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**European Flood Risk
Management Research**

**2nd ERA-NET CRUE Research Funding Initiative
Flood Resilient Communities – Managing the Consequences of Flooding
Final Report**

CRUE Final Report

FREEMAN- Flood Resilience Enhancement and Management: a pilot study in Flanders, Germany and Italy

Prepared by the Joint Project Consortium consisting of

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Second Era-Net CRUE Funding Initiative: Flood resilient communities – managing the consequences of flooding

CRUE Research Report

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ERA-Net CRUE was funded within the Sixth EU Framework Programme and introduced structure within the area of European research on flood risk management (FRM). Its vision was to support and develop an extensive co-ordination and integration of regional, national, and European research programmes, projects and policies in the field of Flood Risk Management. Within the CRUE ERA-Net two funding initiatives were introduced.

The second ERA-Net CRUE Research Funding Initiative “**Flood Resilient Communities – Managing the Consequences of Flooding**” was launched in support of the EU Floods Directive 2007/60/EC, which was introduced as a result of several severe flood events causing loss of life and property. Within this initiative seven joint research projects with test sites all over Europe are funded and focus on a broad spectrum of issues related to the enhancement of resilience. Besides, the scientific coordination project CORE CRUE is funded within this second call, to support the implement of the call and to disseminate its results.

FREEMAN - Flood Resilience Enhancement and Management: a pilot study in Flanders, Germany and Italy

CRUE Research Final Report

Funded by

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A project fact sheet can be found at the end of this document.

Summary for decision-makers

Summary message

Floods can have devastating effects. In recent years people have come to realise that floods can not be entirely prevented, despite all technical engineering solutions. Furthermore, due to climate change it is expected that floods will occur more often in the future. In FREEMAN a methodology has been developed to screen a community for its level of resilience. The Resilience Checker provides a solid scan of the social 'soft' aspects of flood risk management in a certain area. It takes into account flood risk communication and perception, flood modelling tools and flood institutions.

What the report is about and why the work is important

The FREEMAN project states the following phrase as its subtitle and aim: "FREEMAN: Meaning that people become more free (of floods and uncertainty) if they are more resilient". Societies not only suffer the tangible loss of property, perhaps even casualties. Another intangible effect is the negative impact on the mindset of the people having lived through a flood event. Preparing for floods, both from a technical perspective as well as from the social resilience perspective, should make the flood event "manageable". Aiding society, decision makers, water authorities, etc. with ways of assessing their current level of resilience contributes to a better flood risk management in the future.

Aims and objectives

The overall aim of FREEMAN is to find indicators which can enhance the thematic concept as an overall level of resilience. The five main objectives are:

- To convey the concept of resilience to decision makers, flood managers and the general public, and help to translate its basic assumptions into flood management practices.
- To identify important factors that affect flood resilience as well as strategies and measures that increase flood resilience.
- To identify quick wins to enhance flood resilience on case study level.
- To provide guidance on the integration of flood resilience into flood risk management as a contribution to the implementation of the Floods Directive (FD).
- To spread project results to the policy level, as well as to the scientific community.

In the end, it will be the community that benefits from the measures that can be taken to enhance resilience. The tool itself is aimed at policy makers, water authorities and other stakeholders who are professionally involved in flood risk management.

Results and key findings

One of the main results is the actual methodology that has been developed. The process is shown in the Figure 1 below.

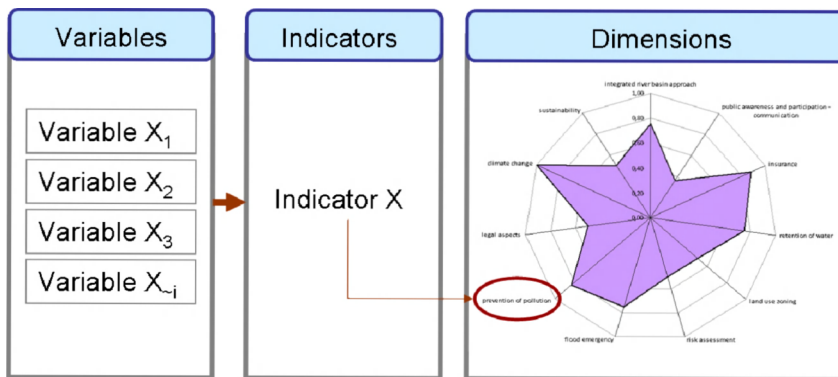


Figure 1: The FREEMAN methodology

Applying the methodology results in comparable diagrams like displayed in Figure 2. It shows the final results of the three dimensions “policy & institutions”, “flood management tools” and “risk communication and perception”. The score attributed to each of the arms of the triangular diagram is created by measuring all the separate indicators, which in their turn are measures by several variables, as explained in the spider diagram of Figure 1.

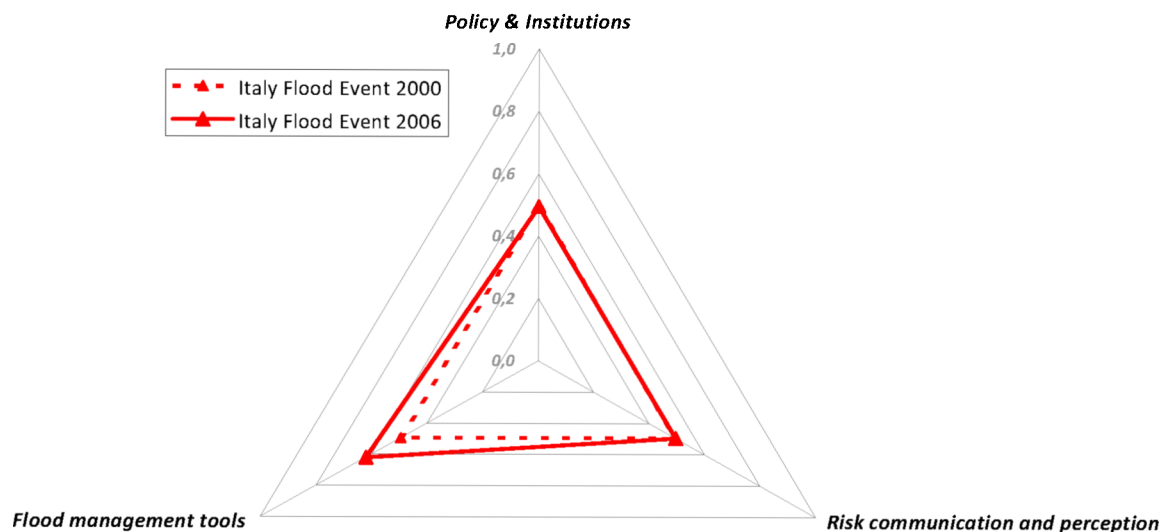


Figure 2: Overall level of resilience, example of the Italian case study

Using this methodology a set of measures to enhance resilience has been created. These measures can be applied on the long, middle or short term. The measures that can be applied on the short term have been called “quick wins”. Most of the proposed measures stem from the principle of applying minimum effort while having a major impact.

The project results outline the role of and contributions from various organisations, involved or affected by the flood risk management, towards an integrated disaster risk reduction strategy. Furthermore, the project has produced case studies that can be applied in capacity building exercises further enhancing the ability and skills of the above organisations. Furthermore, we have shown how flood risk tools (management plans and early warning systems) can be designed and deployed for a better understanding of risk. Equally important though is the recognition of the limitations of these tools, frequently documented throughout this document, that can inform efforts to understand one’s own vulnerability to floods.

