards is generally low in communities in Switzerland because of the well-developed insurance concept. The numerous interactions between residents strengthened the societal network, which decreases social vulnerability.

National setting: The project has a national pilot character and serves as a positive example for a successful risk communication. Several diplomas and masters theses, fieldtrips, documentaries and the publication of a book are among the reasons why the project became well-known on a national scale.

General reflection: The process of risk communication is judged as positive by local residents, local and cantonal authorities and also by the involved engineers. It demonstrates that a well-balanced integration of the local population into the planning process can pave the way for a successful outcome of a protection

project. The description is based on an interview with an expert and one report (Staeger and Perren 2006).

Practice #46 (by Michael Bründl)

Title/location/time: The building of an avalanche deflection dam in the alpine villages of Biel and Selkingen, canton of Valais, Switzerland, permanent.

Type of hazards and the risks involved: Avalanche hazard, risk to persons, buildings, infrastructure and traffic.

Position in the risk cycle and measures: Structural prevention

Purposes/functions of communication: After an avalanche event in the winter of 1999, which caused damage to the villages of Biel and Selkingen in the canton of Valais, a project group was commissioned by the canton to develop a new safety concept within one year, i.e. before the following winter. The project was realized in two phases. In phase 1 several alternatives were evaluated and costs were estimated. In this phase the involved engineers, the mayors of both communities and the cantonal engineer were involved. After intensive discussion on the pros and cons of several alternatives, the project group decided to propose a big dam between both villages. This concept was presented to the residents in both communities. According to the official policy in Switzerland these residents had to vote for the project before it could be realized. The realization of the dam dividing both villages spatially had hard consequences for some people because several buildings had to be removed which is very unusual in mountain villages in Switzerland. In spite of these circumstances, the local population agreed to the project. An empathetic argumentation and a sensitive communication were very essential for the success of the project.

Actors in communication: Local planning engineers, cantonal engineers, mayors of involved communities, local communal authorities, a regional land use planner who worked partly as a mediator for difficult discussions, and the affected population. During the planning and building phase of the project a movie was made, which caused controversial discussions among local people.

Communication tools: Public discussions with the affected community and face-to-face discussions with affected persons. The movie "Im Banne der Lawinen" (Gieri Venzin, SF DRS 1999) was broadcasted via the national television channel in November 1999.

Channels: public and face-to-face discussions.

Time dimension of communication: March – October 1999.

Appraisal of good and/or poor aspects of practice: Considering the difficult situation after the avalanche event, which caused fear and ambiguity, the engineers involved regard the communication as successful. However, after the dam was built, directly affected residents stated that they would have appreciated getting better involved in discussions on the protection strategy at an earlier stage. Engineers argued that they didn't want to be influenced by public opinion at an early phase of the project while analyzing the situation and identifying potential protection measures.

Contribution to social capacity building: Avalanche hazard is well known to the local population in both villages because avalanches have killed over 50 people in the past. Therefore, the avalanche event in 1999 did not increase the social capacity significantly. However, local people became aware that avalanche hazard still exists.

Relationship to social vulnerability: The dam significantly reduced social vulnerability. Local residents now state that they feel safe in their houses even in situations with elevated avalanche danger. A generally safe feeling positively influences the population to stay in their villages in the future.

National setting: This is an example of a local communal problem with a national outreach as a result of movie broadcasting and different articles in national newspapers and journals.

General reflection: This example shows how important a sensitive communication campaign can be for the success of the project. Without the professional communication concept and the agreement of the local population it would not have been possible to realize the project and to start building the dam only 7 months after the avalanche event with hard consequences like the remove of residential buildings. But it also reflects that people often perceive a lack of information as being a problem during the planning phase. The right time for affected people to be included in the decision phase is a crucial issue for the success of a protection project and has to be carefully evaluated.

Practice #47 (by Corina Höppner)

Title/location/time: Sarner See, Canton Obwalden, Switzerland.

Type of hazards and the risks involved: Flooding of residential areas and trading estates.

Position in the risk cycle and measures: Prevention, planning of large-scale structural measures.

Purposes/functions of communication, content of communication and specific challenges/difficulties: To develop measures, participate in decision-making and gain acceptance for measures. The main challenge was to work with a variety of interests at different levels.

Actors in communication: Authorities at cantonal, national level, and municipal level, landowners or public at-risk, representatives of local interests (stakeholders).

Communication tools, channels and time dimension of communication: A steering committee (authorities from the national, cantonal and municipality level) and an extended steering committee (authorities and planners at cantonal, national and municipal level, representatives of local landowners, residents) promote the mutual exchange of information and opinions. The committees also do the pre-screening of prevention options for responsible decision-makers. In this case, the steering committee and experts jointly elaborated a number of alternative protection measures. Parallel to this, 30 local stakeholders representing different interests were involved in a workshop to incorporate their interests, wishes and visions. In a second workshop the same participants were invited to rank the options according to their preferences and to choose from the catalogue of protection alternatives the experts had come up with. Project leaders and experts found the workshop had not produced these results and decided on the alternatives themselves. At the national level they again opted for a different option and put it to vote at a referendum which was rejected by the residents. Three information events were held to inform the public on the project, the proposed measures and their limitations.

Appraisal of good and/or poor aspects of practice: Project leaders decided to involve local stakeholders through workshops rather than informing them only. While the 1st workshop was considered a success as participants came up with general visions of future developments and were able to consent on a general priority list, the 2nd workshop failed in achieving a consensus on specific measures (that would have affected specific properties). The 'failure' of the 2nd workshop has not been evaluated. It can be speculated though that the one-day timescale allocated to facilitate understanding was not sufficient given the manifold interests involved. Moreover the gap between the two workshops was arguably very wide and the link to the actual elaboration of measures and actual decision-making was rather weak. The interviewed expert also suggested there was not enough time for preparing the 2nd workshop and to analyse its results, and that the moderation was open to improvement. The expert was not sure whether the failure was due to the quality issues or whether open dissent was unavoidable at the end of such a participatory event. Transparency was again an issue in that it was questioned whether the open communication of pros and cons during the workshop was helpful to the project as opponents could select and use this information to support their opinions or interests.

Contribution to social capacity building: It is likely that those involved in the workshops but also the general public learned about different flood protection measures as well as about their pros and cons. After the second workshop, local stakeholders set up an interest group to take the issue forward and to propose alternative measures.