The impact and acceptance of the FREEMAN effort is different in each of the case studies. The role of the project partners within the flood management structure differs as well. However, at the end all involved actors, especially the responsible authorities have to make a choice whether or not and to what extent the ideas stemming from the FREEMAN research are incorporated.

Implications for stakeholders

Since FREEMAN targeted several layers of society there are different implications for different stakeholders. Starting from a bottom-up approach implications for the general public are discussed first. Most relevant implications for lay people and local residents refer to risk communication and perception as well as informal social networks. If (potentially) affected residents have a high level of awareness responsible authorities may expect a higher level of preparation. Risk awareness could enable people to conduct a risk-benefit trade-off. The result may be an individual's decision for taking the risk, because the effort of protection is too high. This might be the responsibility of the individual, but can at the same time be an additional risk for other members of the community. In other words, risk awareness does not necessarily entail risk preparedness.

Information provision, consultation and education are tasks that should not stringently be provided by the responsible authorities. Flood managers should make sure that relevant knowledge is easy to access and understand. This also holds for monitoring- and early warning systems: flood managers must provide sufficient, comprehensible and easy to access information for lay people.

For flood management authorities this implies a permanent incorporation of stakeholder interests in their flood management activities. Flood management plans should be reviewed by local stakeholders with a chance of co-operation, and if necessary with a more interactive consultation and learning process. Flood monitoring and flood forecasting tools (only the front ends) should be easily accessible and comprehensible for lay people.

Stakeholders (both experts and lay people) have to accept their own role as well as the role of the other stakeholders concerning flood risks. This requires a minimum amount of pro-activeness to ensure a high level of resilience, and not to merely cope with the flood when disaster strikes.

Recommendations for decision-makers

Modern flood risk governance recognises the importance of all stages of disaster risk management, including prevention and protection, preparedness, response and recovery. All the stages have to be well integrated and balanced in terms of resources and attention it is given. This goes for all three aspects of resilience that have been taken into account in this research, but these are not exhaustive – there is more to resilience than only those aspects covered here.

The following four sections of recommendations have been deemed the most important:

- Understanding lessons from past disaster strikes
- Consideration of future climate and environmental changes, and social trends
- Independent assessment of the risk governance: legislative gaps, enforcement of the policies
- Public participation in the course of the Floods Directive implementation

In order to enhance the level of resilience a thorough understanding of the community at risk should be made. This overview should not only encompass just the hazard maps or just the damage map, but one should look further. The past disaster offer costly, but valuable lessons. These lessons need to be understood and translated into tangible improvements of risk governance. This is far from being a common practice.

In the future it is expected that flood will occur more often. Whether this is due to climate induced changes or man made changes to natural environments (e.g. canalization and urbanisation), floods should be considered as a serious risk. Therefore we recommend that the authorities in charge consider intensity and frequency of future floods, especially for the planned structural defence measures and also the non structural measures. The flood risk management should be closely coordinated with the adaptation strategies to climate change and closely related to spatial planning.

It is a best practice to initiate an independent, external review of performance, strengths and weaknesses of flood risk institutions. We believe that it is in the interest of each flood risk management organisation to initiate a similar review in the context of the their flood risk management. The European Commission could develop guidance and establish best practices for such a review exercise.

Finally, involving the public should be given priority. Nowadays communicating about flood risks is still in its early stages, whereas it becomes more obvious nowadays that in order to manage a flood you need the support of the community. They need to deal with the effects, so they should have realistic information about the possible risks and tangible advice on how to deal with them. Early warning systems provide a technical benefit that could be exploited much more effectively in communicating with the general public. Involving the public in early stages could enhance their awareness and their preparedness.

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1 Introduction

The objective of the FREEMAN project is to assist efforts in improving the resilience of communities in flood prone areas. The overall aim is to design a framework and define indicators and measures of resilience. In doing so, FREEMAN will be able to provide guidance on the integration of flood resilience into operational Flood Risk Management and provide practical policy recommendations to help the implementation of the EU Floods Directive (FD).

Three fields of interest are defined in the project: flood risk communication (WP2), flood modelling tools (WP3) and flood institutions (WP4). These three fields were all expected to effectively contribute to overall flood management of any given area, and thus offering potential for enhancing its resilience. Proper flood risk management not only includes technical measures but pays equal attention to managing other issues such as the social aspects.

First, the question arises of defining flood resilience; a non straightforward task. There are many definitions, stemming from many different origins. Today, this ambiguity is a hindrance in using the concept of resilience in practice. After an extensive literature review (see also chapter 5.1), the FREEMAN project decided to define resilience as adaptive capacity. FREEMAN uses the following definition: *“resilience is the ability to cope and respond before, during and after a hazard occurs. Resilience is about returning to the original state or beyond”*. Resilience is an ongoing dynamic process, which will not only return to its original equilibrium, but preferably will gradually increase its equilibrium to a higher level. This pragmatic hypothesis was tested during the project and appears to be a promising approach to bring resilience into operation. The baseline is clear: increasing flood resilience has the potential to further reduce flood risk, and to lower the potential damage. Consequently, this will decrease the level of vulnerability. Here, vulnerability is seen as an overarching concept including resilience, sensitivity and exposure. This is illustrated in the figure below and is discussed in more detail in 5.1.1.

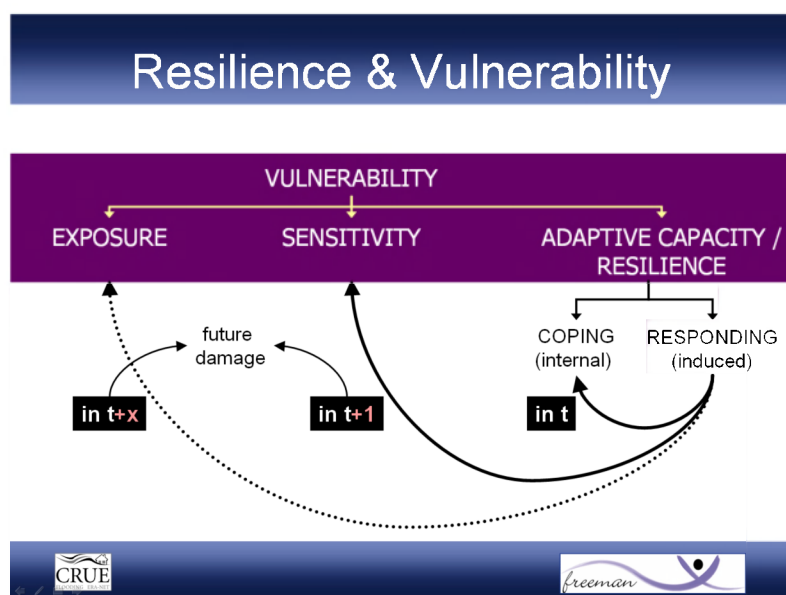


Figure 3: Resilience according to FREEMAN

FREEMAN focuses on two specific aspects of resilience: social resilience and institutional resilience. The municipality is considered as the basis of community-resilience. We argue that people living in the same geographic entity are characterized by a common group of needs that identify a community (shared interests). In order to improve resilience an effective interaction and coordination within all scales (national, sub-national, local, individual) and sectors (mainly river basin management and emergency response) involved is required.

This report describes the overall FREEMAN research, focussing on how to define resilience, how to measure resilience and how to effectively put it into practice. These targets are accomplished on the basis of the three main pillars of the project: flood risk communication, flood management tools and flood institutions.

2 Objectives

The overall objective of the FREEMAN project is to assist efforts to boost resilience of communities in flood prone areas. The project's main aims are threefold:

- to identify important factors that increase flood resilience and formulate strategies and measures that enhance flood resilience;
- to provide guidance on the operational use of 'flood resilience' for flood risk management (FRM) and;
- to provide practical policy recommendations to aid the implementation of the EU Floods Directive (FD).

From the three main goals of the FREEMAN project following five objectives were derived:

- To convey the concept of resilience to decision makers, flood managers and the general public, and help to translate its basic assumptions into flood management practices.
- To identify important factors that affect flood resilience as well as strategies and measures that increase flood resilience.
- To identify quick wins to enhance flood resilience on case study level.
- To provide guidance on the integration of flood resilience into flood risk management as a contribution to the implementation of the Floods Directive (FD).
- To spread project results at the policy level and to the scientific community.

3 Methodology

This chapter provides a short summary of the developed method. More information and details can be found in chapter 5.

3.1 The resilience checker

3.1.1 Context and aim of method

The aim of the resilience checker is to give an indication of the overall level of resilience by means of visual representation. This is created by a global analysis of the three pillars: risk communication (see chapter 5.2), flood management tools (see chapter 5.3) and flood institutions (see chapter 5.4).

Field of application

Forecasting & warning, risk communication, risk governance

Within the resilience checker, three essential resilience dimensions are considered: flood management tools, flood institutions and flood risk perception and communication. In order to effectively assess each of the dimensions, a set of indicators and variables have been defined. The level of resilience can be assessed through a stepwise approach. The first step consists of a detailed investigation of the target area:

- Overview of the institutional organization of the area (see chapter 5.4)
- Overview of flood risk, available tools and maps (see chapter 5.3)
- Overview of effected population (see chapter 5.2)

This creates the qualitative basis defining the gaps, strengths and weaknesses. The next step is to go more in depth. This step allows further quantification of the variable set, which results in a separate, unique score per variable. During the final step the variables are being grouped into their original dimensions by means of a validated methodology. A unique score is thus retrieved, giving a powerful and useful indication of the overall flood resilience within the target area. The scores for the different variables and indicators are automatically standardized and produce values between 0 and 1. Very weak is represented by score '0' and '1' stands for very strong/outstanding. These scores are presented by means of spider diagrams, as illustrated in Figure 4

3.1.2 How to apply the method

Input and resources

The following data gathering methods were used: (digital) questionnaires (chapters 5.2 and 5.3), desktop analysis (all chapters), interviews (all chapters), expert-judgement (all chapters) and GIS analyses (all chapters).

Two types of interview were conducted: structured and semi-structured. Structured interviews contain a fixed list of questions. The scales (answer categories) are predefined beforehand and cannot be changed while executed. This guarantees the result of the case studies to be similar in form and results. Semi-structured interviews were developed especially within the context of chapters 5.3 and 5.4. This type of

interview allows the respondent (e.g. experts) to provide more information and elaborate on the context. The trustworthiness of the answers to the questions was checked. This was done by including several ‘key’ questions measuring the same, but by formulating the same question in a different way, the trustworthiness of the answers could be checked.

Expected results

To measure these dimensions a set of indicators and variables had to be defined. Data triangulation is advised by using multiple variables and sources. When the input of the variables has been fed back to the resilience checker, the results can be displayed as star diagrams.

Assessment of results

In order to effectively analyse the results it is essential that all variables are measured. To guarantee this, structured questionnaires are used. Without a complete overview of the indicators the resilience checker will result in a too narrow view of the area to be analysed. Furthermore, one should stick to the definitions of the variables, as it should measure what its designed for.

Scale of application

At all chosen scales (ranging from the basin level to national and cross national), the method does not depend on time or scale.

Degree of implementation

The method can be applied by policy makers, decision makers, water authorities, risk assessment experts and others.

3.1.3 Example

The figure below depicts the process and results of the analysis of “Flood Management Plans” in the case study of the Demer Valley in Flanders.

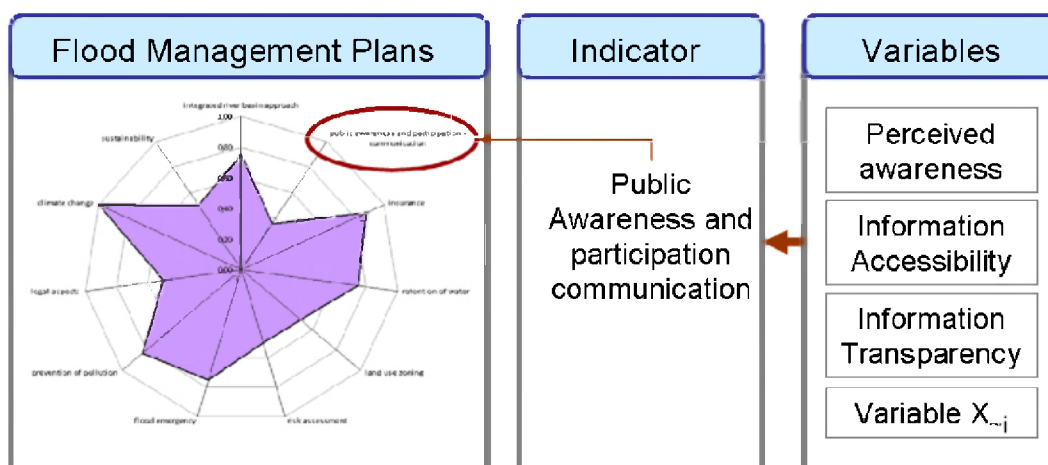


Figure 4: Flemish results: Flood Management Plan

4 Case studies

4.1 Innerste basin, Germany

The Innerste river basin covers a surface of 1264 km². It originates in the mid-range Harz mountains, and has its main stretch in the hilly landscape of the Harz foot hills. The Innerste is a tributary of the Leine river, which flows into the Weser. The Weser catchment is the 4th largest river basin in Germany. The Innerste river is mostly a rain-fed river with a small and variable snow-melt contribution. The Innerste river has a reservoir 'Innerstetalsperre' in the Harz mountains. Floods are generated after long-lasting precipitation periods, mostly coupled with intense rainfall events.

4.1.1 Main characteristics

Major type of flood: pluvial

Size of catchments area: 1264 km²

Past flood events: Winter 1925 including ice sheet jams, Summer 1971, September 2007, August 2010 (very high water levels, but no damage)

Environmental settings: The Innerste river has higher-level water quality, 'Gewässergüteklasse' (GWK I-II) in the Harz mountains. Further downstream the water quality declines remarkably (GWK II-III). This is due to the heavy metal sedimentation from historical mining activities (Pb, Zn, Ca). The reservoir 'Innerstetalsperre' (139 ha water surface) has a number of functions such as drinking and industrial water supply, flood protection and recreation. The Innerste river has a small number of tributaries such as Neile, Nette and Lamme. The Nette rivulet, for example, accumulated a significant amount of water, which was a main thread in Holle during the 2007 flood.

The Innerste river flows through three designated nature protection areas: "Mittleres Innerstetal mit Kanstein" since 2008; "Mastberg und Innersteaue" since 2008 and "Haseder Busch" since 1974.