Relationship to social vulnerability: Stakeholders did not necessarily opt for the most protective option but for the one that best suited their personal concerns (for instance ecological concerns, aesthetic concerns or the fear of noise due to construction work).

National setting: The inspiration to make this process 'more participatory' (workshops) came from Swiss river restoration projects. It is not national mainstream to do so.

General reflection: The practice has not been evaluated with respect to the purposes of communication and capacity building. The description is based on a PhD thesis (Hess 2008) and personal communication with an expert.

Practice #48 (by Corina Höppner)

Title/location/time: Municipality of Weggis, canton Luzern, Switzerland.

Type of hazards and the risks involved: Debris flow, shallow landslides and rock fall.

Position in the risk cycle and measures: Prevention, implementation of middle to large-scale structural measures (Schutzdamm) and non-structural measure (implementation of a masterplan and of hazard maps).

Purposes/functions of communication; content of communication and specific challenges/difficulties: Awareness raising, information on situation and measure, information to gain acceptance, participation in decision-making (referendum)

Actors in communication: Responsible authorities at cantonal and municipal level (Gemeinderat) to residents, landowners and general public.

Communication tools, channels and time dimension of communication: Information events, field inspections, personal meetings with concerned landowners, information letters (on hazard map, planned measures), information brochure for referendum on measures.

Appraisal of good and/or poor aspects of practice: Continuous information is provided on the situation, the hazard map and the planned measures through different channels and tools. The information brochure for the referendum was very extensive, setting out all the pros and cons and was thus very long (43 pages). The brochure was arguably overloaded with text and had a design that didn't help its readability. A

local expert even thinks that due to its length only those people who actually wanted to find a reason to reject the measures would have read it to find information that would support their case. Residents of Weggis rejected the proposed measures on a referendum. The reasons are not clear though a local expert suspects that they are manifold: 1) A perception that one landowner was treated more favourably, 2) A perception that some parts of the village, especially those with newcomers, would profit more than long-term villagers, 3) A perception that there was already enough money spent on natural hazard mitigation. Some of the local media reported less favourably on the measures than others depending on the views of the editors and their personal relationship to the responsible authorities. 'Opinion leaders' that owned land in the red zone made strong efforts to protect their interests. There was no official platform other than bilateral negotiations to resolve the long-standing and manifold conflicts of interest in this heterogeneously structured community.

Contribution to social capacity building: Potential increase of knowledge on the situation, and possible prevention measures and their pros and cons.

Relationship to social vulnerability: Part of the communication was on the distribution of financial costs among residents. An issue was the differently perceived fairness and equal treatment of residents in the distinct parts of the municipality.

National setting: There is no Swiss mainstream as such. Each municipality can communicate as they wish and decide on how to deal with emerging conflicts. A referendum is needed if the project exceeds a certain size or a certain amount of costs. In Sörenberg, a neighbouring community, residents voted for a large-scale protection structure after long discussions in their municipal assembly (attended by at least 100 residents). They opted to sacrifice 49 houses to protect the whole village. Reasons might lie in the different socio-demographic and political structure of the municipality (e.g. more homogeneous than Weggis).

General reflection: The practice has not been evaluated with respect to its contribution to social capacity building. The description is based on brochures and personal communication with an expert.

Practice #49 (by Corina Höppner)

Title/location/time: Felsberg, canton Graubünden, Switzerland

Type of hazards and the risks involved: Rock fall and rock avalanche above the municipality of Felsberg. Frequent rock fall (at least every spring), bigger rock fall events and rock avalanches in March 2000, May 2001, July 2001 and March 2002.

Position in the risk cycle and measures: (Early) warning and prevention. Prevention measures consist of risk information, early warning, emergency training and evacuation rather than other non-structural measures. Structural measures are not being applied as they would have to span the entire hill above the village and would not significantly increase safety.

Purposes/functions of communication, content of communication and specific challenges/difficulties: 1) Information of the public: Early information on a potentially large future event and what the local authorities and responsible bodies do about it. Information on physical processes that trigger events and on endangered areas. To trigger protective behaviour through the dissemination of behaviour advice. Information of the local population and the media to avoid the spreading of rumors and to keep authority. Reassurance of the local population that everything is under control and that they can have confidence in the responsible bodies. 2) Communication within the 'Gemeindeführungsstab' (see below) and also to improve coordination and to share tasks efficiently. Communication with the local population to allocate responsibilities and ownership of risk. Local, national and even international media took a great interest in the biggest event which was forecasted in July 2001, and the work with the media took up considerable time and resources.

Actors in communication: Gemeindeführungsstab (a local committee consisting of the president of the municipality, a representative of the municipal administration, the chief of the local fire brigades, the chief of local civil protection services, a representative of local technical services, the local chief of supply services), external experts, the local population, local, national and international media (press and TV).

Communication tools, channels and time dimension of communication: Gemeindeführungsstab as a well-established local committee coordinates warning, prevention, emergency situations and recovery. From 1999-2002 they regularly informed the local population about forecasted large-scale events using the local gazette, leaflets, information events and field inspections. Long-term residents usually contact the Gemeindeführungsstab if they observe a significant increase in rock fall. The Gemeindeführungsstab then asks experts to intensify the observation of the source. Warning signs are then installed and particularly dangerous zones are temporarily closed (both before and sometime after bigger events). Sometime after bigger events, they are replaced by signs that inform passers-by that they enter these zones at their own risk. Infotax and press communiqué inform the media (regional and national press, national and even

international TV) regularly before and after the event. Evacuations are prepared by leaflets, personal letters and through personal visits. News is also available on the municipal homepage.

Appraisal of good and/or poor aspects of practice: Gemeindeführungsstab proactively communicated with the local public and the media before, during and after bigger events. Responsibilities were clear and there was a plan as to who was to be informed and by which means. The Gemeindeführungsstab works well as there is some continuity in terms of the people involved and because they meet regularly and exercise emergencies every 2-3 years. The hazard events in Felsberg have produced ideal conditions in that their comparatively frequent and regular occurrence keeps awareness high and gives the community reason and time 'to practice'. Very specific and correct forecasts of big events allowed the authorities to prepare the local population and target them by different communication means and with different intent according to the actual risk situation. The very precise forecast did, however, generate a considerable media interest which the Gemeindeführungsstab tried to manage through early and regular press information.

The biggest event was witnessed by many local spectators and the media (national and international) who waited behind a fence eating pizza and with their cameras ready. People felt obviously safe behind this fence as this was what they had heard from the Gemeindeführungsstab. People crowding the streets posed a potential problem for the emergency services.