Socio-economic settings: The largest municipalities along the Innerste river are Hildesheim and Salzgitter, which are classified as large Cities 'Großstadt'. Furthermore, there are two smaller towns Langelsheim and Sarstedt, and 10 smaller municipalities along the 100 km river stretch. Especially, the Harz mountains have a history of mining. However, all mines are abandoned for more than a century. Currently, supplying industry and smaller units of metal-working industry produce industrial goods within the Innerste river basin. The landscape, however, is characterised by agricultural production. In the case of inundations agriculture is thus the most threatened sector, including pollution by heavy metals. After the flood of 2007 the Leine-Innerste system is classified as a flood-prone area. For this reason a particular flood management plan is being developed.



Figure 5: The place-name sign of Holle during the flood of 2007

4.1.2 Level of stakeholder involvement

Before approaching stakeholders such as responsible authorities, a stakeholder analysis was conducted. This has been accomplished through a literature research and phone calls. Later on during the interviews a list of potential stakeholders and authorities was presented to the interviewees. They reviewed that list according to their own perspectives of who are the relevant stakeholders. Due to the institutional structure of the federal state of Lower Saxony, the research team tried to cover all relevant institutional levels: federal state, district and municipality. Furthermore, two main methodological approaches have been chosen: 1) semi-structured interviews with 'experts' (representatives of relevant institutions) and an online survey for the public in the Innerste river basin. For the municipal level there was a focus on the municipality of Holle, since there was not enough capacity to interview representatives of all municipalities in the Innerste catchment. The term 'community' of resilience was therefore applied to the municipality of Holle including the official authorities and residents.

Table 1: List of relevant stakeholders and there functions

Stakeholder	Function	Level of activities
NLWK	Flood protection, flood management, planning, rules and regulation, nature protection, planning permissions	Federal state
Untere Wasserbehörde	Water management, crises management, planning permissions	District level
Police department	Crisis management	District level
Harzwasserwerke	Reservoir management, drinking water supply	Local level (relevant for the entire river basin)
Gemeinde Holle	Planning and implementation of flood protection measures, informing and supporting residents, land use planning, crisis management	Local level

The stakeholders in Table 1 were interviewed. Furthermore, the research partner maintained phone contact on a regular basis. Residents had the possibility to fill in an online survey. Here as well, sporadic phone contacts were held. Both experts and lay people were asked for their views on the performance of the responsible authorities, the quality of communication and participation, flood forecasting, the performance of crisis management as well as flood management including preparation and post-flood mitigation and individual flood-risk perception.

4.1.3 CRUE activities

The site as a pilot:

During the entire summer of 2007 long lasting precipitation resulted in exceeding the water retention capacity of the Innerste river basin. Moreover, a number of consecutive rainfall days generated a flood with a number of serious consequences: The gauging station of Heinde reported a water level of 6.75m, which is the highest since the beginning of the records in 1952; the rail way tracks between Hildesheim and Goslar was interrupted; the municipality of Baddeckstedt was inundated to a great extend; the dikes in the vicinity of the municipality of Hockeln breached with the result of inundating an entire business area; and a number of homes were flooded in the municipality of Holle.

As a consequence of the flood the crisis management system was reviewed and improved. Furthermore, the Leine and Innerste river basins will have a particular flood management plan. A new flood forecasting centre was founded in Hildesheim and is now in a testing phase.

For the FREEMAN project the flood of September 2007 was examined with more detail, and with focus on the municipality of Holle. Post-flood activities and the high water levels of August 2010 have been taken into consideration.

Keywords/topics:

Resilience, flood forecasting, risk communication, participation, crisis management, risk reduction, flood-risk management.

Methods applied:

semi-structured interviews with representatives of the responsible authorities, online survey with the public

Methods developed, tested and validated:

resilience assessment developed, tested and validated among the three case studies.

4.2 Demer basin, Belgium

The Demer river basin covers 1920 km². It is a typical lowland river, and part of the Scheldt river basin. The Demer is mainly a rain-driven river that reacts quickly upon precipitation with high peak discharges. Flooding occurs usually after heavy, long-lasting rainfalls.

4.2.1 Main characteristics

Major type of flood: Fluvial, Pluvial

Size of catchment area: 1920 km²

Past flood events: Winter 1966-1967, October 1974, Spring 1987, Spring 1988, 25 December 1993, 30 January 1995, 13-14 September 1998, February 2002, Augustus 2002, December 2002-2003, January 2004, January 2007, November 2010.

Environmental setting: The Demer used to have an important function as waterway. This was the prime reason for its near-complete canalization and straightening (normalisation) in the 19th century. Nowadays the Demer is no longer suitable for transport and shipping, but the downstream branches are still categorized as navigable waterway. After historical floods in 1965 and 1966, more engineering measures were further applied by the authorities. This time to reduce the flood risk: enlarging and deepening of the river, eliminating meanders and constructing higher dikes. This approach was also necessary because of the insufficient water quality (chemical industry, pesticide use in fruit industry etc.). Although the water quality is now slowly improving, flooding is still detrimental for the fragile valley which has high nature value.

Socio-economic setting: During the 1990's a shift towards a more integrated water management. The flood events of 1998 and 2002 also triggered the development of two operational flood forecasting and warning systems for the Demer basin. Forecasts are only available for registered users. In 2007 an integrated water management plan was presented for the Demer river.

Socio-economic data give an insight in the population and the general prosperity of the area. The mean population density for the Demer valley is 357 inhabitants / km². This is below the mean population density for Flanders. The mean unemployment degree for Flanders is 7.06 % (Arvastat, 2010) which is higher than the percentage obtained for the case study area.



Figure 6: Picture of the Demer valley during 1998 flood Source: Agentschap Natuur en Bos, 1998

4.2.2 Level of stakeholder involvement

Stakeholders from every level of governance have been to some extent involved within the project. An analysis was performed of the current emergency management and of the current water management structure. As for the impact on our results it was essential in creating a thorough overview of the case study set up. In flood risk management it is important to know and acknowledge all the actors, and know their position and role in this field. By involving the organizing actors (like municipalities, water authorities and crisis response units), the project could find indicators contributing to good governance and best practices.

Within FREEMAN, the target 'community' for resilience is considered at four levels

- Individual: meaning the individual person
- Community: meaning a municipality, or system acting as a community (serving the same goals and objectives)
- Sub-national: this can be water basins, regions, provinces etc. This depends on the governmental structure of a country
- National: meaning the national government or national based institutions and organisations

The table below gives an overview of the involved stakeholders and actors.

Table 2: Interview overview – actors and representatives of Flanders (Case study Demer valley)

Actors and representatives - Flanders
Fire brigade (local)
Town Mayors (local)
Water authorities (sub-national)
Emergency department (national)
Emergency department (sub-national)
Civil protection (national)

A questionnaire was conducted with the aim to reveal the specific communication requirements of vulnerable inhabitants. Afterwards, an action plan for communication at case study level was designed and addressed to inhabitants and authorities. The main aim was to clarify the role of the authorities for inhabitants as well as the citizens' own responsibility. The existing flood forecasting tools were evaluated and recommendations were given to improve the utilisation of flood forecasting tools.

4.2.3 CRUE activities

This site as a pilot:

Periods of heavy and long lasting rainfall, caused severe flooding in the past. After the historical floods of 1965 and 1966, typical engineering measures were applied by the authorities: enlarging and deepening of the river, eliminating meanders and construction of high dikes. This engineering approach however could not eliminate floods completely.