In quiet times the communication with the public is silent too (nobody seems to be interested according to a local expert).

The Gemeindeführungsstab communicates the message of safety beyond the danger area and whatever the size of the event (red zone in the hazard map). There seems to be hardly any communication on residual risks and local experts doubt whether this would actually make sense. It seems to be unclear as to who owns residual risks. Permanent warnings and restrictions to enter dangerous zones are ignored after a while and are thus replaced by signs that allow people to enter at their own-risk once the risk has decreased to a level that is considered to be 'normal' for Felsberg.

Contribution to social capacity building: According to the interviewed experts, the 'Gemeindeführungsstab' learned how to coordinate tasks across the risk phases. Over time they acquired knowledge and relationships important to coordinate responsibilities, share work and to communicate with the local public and the media. The local public seems to trust the work of the 'Gemeindeführungsstab'. The general public seems to be aware of the threat thanks to the frequent occurrence and the proactive communication.

Relationship to social vulnerability: People living near a threatened zone were targeted by different communication tools such as personal letters, talks, field inspections, and leaflets.

National setting: There is no national mainstream discernible. Each case seems to be unique due to the varying characteristics of rock avalanches, local geographies and the possibility of forecasting big events. Gemeindeführungsstäbe exist in many other municipalities too. However it is not given that they work as well as in the case presented and much seems to depend on personal continuity and engagement.

General reflection: The practice has not been evaluated with respect to the purposes of communication and capacity building. As with other examples too, the purposes of communication are not explicitly mentioned but implicit in the communication material. This description is based on interviews with two local experts and an internal documentation of the case 'Umgang mit Bedrohungslagen- Geschichte und management einer Bedrohungslage am Beispiel des Bergsturzes in Felsberg' (Markus Feltscher).

Practice #50 (by Matthias Buchecker)

Title/location/time: River broadening Augand/ River Kander Spiez-Reutigen, Switzerland/ 1995-2005

Type of hazards and the risks involved: Erosion of the riverbed and flooding. Backward erosion of the river Kander undermines the old dams upriver dating back to the early 20th century. As the affected river section had been added to a National Inventory of protected floodplains, permission to rebuild the lateral protection barrier was refused by the cantonal authorities. As an alternative, they suggested widening the riverbed.

Position in the risk cycle and measures: Planning and implementation of large-scale structural measures. The main idea of the project was to eliminate the lateral and also longitudinal protection barriers and to widen the riverbed, so that the Kander will start meandering again, deposit the detritus and thus avoid vertical erosion. This new river management strategy will contribute to maintaining the flood protection infrastructure of the upper catchment area that is threatened by vertical erosion. It will also help with the restoration of the original floodplain vegetation.

Purposes/functions of communication; content of communication and challenges:

The communication included public information and negotiations with the local stakeholders. The main purpose of this procedure was to avoid (false) rumors about the project and to promote the acceptance of the innovative management measures, i.e. river widening.

In a second step, the measures were negotiated with the local stakeholders. The negotiations also helped avoid resistance against the project. Matters up for negotiation were the definition of the intervention lines, the access infrastructure to the river and visitor management. Besides the initial lack of trust in the new management strategy, a main challenge was the resistance against the loss of forest from the side of the cantonal forest office.

Actors in communication: Main actors were the relevant regional offices (water engineering, nature protection, forest, and fishery) and the local stakeholders (municipalities, land owners), but also the local public.

Communication tools, channels and time dimension of communication: The project started with public information events (hearings) and face-to-face information talks with the land owners. Later on, the stakeholders were provided with written information, in particular with concepts and plans. The details of the project were negotiated with the stakeholders during field visits. Shortly before the realization of the project, the local population was informed about the measures through the local media. Furthermore, stakeholders were invited to participate in excursions to places where similar measures had been implemented. The cantonal authorities explained the planned strategy in several information events to the local public and the local authorities. The project leader first established an accompanying group of public and private stakeholders.

Appraisal of good and/or poor aspects of practice: The local stakeholders and also the local public were involved very early in the planning process and thoroughly informed about the procedure. They were able to be convinced of the new strategy which was also based on the assurance of financial risks. The concerns and requests of the local stakeholders (e.g. about road infrastructure or harvesting timber) were taken into account. In terms of problems, the long duration of the planning process was one factor mentioned. Also, a communication strategy did not exist at the beginning of the process. It was only in the course of the project that official bodies learnt how to communicate with stakeholders. The particularly innovative aspect of risk communication within the project was the combination of clear information about the main idea of the project and the negotiation about the details of the project. Through this procedure the stakeholders could be convinced of the benefits of the new river management strategy, while conflicts about details of the project could be avoided and a certain local appropriation of the project could be achieved.

Contribution to social capacity building: A main aspect of the communication process was the learning about, and approval of, the new prevention strategies. In the beginning, there was a lot of resistance and skepticism within the local population that was overcome during the communication process. Important for future capacity building was the fact that, towards the end there was no losing party that might act to obstruct future planned prevention projects. Furthermore, trust in regional offices was promoted. Authorities learned how to communicate with stakeholders.

Relationship to social vulnerability: The financial vulnerability of the diverse statutory corporations was a key aspect of the negotiations. Importantly, the authorities explicitly guaranteed that eventual damages would be compensated by the canton. More marginally, the autonomy of these institutions was also an issue.

National setting: Risk communication in this case differed from the mainstream in the country mainly in terms of the intensity and length of the communication process. It was also a novelty that the public was informed about the project in a public hearing, and that details of the project were thoroughly discussed with the stakeholders and partly adjusted according to the wishes of the stakeholders. This practice was new at the time, but has become a mainstream practice in the last decade.

General reflection: Neither the project nor the communication process has been evaluated so far; it is now being evaluated ex-post in the framework of a research project, in agreement and with the support of the former project leader. The description of the practice is based on interviews with local project leaders.

Practice #51 (by Matthias Buchecker)

Title/location/time: Displacing the river Flaz and restoring the river Inn/ Municipality of Samedan, Switzerland/ 1998-2005

Type of hazards and the risks involved: During the big flood of 1987, the Inn river was very close to exceeding the discharge capacity of its riverbed and flooding the town of Samedan. But, after the event, the municipality of Samedan could not be convinced of the need to take any measures against flooding.

Position in the risk cycle and measures: Awareness raising, planning and implementation of prevention measures. The cantonal authorities had to convince and also urge (by banning building zones) the municipality authorities that far-reaching prevention measures were needed. Studies showed that the settlement of Samedan could only be protected from flooding by either displacing the tributary of the Inn river, the Flaz river, or by introducing measures of controlled flooding of the river Flaz. Eventually, the population of Samedan voted for the alternative of permanently displacing the river Flaz. As time was pressing,

an unconventional form of rolling planning was pursued, during which a new river bed of the Flaz was opened and also the river Inn was restored.

Purposes/functions of communication; content of communication and challenges:

Communication included various written and oral forms of public information, votes and participatory working groups. The communication served, in the first instance, to raise awareness of the risk of flooding and the necessity of prevention measures. Latterly, it also served to enhance consensus building and helped improve the project. In the first stage, the main content of the communication was information about the benefits of the project, not just in terms of safety, but also in terms of ecological enhancement and tourism. A key role was also played by financial incentives (subsidies). In the second stage, the details of the measures were negotiated within a working group of affected stakeholders, between the working group and an ecological accompanying group and between these groups and the engineers of the building enterprises.

Actors in communication: Main actors were the relevant regional offices (water engineering, nature protection and fishery) and the local stakeholders (municipalities, land owners, enterprises), but also the local public.

Communication tools, channels and time dimension of communication:

The communication tools of the project included public information events, newsletters, public votes, working group discussions, discussions with single land owners and field visits. The information phase on the project alternatives mainly took place between 1998-2000; the negotiation phase and the rolling planning lasted between 2000-2004.

Appraisal of good and/or poor aspects of practice:

The project started under difficult conditions, as the municipality had to be urged to undertake protection measures. But as soon as the municipality was convinced of the necessity of the protection measures, an extraordinarily inclusive and constructive communication process was launched. Through this procedure, the population could be encouraged to vote for the more expensive and more ecological alternative. Of similar importance was that the details of the project were negotiated within the local working group, so that the project eventually became a local project. Another positive aspect of the project was the rolling planning and the active role of the ecological accompanying group during this phase. Discussions between the ecological group, the local working group and the engineers on tangible details of the project allowed for mutual learning, increased mutual trust and a considerable improvement of the project in all respects.

The rolling planning led to a considerable improvement of the project, as a mutual learning process allowed for unexpected solutions. A main challenge of the project was to find a balance between farmers' land use interests, flood risk safety and ecological interests.

Contribution to social capacity building:

The inclusive and proactive communication on the prevention project mainly contributed to a local sense of self-efficacy, i.e. to the belief that the municipality is able to cope with necessary changes. Another important achievement was that conflicts with negative impacts on future projects could be avoided, and that awareness of natural processes and the understanding of more dynamic strategies of river management could be raised, in particular among the involved stakeholders. Participants learned to find creative and unexpected solutions.

Relationship to social vulnerability:

A main issue of the project was the farmers' objection to alternatives that involved regular flooding of their fields. They appeared to be less vulnerable to loss of land than to uncertainty to flooding. People generally objected to controlled flooding as they perceived there to be a risk of social conflicts. Fear of social conflict seems to be a main issue also in the context of risk management.

National setting: Risk communication in this case differed from the mainstream in the country mainly in terms of the intensity and length of the communication process. It was also a novelty for the public to decide between alternatives of risk prevention measures. Another innovative aspect of the project was the communication during a rolling planning process. This procedure was chosen to reduce the risk of flooding before the implementation of the measures. Unexpectedly, however, this had the positive effect that stakeholders could negotiate on very tangible issues, which increased the mutual learning process.

General reflection: The project served as a case study for a dissertation project (Junker et al. 2007). It was also reflected in several publications for the practice (e.g. Beilage zur Engadiner Post Nr. 64, 2004). An ongoing study also uses the project as a case study to identify the long-term effects of participatory river management (ENHANCE, WSL). Part of the project is also a monitoring project that focuses mainly on ecological aspects.

Practice #52 (by Rebecca Whittle and Gordon Walker who thank Hugh Deeming for his help with this review)

Title/location/time: 'Preparing for Emergencies' campaign/UK/Continuous.

www.preparingforemergencies.co.uk

Type of hazards and the risks involved: Generic advice service for all types of emergency (both natural and non-natural hazards)

Position in the risk cycle and measures: Non-structural prevention/preparation.

Purposes/functions of communication: To make UK residents aware of the various hazards and threats that they might face and to give them some knowledge about how to prevent and/or stay safe in the event of such incidents occurring.

Actors in communication: UK government to the public.

Communication tools, channels and time dimension of communication: The 'Preparing for Emergencies' campaign is the government's principal public emergency preparedness information scheme. It was launched in 2004 in response to a series of disasters including the September 11th terrorist attacks on the USA and the 2001 foot and mouth disease crisis in the UK. The campaign has an associated website: www.direct.gov.uk/en/Governmentcitizensandrights/Dealingwithemergencies/Preparingforemergencies/index.htm

At its outset a 22-page booklet was distributed to UK households. This booklet contained general advice on staying safe in relation to a range of emergencies, including transport accidents, fires and terrorism incidents. The core message of the booklet, and now the website based guidance is:

- Go inside a safe building
- Stay inside until you are advised to do otherwise
- Tune in to local radio or TV for more information

Appraisal of good and/or poor aspects of practice: The simple 'Go In, Stay In, Tune In' message that is the focus of this campaign was adopted in the UK on the advice of the independent National Steering Committee on Warning and Informing the Public. The website associated with the campaign also has some useful links to further information. Unfortunately, however, after the booklet was initially distributed to householders it was much criticized by the media for being too simplistic and patronizing in tone. Others accused the government of scaremongering and claimed that the booklet was too focused on terrorism. Many householders viewed the booklet as just another example of the government seeking to interfere in their lives. From a risk communication perspective the use of such a generic model of 'effective response' is also problematic, because it can cause confusion and therefore is likely to result in advice being ignored. For example, the 'Go in, Stay in, Tune in' advice was directly contradicted by a campaign run by the UK Fire and Rescue Services, whose common sense catch phrase was 'Get Out, Stay Out, Call Us Out'.

Contribution to social capacity building: Although the campaign aims to help keep people safe, it represents a very 'top down' form of communication with the public being instructed to behave in a certain way (as opposed to using their intelligence and initiative). However, the government's new emphasis on community resilience (see below) does show some signs of countering this.