Shifting insights towards integrated water management has resulted in 2007 in a new integrated water management plan for the Demer. An operational flood forecasting and warning system for the Demer basin was developed. In addition, a complete flood risk assessment is available including flood probability maps and associated damage maps. As a consequence of the strong involvement of Antea Group in the development phase, the available tools and data on flood risk management are well known by the project team and were readily accessible.

For this project, the focus is on the major flood events: September 1998 and December 2002. These are the floods which have led to the development of the currently available tools. In addition, further insights are gained from the recent floods of November 2010.

Keywords/topics:

Resilience, forecasting and warning, risk communication, participation, emergency, risk reduction, risk governance

Goals:

develop methods to compare resilience in case study areas, and use resilience as measure to guide flood risk management.

Methods applied:

structured interviews with key figures in emergency and flood management, survey among residents, questionnaire for experts

Methods developed, tested and validated:

resilience assessment developed, tested and validated amongst the 3 case study areas.

4.3 Calabria Region, Italy

4.3.1 Main characteristics

Major type of flood: flash flood and landslides triggered by intensive precipitation (3h max around 190 mm)

Size of catchment area: the floods in 2000 and 2006 affected areas of 50-100 km² along several creeks and torrents in 2006.

Past flood events: Major floods and landslides in 1931, 1951, 1953 (Reggio Calabria), 1972-73, 1996 (Crotona), 2000 (Soverato), 2006 (Vibo Valentia) and more recently 2009 and 2010 (Reggio Calabria).

Environmental setting: More than 90 % of the 15.079 km² is covered by hills and mountains that belong to Apennine Mountain Range. Due to the rough orography of this region and the quick hydrologic response of most watersheds, the floods develop rapidly during the rainy season and suddenly inundate the areas downstream. Most of the water courses are short and of torrential nature, called **fiumara**. Dry most of the year, they can get swollen quickly in case of intense precipitation and inundate the ample riverbed downstream.

Economic and social: Calabria is one of the 20 Italian regions, first-level administrative divisions of the state. Located at the south end of the Italian peninsula, the region is bordered by the Basilicata region to the north, by the Ionian Sea to the east and the south, and by the Tyrrhenian Sea to the west. The region extends on 15,080 km² (~5 % of the state territory) and is home to a population of 2,011,395 inhabitants (~3.3 % of the state total) (ISTAT 2010). With 133 inhabitants/km² the population density is far below national average ~200 in/ km² (ISTAT 2010). Out of the 20 regions, Calabria ranks 10th in terms of population and 11th in terms of area.

4.3.2 Level of stakeholder involvement

The CMCC team has conducted a series of more than sixty (60) semi-structured interviews with representatives of flood risk management institutions, citizens and experts in Calabria. The interviewed persons included representatives of the River Basin Authority; Reclamation Boards; Corp of Forest Engineers; Prefect; Layers and Attorneys; Regional and Provincial Government; Local administrations; Civil Protection, Regional Nature Protection Authority; Corp of Fire-fighters; Entrepreneurs; Civil Society Organisations and others. In addition, local experts, rescuers in the analysed flood events, and victims – survivors of the flood and/or their families were interviewed. Furthermore, a focus group discussion was organised with a randomly chosen set of 14 citizens from Catanzaro, Soverato and neighbourhood communities.

4.3.3 CRUE activities

The research activities in the Calabria case study include analysis of the risk perception and communication; performance of the early warning systems, evaluation of the predictability and return period of the analysed extreme events; and the normative and judicial review of the flood risk institutions at the national and regional scale.

The site as a pilot: The flood events analysed include the Soverato 2000 flood and Vibo Valentia 2006. Triggered by intense precipitation, the torrent Beltrame/Soverato turned early morning on September 10th, 2000, into a monster destroying anything in its way, including a camping site Le Giare. The death of thirteen victims, mostly physically impaired persons sparked a public outcry that unsettled the disaster risk governance in the country. On 3 July 2006, the suburbs of Vibo Valentia - Vibo Marina, Bivona and Longobardi were hit by flood triggered by torrential precipitation uphill. The flood claimed three casualties, and severely damaged property and industrial buildings. The flood had triggered a declaration of state of emergency and special flood management plan that had demanded stop of all new developments until after the flood defence measures are put in place.

Keywords/topics: resilience, flood forecasting, risk communication, risk reduction, flood risk governance

Methods applied: semi-structured interviews, focus group, text analysis, normative analysis of risk institutions and governance, analysis of legal proceeding, desk review, expert elicitation

Methods developed, tested and validated: resilience assessment developed, tested and validated among the three case studies



Figure 7: Place of the camping site Le Giare flooded on September 10th, 2000

5 Results and discussion

5.1 Framework development (WP1)

Chapter 3 provided already a short summary of the definition, which is used within the context of the FREEMAN project. The text in this chapter elaborates on the performed literature review and terminology used within the project.

5.1.1 Overarching framework

5.1.1.1 Theoretical framework

Investigating the social dimensions of floods, the concepts of vulnerability (V), adaptive capacity (AC) and resilience (R) are increasingly important. All three concepts have a rich history and their origins do not lay within the same research domain. Throughout the years, a wealth of definitions was developed, not only with different foci but also with different meanings across disciplines. Today, this plurality is a hindrance in understanding, communicating, and using the concepts. Since the focus of flood risk management is shifting from sole prevention to preparation the concepts of resilience and vulnerability can be useful concepts. Before any concept can be of effective use there is a need to clarify the concept, and place it in an operational framework. In this framework the history of the different concepts (V, AC and R) will be briefly discussed, and the FREEMAN approach will be introduced.

Besides the challenge that lies in the lack of clear operational definitions, intensive discussions on scale issues in the domain of vulnerability and resilience research exist. Scale effects are important for the conceptualisation of vulnerability and resilience, especially when V & R need to be put into practice. However, only few researches take the issue of scale into account. In FREEMAN we agree with the definition by Fekete (2009). A scale is the vertical axis along which any object of interest is ranked. Examples are administration scales (municipality, county, nation), ecosystem scales (micro-, meso- and macro scale). In order to improve resilience, effective interaction and coordination will involve all scales (national, sub-national, local, individual) and levels (mainly river basin management and emergency response) involved in flood risk management.

In order to better understand resilience as a concept and as a challenge one cannot overlook the concepts of vulnerability and adaptive capacity. The latter two are described below, placing resilience to be a “brother” or “sister” concept.

Social vulnerability

The concept of vulnerability finds its roots in the studies of natural hazards, poverty studies, geography and climate change research and adaptation studies (Janssen *et al.*, 2006; Schoon, 2005). This background in research domains makes it difficult to formulate a uniform definition of social vulnerability.

According to literature vulnerability generally includes attributes of individuals, groups or systems that enable them to cope with the impact of disturbances like for instance floods. Nonetheless, other terms like perturbation (stress, hazard), sensitivity, capacity of response, exposure and transformation are cited within the different definitions. These terms place the vulnerability concept within a broader frame.

In general, the working definitions can be divided into three main categories or approaches.

- The first approach emphasises the characteristics of the *hazard* and the associated losses and damage (i.e. exposure).
- The second group sees vulnerability as a social construct, where the focus is mainly put on the *susceptibility* to an event.
- The last group considers both the biophysical risk as well as the social response to an event. A useful working definition, used throughout the FREEMAN project is:

“**Vulnerability** is the susceptibility of a given population, system or place to harm from exposure to the hazard and directly affects the ability to prepare for, respond to and recover from hazards and disasters.”

Thereby, “social vulnerability focuses explicitly on those demographic and socio-economic factors that increase or attenuate the impacts of hazard events on local populations. In other words, who is at risk and the degree to which they can be harmed”.

Concluding, the fundamental elements of vulnerability can be defined as:

$$V = f(\text{Exposure, Sensitivity, Adaptive Capacity})$$

Furthermore, it is notable that throughout different sources of literature, often four different phases or dimensions can be distinguished when vulnerable situations are described. These are *the system*, the *perturbation*, the *attributes of interest* and a *time dimension* (Füssel, 2007; Füssel, 2010).

A *system* is defined as a unit that includes human and biophysical subsystems in mutual interaction (Adger *et al.*, 2004; Füssel, 2007). The notion of ‘system’ refers us to the importance of defining a *scale of analysis*. A system can undergo different threats. Threats are comprised of perturbations, stress, and stressors (causes of stress), mainly a combination of external and/or internal processes.

Adaptive capacity

Not only for vulnerability, but for adaptive capacity as well lot of definitions can be provided. Based on an extensive literature review, it can be stated that the definitions of adaptive capacity represent a reaction to and a recovery from a perturbation which further develops.

It has a slightly different meaning than adaptation, though there is some overlap. Adaptation refers to *actual response or actions* (who will take place after the perturbation), whereas adaptive capacity is the *ability* to take these actions. Adaptive capacity is therefore considered as a process, whereas adaptation can be considered as being an end-point.

A working definition for adaptive capacity is:

“**Adaptive capacity** refers to the ability of a system to adjust to changes or perturbations/disturbance.”

This definition is based on definitions as outlined by e.g. Cutter *et al.*, 2008, Gallopin, 2006, Smit & Wandel, 2006. The key message within these definitions deal with the ability to plan, prepare for, facilitate and implement adaptation options.

The concept of adaptive capacity is closely related to resilience. Factors that determine a community's level of adaptive capacity include its economic wealth, technology and infrastructure, information, knowledge and skills that it possesses, the nature of its institutions, its commitment to equity, and its social capital.

Resilience

Social resilience

Attempting to define social vulnerability throughout the years illustrates the origin of the resilience concept. Today, there continues to be a considerable interest in the subject of disaster resilience, especially with the formulation, guidelines and instructions of the Water Framework Directive – focussing on increased interaction in water management.

Resilience is being increasingly considered as one of the guiding principles for making a system safer. The general goal of resilience is clear: if a system is able to increase its resilience, then it is in a better position to withstand shocks and perturbations and able to recover more quickly than would be the case if no investments are undertaken. This is also emphasised increasingly within different academic discourses.

Social resilience has a multifaceted nature and there are many divergent views on what the concept consists of. Moreover, the description of the concept is easily adjusted to fit the need of the research domain. There are not only disagreements on the nature of its definition, there is also an ongoing debate whether resilience should be considered as a process or an outcome, what type of resilience is being addressed etc. (see cross references Cutter *et al.*, 2008; Klein *et al.*, 2003; Manyena, 2006; Maguire & Hagan, 2007).

Like (social) vulnerability, and based on performed research, resilience can be placed within a conceptual framework, taking into account three components (Adger, 2000; Maguire, 2007; Tapsell, 2005). This is also illustrated in Figure 8.

The first component “resistance” describes how a system withstands perturbations and its consequences. It can be understood in terms of the degree of disruption a system can tolerate without undergoing a significant change. Once a system reaches a threshold, the system will change.

With important recent hazards in mind, some authors use this part of resilience or resistance to describe the state of critical infrastructure. In this way, resilience is not considered as a process, but rather as a state with an end goal of limiting damage to infrastructure in general. However, this kind of resilience ignores the social dimension of a system and does not fully describe the needs in defining a working definition of social resilience.

The second component “recovery” relates the system to its ability to pull through the perturbation and the time span needed to recover from a perturbation. Within literature, this is often defined as “bouncing back to the original state” or equilibrium (Holling, 1973).

Both concepts describe the initial definition of resilience. Holling (1973) defined (ecological)_resilience as “a measure of the persistence of a system and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables”. In this case it indicates to what extent a system is able to recuperate after an imperturbation. It described the resilience of a natural habitat when confronted with negative events, e.g. flooding or pollution (Prasad *et al.*, 2009; ISDR, 2008).

However, an optimal recovery of a system does not only include the return to the original state or equilibrium. Only higher levels of functioning and thereby resilience can only be attained by adapting to new circumstances and by learning from the perturbation; it is about returning to a more resilient and less vulnerable state. (Maguire & Cartwright, 2008; Gallopin, 2006; Schoon, 2005).

The three components are illustrated within the following figure (Figure 8).

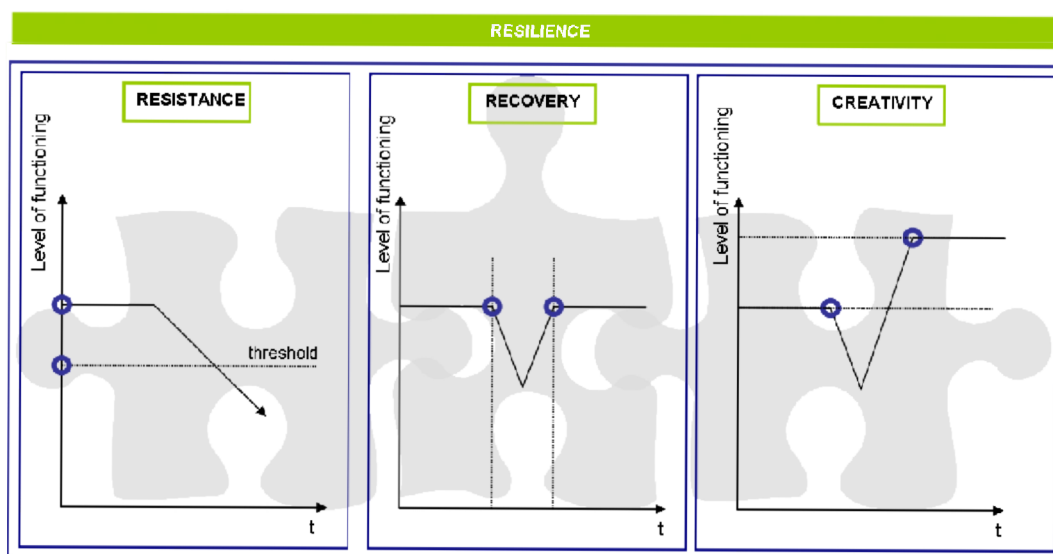


Figure 8: The concepts of resilience illustrated

Within the FREEMAN project, we suggest the following working definition for social resilience: “(Social) Resilience is defined as a system’s capacity to absorb disturbance and re-organize into a fully functioning system. It includes not only a system’s capacity to return to the state (or multiple states) that existed before the disturbance, but also to advance the state through learning and adaptation.”

“Resilience: the ability to cope and respond before, during and after a hazard occurs. Resilience is about returning to the original state or beyond”. Resilience is an ongoing dynamic process, which will not only return to its original equilibrium, but preferably will gradually increase and thereby bring its equilibrium to a higher level.