Relationship to social vulnerability: The campaign is targeted at all UK residents, rather than at vulnerable groups more specifically. However, the Preparing for Emergencies leaflet and website do encourage people to think about the needs of vulnerable friends and neighbours.

National setting: The 'Preparing for Emergencies' campaign represents national best practice for the UK.

General reflection: Following the criticisms of the campaign, the UK government is currently consulting on revisions to the Preparing for Emergencies resources. The new resources are set to be packaged within a framework that seeks to encompass wider community resilience through encouraging social capacity building and a two-way exchange of information between the public and emergency practitioners (see: www.cabinetoffice.gov.uk/ukresilience/communityresilience.aspx).

Practice #53 (by Rebecca Whittle and Gordon Walker who thank Hugh Deeming for his help with this review)

Title/location/time: UK Resilience Website/UK/Continuous. www.cabinetoffice.gov.uk/ukresilience.aspx

Type of hazards and the risks involved: All those identified in the National Risk Register (from storms, flooding, gales and snow through to non-natural hazards and threats, such as terrorism, transport accidents and Chemical, Biological, Radiological and Nuclear (CBRN) emergencies.

Position in the risk cycle and measures: Non-structural prevention/preparation measures as well as emergency response and recovery

Purposes/functions of communication: The UK Resilience Website is run as a news and information service, which provides resources for emergency practitioners in order to support the work that goes on across the United Kingdom to improve emergency preparedness. The website is run by the Civil Contingencies Secretariat (CCS) at The Cabinet Office.

Actors in communication: Government to emergency practitioners at national level. This is not a communication measure that is explicitly aimed at the public at present, although this may change with the government's new focus on community resilience.

Communication tools, channels and time dimension of communication: The website is split into three main sections: emergency preparedness, emergency response and recovery, and emergencies generally. Each section contains further subsections with advice, guidance documents and case studies of lessons learnt from previous emergencies as well as links to relevant legislation, such as the Civil Contingencies Act.

Appraisal of good and/or poor aspects of practice: The website contains a wealth of information on all aspects of emergency management. It is also not hazard specific and it therefore provides a single point of access to information on a wide range of emergencies. However, it is also possible to make a number of criticisms of the website. Firstly, the website is not very user-friendly in design and the sheer volume of information available can make it hard to find the specific section that you need (e.g. the use of hyper-links to guide users to documents is not particularly effective). Secondly, it represents a very 'top down' vision of communication (as opposed to a two-way exchange), from the government to emergency planners. The public are not currently targeted as an audience for this communication.

Contribution to social capacity building: The Cabinet Office is currently undertaking a new body of work on community resilience which is trying to encourage social capacity building at all levels (see www.cabinetoffice.gov.uk/ukresilience/communityresilience.aspx). The CCS has been trying to work more closely with the public as part of the consultation process for this work programme.

Relationship to social vulnerability: Rather than its content influencing aspects of social vulnerability directly, this site provides a gateway to a range of UK Civil Protection guidance documents. These, in turn, detail what emergency practitioners must (statutory requirements), should or could (non-statutory requirements) plan for, in relation to targeting the needs of more vulnerable individuals and groups throughout the emergency cycle.

National setting: The UK Resilience website gives details of national practice for emergency preparedness, response and recovery.

General reflection: The government regularly updates and refreshes the guidance and case studies available on the site.

Practice #54 (by Nigel Watson)

Title/location/time: Flood Warning Service/England and Wales/ continuous. www.environment-agency.gov.uk/homeandleisure/floods/31618.aspx

Type of hazards and the risks involved: River (including flash floods) and sea floods – hazards to people: death, injury, disease; hazards to goods – property damage, loss of communications links, economic loss.

Position in the risk cycle and measures: Preparation for imminent flood risk and better preparedness to reduce flood damage – a non-structural measure which can be used to trigger a range of additional responses such as evacuation or construction of temporary flood defences.

Purposes/functions of communication: Informing to build up awareness of possibility of flooding in near future (hours/days). Increased warning time provides greater opportunity for triggering damage-avoiding actions at individual, community and institutional levels.

Actors in communication: Flood Warnings generated by a regulatory and management agency (Environment Agency) in England and Wales and sent to members of the public, businesses and public institutions.

Communication tools, channels and time dimension of communication: Warnings issued for river and sea flooding based on 24 hour monitoring of rainfall, river levels and sea conditions. Warnings are disseminated through a variety of channels: the Environment Agency's Current Flood Warnings in Force web page (updated every 15 minutes), through TV and radio weather and travel reports, via telephone (including mobile phones), text messaging, email, fax or pager, Flood Wardens in the community who pass information on to their neighbours, public address, loudhailers and siren systems, and recorded flood information which can be accessed 24 hours a day via the Floodline number (0845 988 1188). Four codes are used for flood warnings, which can be issued in any order: Flood Watch; flooding in low lying land and roads is expected – be aware, be prepared, watch out; Flood Warning; flooding of homes and businesses is expected – act now; Severe Flood Warning; severe flooding is expected. There is extreme danger to life and property –act now; All Clear; flood watches or warnings are no longer in force for this area. For each of the types of warning, additional information is provided which describes what actions people should take at that point in time.

Appraisal of good and/or poor aspects of practice: Good aspects: The Flood Warning Service differentiates among different levels of risk and describes the potential impacts on people and property in sim-

ple and clear language. Additional information regarding appropriate steps to take is provided alongside each warning. A variety of high-tech and low-tech communications methods is used which reduces the chances of people not receiving the warning altogether. Initially, members of the public had to sign-up to receive automated warnings via telephone. However, the Environment Agency is being more proactive and has obtained the telephone numbers of around 500,000 people who reside in at-risk areas so that warnings can be sent to all those who are likely to be affected by flooding. Poor aspects: not every part of England and Wales is covered by the full four-stage service due to difficulties with producing reliable flood forecasts due to complex topography and terrain and highly variable weather conditions. The automated telephone warning service is designed to give people just two hours' notice of flooding.

Contribution to social capacity building: early warnings of flood risk offer the potential to enhance preparedness and to limit loss of life and damage to property. However, a warning in itself does not ensure appropriate action is taken. Much depends on the capacity of the individual, household or community to respond to the warning and, in particular, to help those who are unable to help themselves.

Relationship to social vulnerability: The Flood Warning Service does not specifically target socially vulnerable groups or aim to give advanced warning for those who may not be able to act quickly. However, the use of Flood Wardens who are familiar with their local community goes some way towards addressing this need.

National setting: Floods are a significant problem in the UK and there is increasing emphasis nationally on individuals and communities taking more responsibility for their own safety and property through better preparedness. The Flood Warning Service is indicative of this shift in approach.

General reflection: The Flood Warning Service is one of the key non-structural measures currently used in England and Wales to deal with river and sea flooding. It uses quite a sophisticated range of communication methods to deliver clear warnings and advice. Ultimately, public confidence and support for the service depends on the accuracy and reliability of the flood forecasting techniques which are used to generate the warnings.

Practice #55 (by Rebecca Whittle and Gordon Walker who thank Sam Brown for his help with this review)

Title/location/time: Heat-Health Watch Scheme/UK/Annually from June 1 to September 15

Type of hazards and the risks involved: Heat waves

Position in the risk cycle and measures: Non-structural prevention/preparation measures and warning

Purposes/functions of communication: Informing the public and social and healthcare services to prepare for and take specific actions to help people stay safe in the event of a heat wave.

Actors in communication: Experts to stakeholders and general public at national level.

Communication tools, channels and time dimension of communication: The Heat-Health Watch Scheme (HHWS) is run by the Met Office in conjunction with the Department of Health (DoH) and comprises four levels of alert which are triggered by regionally specific daytime and nighttime temperature thresholds. The scheme includes websites giving advice on how to stay safe in the heat. The DoH also produces a number of advice booklets giving guidance on the Heat Health Plan. These are posted out at the start of the summer. During heatwaves, warnings are also given during routine weather forecast summaries on TV.

Appraisal of good and/or poor aspects of practice: The HHWS is a relatively new warning service that builds on existing Met Office efforts to provide warnings about other kinds of severe weather events. It is thus the first warning system in the UK to deal with heatwaves and therefore represents an improvement on the previous situation where no warning system was in place. The scheme also makes some provision for proactive warning (i.e. when there is a likelihood of a heatwave but before the requisite temperatures have been reached). This is important as research has shown that it is important for health and social care services to be properly prepared as, without preventative action, the onset of a heatwave can very quickly prove fatal to vulnerable residents. The scheme is yet to be extensively tested, although there are a number of criticisms which can be applied to it. Firstly, there is low awareness of the HHWS amongst frontline staff working in care homes for the elderly, where residents may be particularly vulnerable to the effects of heat, because the advice booklets are posted out to managers who may not pass on the advice to care staff. There is also an issue with the timing of the advice. The booklets are sent out at the start of the summer and, consequently, they are often filed away and not communicated to care staff by the time any heatwave arrives. Finally, evidence suggests that uptake of the advice given in the booklets may be low amongst care homes. Clearly there is much variation between homes with much depending on how aware managers and care home inspectors are. Some inspectors do not know about the HHWS, while others may be aware but not make any modifications to their inspection regime as a result. Research also suggests that, rather than following the advice in the booklets, frontline care staff prefer to use their own cooling practices, regardless of how effective they may be.

Contribution to social capacity building: Depends on the personal interest, motivation and need of individual users to learn about the effects of heatwaves. The websites and associated booklets provide advice on staying safe in the heat but whether this advice is acted on is down to personal choice.

Relationship to social vulnerability: Although the website and associated booklets are available to everyone, they are targeted particularly at vulnerable groups and those caring for them (i.e. older people, care home managers and social care professionals).

National setting: The HHWS embodies national practice for heatwave preparation and warning.

General reflection: The scheme is relatively new and has yet to be thoroughly evaluated. It was used in the July heatwave of 2006 and mortality during this time was considerably lower than it was in 2003 (when the scheme wasn't in operation). However, researchers have yet to confirm whether this was as a result of the scheme or other factors because, as yet, there have been no studies comparing these events directly.

Practice #56 (by Rebecca Whittle and Gordon Walker who thank Heather Chappells and Alison Browne for their help with this review).

Title/location/time: Communication about drought conditions/UK/during times of water scarcity

Type of hazards and the risks involved: Drought and water shortages

Position in the risk cycle and measures: Non-structural measures focused on the prevention/preparation phase – the goal is to help people to change their behavior and day to day water consuming practices so that more serious drought conditions do not arise.

Purposes/functions of communication: Informing and triggering awareness in order to try and persuade consumers to change their water consuming practices. In addition to telling consumers what they should/shouldn't be doing, the campaigns aim to explain to people how and why the water supply system works as it does (for example, the function of reservoirs, aquifers etc.) so that people support the water conservation measures being put in place. A more recent tactic is to highlight infrastructural improvements in order to send out a positive message about the steps being taken by water companies to alleviate drought by plugging leaks etc.

Actors in communication: Main actors are the Environment Agency (EA), water companies and consumers. The EA has a significant coordinating role in drought communications and there have been calls for this regulatory role to be strengthened (see O'Connor 2007). This would allow companies to be distanced from the decision to 'impose' restrictions on use so that customers see the EA as responsible. The Consumer Council for Water is another important actor. Indeed, it is argued that CC Water should have a stronger role in reinforcing communications of risk to consumers (another argument for this is that it would mean communications would come from a more trusted source than private water companies (O'Connor 2007)).

Communication tools, channels and time dimension of communication: During a drought, the EA coordinates a communications and media strategy to ensure that appropriate messages are being communicated to the areas affected by the drought. Information about current water status and any use restrictions (such as bans on the use of hosepipes in gardens, irrigation status etc.) are available from the EA website. Other tools include the use of local/national TV and radio, though there is local variation as individual water companies are also given freedom to work out their own communication strategies about the implementation of water reducing strategies such as hosepipe bans. When there is no drought, individual water companies work in tandem with the Non-Governmental Organization, Waterwise, to communicate water-saving tips to householders through advice leaflets included with bills, webpages, etc.