In a narrow sense, the research on social resilience refers to components of ‘social fabric’ which determine the ability of communities to cope with the disaster impacts.

This agrees with the following definition, presented by Folke (2006): “The resilience approach emphasis non-linear dynamics, thresholds, uncertainty and surprise. It asks how periods of gradual change interplay with periods of rapid change and how such dynamics interact across temporal and spatial scales” and the definition of Cutter *et al.* 2008: “Resilience is the ability of a social system to respond and recover from disasters and includes those inherent conditions that allow the system to absorb impacts and cope with an event, as well as post-event, adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat”

The working definition includes the three different components of resilience and takes into account the dynamic social nature of a system and the process of enhancing and fostering resilience, which is one of the goals within the project.

Economic and institutional resilience

Another type of resilience is economic resilience, which can be defined as the “policy-induced ability of an economy to withstand or recover from exogenous shocks” (Briguglio *et al.*, 2008). Research on *economic resilience* observes how the different economic subjects, sectors, regional and national economies are affected and cope with disasters.

This type of resilience is closely linked to social resilience. Within the objectives of the FREEMAN Project, economic resilience is considered to be part of social resilience.

Resilience linked to *planning* and *adaptation* to hazards is called institutional resilience (Klein *et al.*, 2003). This type of resilience provides a framework for considering the rigidity and the adequacy of present institutional responses to perturbations or changes. Today, responses are shaped by what is perceived to be politically and economically viable on the short term. Long term approaches and solutions dealing with the core of the problem are not always easy to find or implement. One of the difficulties with institutional resilience is finding the balance between finding quick wins and being able to implement long term structural measures.

In the view of the FREEMAN project aiming at improving social resilience automatically means taking the economic and institutional aspects into account (Schelfaut *et al.*, 2011).

Scales and levels of resilience

Resilience occurs across several levels. A person on its own can be resilient, but a society may not. Or the other way round, institutions and organizations in a flood prone area may be highly resilient, but that does not have to mean the average person on the street is too. A perfect example of individual resilience is having a supply of sand bags. While in fact this is measure of last resort, it tends to be known the best (possibly due to the images in the media). The effect might be minor put against the background of the whole flood, but it might just keep one's home free of the incoming water.

The next level is resilience on a societal or community level. A community resilient perspective enables an adaptive form of governance, which encourages the use of environmental and social resources in a sustainable way. The final level of resilience is the institutional resilience and questions how resilient institutions are. Good examples of institutional resilience are preparation plans, and ways or manners to react to floods.

The municipality is viewed as the basis of our community-resilience. We argue that people living in the same geographic entity share the needed characteristics that identify groups or communities (shared interest or stakes) (Dwyer, 2004; Maguire & Cartwright 2008). In order to improve resilience, effective interaction and coordination will involve all scales (national, sub-national, local, individual) and sectors (mainly river basin management and emergency response) involved in flood risk management is required.

In FREEMAN, we therefore consider the target 'community' for resilience at four levels (in accordance with Tapsell *et al.* 2010 & Fekete, 2009):

- Individual: meaning the individual person.
- Community: meaning a municipality, or system acting as a community (serving the same goals and objectives).
- Sub-national: this can be water basins, regions, provinces etc. This depends on the governmental structure of a country.
- National: meaning the national government or national based institutions and organisations.

5.1.1.2 Practical framework: the FREEMAN focus

In order to make resilience understandable and ready for implementation in policy or for practical use, the interrelationships between the concepts of vulnerability, adaptive capacity and resilience need to be explored. The conceptualizations of vulnerability, adaptive capacity and resilience have shown that these concepts are related in non-trivial ways (Bharwani *et al.*, 2008; Brooks, 2003; Klein *et al.*, 2003, Gallopin, 2006).

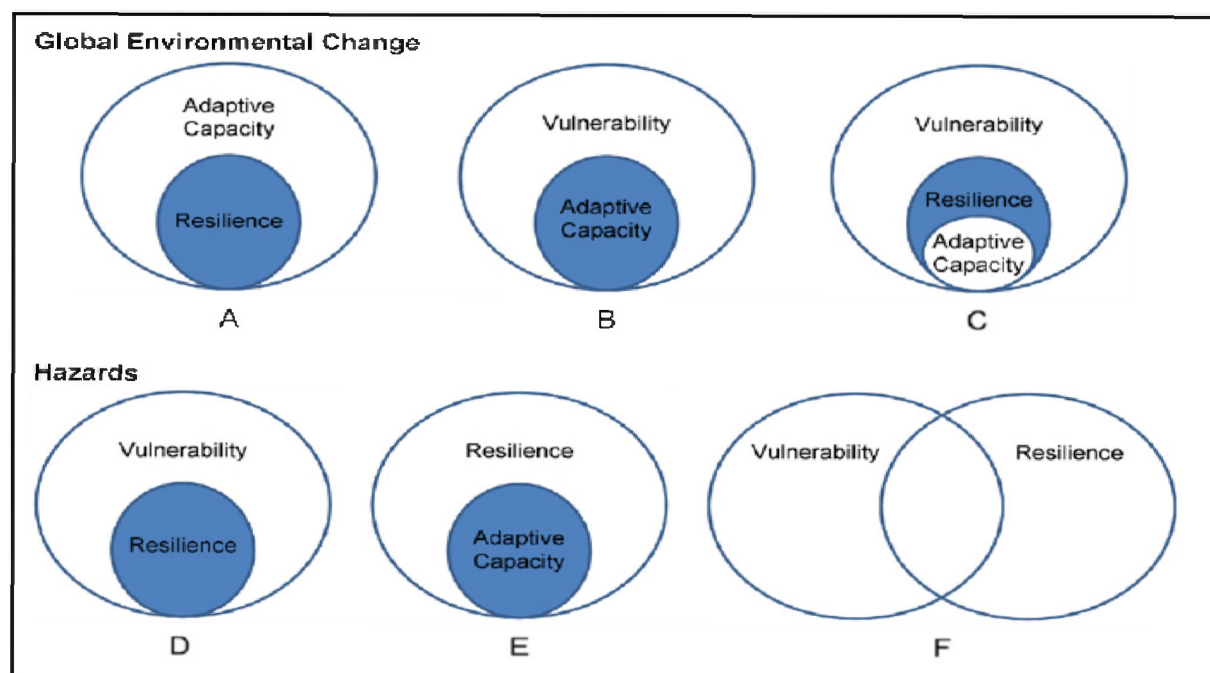


Figure 9 Conceptual relations between Vulnerability, adaptive capacity and resilience (taken from Cutter et al., 2008).

This is due to the many existing definitions of the terms itself, and the area in which they are applied. This is illustrated in the Figure 9 (taken from Cutter et al., 2008). It is important to clarify on the onset whose resilience is meant and to what type of disturbances.

Resilience has a direct link to several other concepts closely related to managing risks. However, not all used terms are properly explained in literature. Most commonly used terms are listed in Table 3. More information on terms is found in the section of 'terms and definitions'.

Table 3: Related concepts of resilience

Adaptive capacity	Exposure	Preparedness	Stability
Adaptation	Flexibility	Resistance	Susceptibility
Awareness	Persistence	Sensitivity	Vulnerability

In most simplified terms, it seems that resilience and vulnerability are linked: a decrease in vulnerability increases the level of resilience, but this does not mean that both terms are opposites of each other. Cutter et al. (2008) view vulnerability and resilience as two interlinked concepts, without determining a sense of direction as to who influences who.