Appraisal of good and/or poor aspects of practice: Water management in the UK is hindered by a fragmented approach whereby each individual (privatized) water company makes its own calculations for establishing whether it has enough water to meet the predicted demand. Therefore determining what counts as a drought (and thus which communication strategies are employed) varies regionally, depending upon the strategy of the water company in question. The fragmentation resulting from privatization also leads to a lack of consistency as a result of the way in which jurisdictions are carved up. For example, households on one side of the street can be experiencing a hosepipe ban while those on the other side do not. Risk communication campaigns have also encountered skepticism from the public due to well-publicised reports of water companies wasting water through leaks. Also, while there is a general move towards more consistent messages in order to address the fragmentation problem, some managers also support the need for more localised communication strategies. For example, companies who are doing a good job managing water are sometimes reluctant to initiate specific campaigns asking consumers to save water at times of drought even if this is perceived as being for the greater good by the EA. They argue that they are being penalised for mismanagement elsewhere. Furthermore, some companies prefer to initiate longer-term campaigns for water saving and efficiency in order to make this normal behaviour rather than a specific response to drought. They argue that more reactive strategies are ineffective and represent a failure in terms of demand management.

Contribution to social capacity building: Improving levels of trust between consumers and water companies remains a major challenge for the future.

Relationship to social vulnerability: Vulnerable groups do not receive specific attention in communications about drought. However, in a 'non-drought context' they are increasingly the focus of dedicated communications (and actions) on 'water debt' (more than five million households in the UK currently owe money on their water bills). For example see: http://www.ofwat.gov.uk/publications/prs_web_1002baddebt

National setting: As the UK is generally regarded as a wet country, drought communications are perhaps not treated as seriously as those pertaining to more 'common' hazards, such as floods.

General reflection: There have been no specific evaluations of drought communication practices – although CC Water undertook a study called 'Using Water Wisely' in 2006 (Consumer Council for Water 2006) which looked at how water companies communicate with their consumers about water saving in general. This did offer some insights into consumer perceptions of companies' drought communication campaigns.

Practice #57 (by Simon McCarthy)

Title/location/time: Probabilistic flood forecasting and warning / UK / continuous

Type of hazards and the risks involved: Rainfall, snow and flooding

Position in the risk cycle and measures: Warning

Purposes/functions of communication: There is a distinction between forecasting and warning. Two functions either to provide a forecast of possible heavy rainfall or snow events or to provide warning of possible flooding. The forecasts and warnings are given as a percentage probability of an event occurring.

Actors in communication: Experts to general public at national level for rainfall and snowfall forecasts of events. Experts to experts at national and regional levels for forecasting and flood warnings.

Communication tools, channels and time dimension of communication: Forecasts originate from the generation of ensembles forecasts which are in turn interpreted into a probability of an event. The ensembles themselves could be used to communicate between professionals illustrating the uncertainty in the forecast but currently such interpretation is held with the generators of the ensembles. The interpretation in the form of rainfall and snow forecasts are communicated through an integrated national forecast delivery using a Website (www.metoffice.gov.uk), risk map at national and regional level and text in the form of percentage likelihoods. Multi-media capabilities are available depending on the recipient professional responsibilities or the public. These include channels of regular national and regional broadcast media and targeted electronic media. Probabilistic forecasts also feed into warnings in the form of an Extreme Rainfall Alert Service (ERA) focused on surface water flooding. It is composed of a daily guidance statement when a 10% or greater probability of certain set thresholds that indicate surface water flooding might be met. At a 20% or greater probability an alert is issued. Guidance and alerts include mapped extent and guidance to actions. They are sent to professionals by email (including pdf attachment), fax, SMS and auto-voicemail.

Appraisal of good and/or poor aspects of practice:

Both forecasts and warnings are heavily dependent on weather monitoring and modeling technology. These dictate the certainty with which a forecast can be made at a certain time in advance of the event. The technology also dictates the resolution at which the forecast can be made so how certain it will affect a particular area how certain we are of the size of that area and the time it will occur. These issues are closely linked with both professionals' and the public's ability and confidence to take action as a result of the forecast or warning. While rainfall and snowfall forecasts are becoming well established the ERA forecasts associated with surface water flooding both in terms of technologically and systems continue to develop. A recent development has been the integration of ERA into an established Flood Guidance Statement so that surface water information is now part of a daily assessment of river and coastal flooding. Concerns regarding probabilistic forecasts and warnings is that the recipients do not truly understand the meaning of the probabilities and so require training. Once understood appropriate abilities and actions also need to be defined. For ERA improvements in technology are required to provide actionable levels of probability and better defined areas that might be affected. Better defined channels and more targeted information is currently being addressed.

Contribution to social capacity building: To provide a clearer and wider window of opportunity to take action to mitigate the consequences of an event. At a regional level authorities can put emergency plans into action and better focus activities. At a local level this can involve individual behavioural actions and actions by the authorities or communities themselves.

Relationship to social vulnerability: Targeted communication for the professionals but not currently for the public. With improved forecast technology the communication will become more relevant to those communities vulnerable.

National setting: Probabilistic forecasting and warning is viewed nationally as an improvement to inform forecasting and warning activities.

General reflection: Use of probabilistic forecasting and warning is still in its early stages of development both in terms of the technology and the decision making processes. Apart from extreme rainfall alerts it currently informs or runs in parallel with conventional methodologies.

Practice #58 (by Rebecca Whittle and Gordon Walker)

Title/location/time: Flood Recovery 'snakes and ladders' game/ UK/ continuous

Type of hazards and the risks involved: Floods – loss of home and possessions

Position in the risk cycle and measures: Non-structural prevention/preparation measures and recovery

Purposes/functions of communication: Informing to build up knowledge on impacts of flood recovery and train recovery workers; Facilitating mutual exchange/understanding and improving relationships between flooded residents and stakeholders/policy makers on risks and on how to act.

Actors in communication: From national and regional-level stakeholders and policy makers through to general public at local level. There is a version of the game for adults and one for children.

Communication tools, channels and time dimension of communication: Flood Snakes and Ladders is an interactive flood recovery simulation tool which illustrates the processes and difficulties experienced by residents who have to recover from a flood. Drawn from the results of qualitative research into flood recovery (see www.lec.lancs.ac.uk/cswm/hfp) it uses floor tiles, a giant dice and a linked PowerPoint to guide the players through the recovery process, from the initial stages of losing their possessions through to managing builders and insurers, choosing new things and finally moving back home. The game is played as a one-off activity and can be used in classrooms (with students), on institutional training courses or at workshops with academics and stakeholders.

Appraisal of good and/or poor aspects of practice: In terms of its specific advantages, the game provides an informative yet entertaining means of allowing people to learn more about the flood recovery process – and the frustrations and setbacks involved. It is very flexible and can be easily adapted for use with a wide range of actors, ages and group sizes. The fact that it is designed as a 'game' has the effect of breaking down barriers and diffusing some of the tensions that can arise when discussing flood recovery in a mixed group of residents and stakeholders. There are no specific elements of 'poor practice' involved in the game, although it only exists in prototype form at present, and is therefore not yet available to a wide audience.

Contribution to social capacity building: In every case where it has been used, the game has increased people's knowledge and understanding about the difficulties involved in flood recovery. Especially where it is used as part of a broader group discussion process it can be very effective in changing stakeholder and policy maker attitudes towards flood recovery. It can also encourage reflection on ways to build resilience for the future.

Relationship to social vulnerability: The game does not address this specific issue directly. The experiences of vulnerable residents (for example, those with disabilities or without insurance) do arise during the game and can be highlighted by the facilitator, although the game could be modified to make these factors more explicit.

National setting: Floods are an increasing problem in the UK but there is, at this stage, little awareness of the recovery phase. This, combined with the fact that the game is interactive in character, makes it an innovative approach to risk communication in the UK context.

General reflection: The game has been reviewed and modified through pilot studies.

Practice #59 (by Nigel Watson, Rebecca Whittle and Gordon Walker)

Title/location/time: Flood Map/ UK/ continuous

Type of hazards and the risks involved: River and sea floods – hazards to people: death, injury, disease; hazards to goods – property damage, loss of communications links, economic loss.

Position in the risk cycle and measures: Prevention/preparation – a non-structural measure but can be used as aid to implementation of other structural and non-structural measures. Implementation.

Purposes/functions of communication: Informing to build up awareness and knowledge of the risk of flooding and to encourage people living and working in areas prone to flooding to take appropriate action. Flood maps can also be used in land-use development planning and those wishing to apply for planning permission to build a new property. Reassuring members of the public who are worried about potential flood risk in their area. Facilitating mutual exchange/understanding and improving relationships among those with responsibilities for land use planning, water management, emergency services and members of the public in at-risk areas.

Actors in communication: Maps produced by a regulatory and management agency (Environment Agency) in England and Wales for use by insurance industry, land use planners, the emergency services and members of the public.

Communication tools, channels and time dimension of communication: Flood Map is a multi-layered map providing information on flooding from rivers and the sea for England and Wales. Information is also provided on flood defences and the areas currently benefitting from flood protection. This is an on-line communication tool which can be interrogated using simple post code information to learn about the types of flood risk and the levels of protection in a particular geographical area.

Appraisal good or/and poor aspects of practice: Good practices: Flood Map provides several layers of information, including the natural flood plain area without defences that could be affected by a 1 in 100 year (1%) river flood or a 1 in 200 year (0.5%) sea flood. The Map also shows the extent of an extreme flood with a 1 in 1000 year (0.1%) return period and also the locations of flood defences. This gives an indication of the areas that would flood if the defences were not in place or were no longer maintained. Flood Map is updated four times each year, in January, April, July and October. Poor aspects: Maps do not show all areas benefitting from flood defences as the Environment Agency only has powers for main rivers. Additional defences constructed by local authorities or private organizations on non-main rivers may not be shown. Flood Map does not provide information on flood depth, speed or volume of flow. It does not show the risk of flooding from other sources such as groundwater, sewers or direct runoff from the land surface. The Map provides an indication of the general level of flood risk in a given area but is not sufficiently detailed to show the risk to individual properties.

Contribution to social capacity building: Theoretically, Flood Map is an important tool for raising awareness and promoting flood damage prevention and better preparedness. However, there is little documented evidence at present on the actual use of Flood Map at the community level. The Environment Agency can only advise land-use planners on the risk of flooding at proposed development sites and does not have legal powers to stop development. As such, the positive impact of Flood map on social capacity building and community resilience is difficult to substantiate.

Relationship to social vulnerability: Flood Map does not include information on social or economic variables which might contribute towards, or indicate the existence of, social vulnerability.

National setting: Floods are a significant problem in the UK and there is increasing emphasis nationally on individuals and communities taking more responsibility for their own safety and property through better preparedness. Flood Map is indicative of this shift in approach.

General reflection: Flood Map is one of the most significant non-structural measures currently in use in England and Wales and reflects a recent policy shift away from the prevention of floods using structural measures and towards the prevention of flood damage through increased public awareness and preparedness.

Practice #60 (by Corina Höppner)

Title/location/time: 'Making people flood wise' flood awareness raising campaign, Environment Agency, UK; continuous since 1998

Type of hazards and the risks involved: Fluvial and coastal flooding

Position in the risk cycle: Prevention/preparation: information and warning.

Purposes/functions of communication: To raise awareness, to inform to encourage people to prepare in advance of flooding and to take appropriate action in response to flooding, and to build trust within communities.

Actors in communication: Environment Agency, local champions and local partnership organisations to the public at-risk (people living, working and travelling in flood risk areas).

Communication tools/channels: Mainly through one-way communication tools and through diverse channels, e.g. advertising in local TV, radio, press, floodline pack and directories, flood guides, flood product booklets, business online flood guide, flood warning services and public events such as Gardeners World and a Flood Awareness Week.

Appraisal of good or/and poor aspects of the practice: The practice stands out as a multi-step and long-term communication strategy that is well planned from the outset and that changes its focus and its contents according to the needs of the audience, i.e. year 1: raising awareness, year 2: transfer of awareness into action, years 3-5: maintain awareness and encourage action, year 5: information and support to take action, years 6-7: maintain awareness and focus on specific groups, years 8-9: maintaining awareness, information and support at the local level, year 10: community engagement and trust building, year 11 and onwards: local and targeted activities. The needs of the audience were investigated and the results were used to develop the communication programme. Celebrity endorsement helps to gain peo-

ple's attention. A diversity of communication tools and channels are used and the target levels of the communication programme are clear, and are being evaluated across all eight targeted regions. Indirect and face-to-face communication are coupled as the latter seems to be most effective in encouraging people to take preparatory actions.

Contribution to social capacity building: The practice aims at raising risk awareness of at least 55% of the audience. Of those who are aware of the risks, 63% should take preparatory actions in advance of flooding. 10% of 'vulnerable' people should be informed of their flood risk.

Relationship to social vulnerability: The practice included communication activities targeting different vulnerable groups, e.g. the elderly and infirm, young parents, socially deprived people.

National setting: The practice is a key part of the UK Flood Warning Investment Strategy and funded with £2 million per year.

General reflection: This description of the practice is based on materials released by the researchers involved in the project and the Environment Agency.



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