Within FREEMAN we agree with this approach, since a community can be highly vulnerable and highly resilient at the same time. It could also be that a community is highly vulnerable and not resilient at all. This depends on characteristics of the community involved, their level of adaptive capacity, their flexibility, their economical means etc.

Brooks (2003) further explains the relation between adaptive capacity and vulnerability: “the relationship between the vulnerability and adaptive capacity of a human system depends critically on the nature of the hazard faced. Adaptation by a system may be inhibited by process originating outside the system, it is therefore important to consider ‘external’ obstacles to adaptation, and links across scales, when assessing adaptive capacity”. This is agreed upon by Cutter et al. (2008) who argue that it is essential how you view resilience: as an end result (static) or as an ongoing dynamic process. Adaptive capacity, according to Brooks (2003), is not about the actual adaptive capacity, it is about the anticipated or expected level of adaptive capacity. Maguire & Cartwright (2008) state that the level of a community’s adaptive capacity can be measured by using indicators such as “the presence of local leadership, communication channels (...), and the community’s ability to organise itself”. They even call this the “essence of resilience – being able to utilise community resources to transform and respond to change in an adaptive way”.

According to Cutter et al., 2008; Maguire & Cartwright, 2008; Schoon, 2005, Klein, 2003; Gallopin, 2006, adaptive capacity is closely linked to resilience, but the actual link to resilience is not clearly defined yet. Some view adaptive capacity as a process originating from the level of vulnerability and influencing resilience (Barwhani et al., 2008). Others view adaptive capacity as bound up with vulnerability (Schoon, 2005; Gallopin, 2006). In general it remains unclear whether adaptive capacity is a subset of resilience, of vulnerability, or whether resilience and or vulnerability are a subset of adaptive capacity. Most researchers tend to view adaptive capacity as an onset of resilience (Cutter et al., 2008, Gallopin, 2006, Janssen et al., 2006). Bharwani et al., (2008) view adaptive capacity as a component of resilience that reflects a learning aspect of system behaviour in response to disturbance. They also view adaptive capacity as a super set of adaptive strategies, that is the combined set of actions that exist within the domain of an individual actor. Meaning that adaptive capacity consists of adaptive strategies, which in turn consist of individual adaptive actions, that consist of the combination of the required information and resources, the expected outcomes and the linkages to other concepts.

The main goal of the project is to bring resilience in practice. This means the definition and the measurement should be accessible for different actors of the society. To do so, the meaning of adaptive capacity and resilience are equated throughout the project. Firstly, the identification of resilience will remain a challenge and it is assumed that scientific discussions and research will proceed. Academic discourse still tries to reveal the different relationships between the concepts. So far, the possible relationships among the different concepts (vulnerability, adaptive capacity and resilience) remain contested and the debate is still ongoing. This highlights the complexity of the concepts as well as their importance in general. Secondly, there is a considerable interest in the concept of resilience as such. Authorities and institutions see resilience a mechanism for mitigating the impacts to local communities. It can be stated that both resilience and adaptive capacity have a similar goal: to better cope with existing or future perturbations and diminish inconveniences.

Equating both concepts constitutes a simplification. Nonetheless, it is expected that this hypothesis ensures the comprehensibility of the resilience concept. This is an important requirement if resilience will be brought into practice. Once the content of the concept is understood, it will be more obvious to integrate the concept into risk management plans and policies.

The FREEMAN view on resilience is illustrated in the figure below (Figure 10).

Each Work package within FREEMAN will develop or select its own indicators. As they will be used across each case study, they can be compared in a quantitative manner. In the following chapter it will be discussed in more detail how this applies to the FREEMAN project.

Applying the indicators

An important target of FREEMAN is to develop and apply a common methodology to integrate flood resilience into operational flood risk management (FRM) for (intrinsically different) case studies. In order to ensure the comparability of the case study outputs, a similar research methodology needs to be followed. There are two major challenges that can be distinguished in the project concerning methodology:

1. Measurement of the concept of resilience across the three different work packages
2. Comparability of the case studies.

To be able to cope with these problems a solution has been found by using a similar scoring system across all work packages and all case studies.

In order to explain our approach it is important to understand our basic scheme of analysis. In our view a system consists of several sets of **dimensions**. These dimensions can be organized and valued by the use of **indicators**. Indicators contain a field of different **variables** on several scales. For instance *awareness* can function both as an individual levelled indicator and as a community levelled indicator. Variables for this indicator can be *knowledge*, *risk communication*, and *past experiences*.

In the end, indicators provide a means of **measuring** resilience and vulnerability by forming the points of a star (or spider) diagram. In the figure below this sequential chain is visualized.

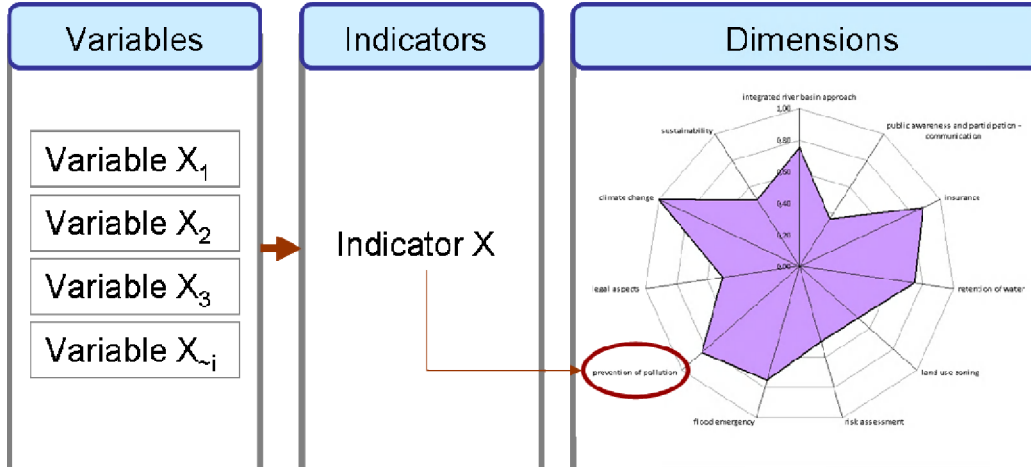


Figure 11: From variables to indicators and dimensions

Each work package will produce their own Dimension. The methodology used to create the values used in this Dimension (measurement of variables) is then applied on all three case studies. This results in nine star diagrams covering three dimensions for three case studies. By analyzing the star diagrams produced by each of the case studies on all three the work packages comparisons can be made. An important note is that in all cases the cultural and national context of the study area should be taken into account, since they can have serious impact on the outcomes, effects and possibilities of the measures.

In FREEMAN each of the partners will be responsible for developing the scoring of the indicators and variables for one of the work packages, see the figure below (Figure 11). The local partner will also be responsible for gathering data in his or her case study area.

For this purpose, we have developed three mechanisms in FREEMAN:

- **Overarching framework** as a means to improve the common understanding, streamline the methodology, requirements for data and information and targeted stakeholder group
- **Thematic analysis by the WP leaders.** Each WP leader is responsible for the analysis of his/her theme for all three case studies. To do so, they will be assisted by the case study leader for the collection of data/information and case study specific framework. For example, Antea Group is responsible for the analysis of WP3. For this purpose, we will ask CMCC and SECONSULT to collect the required information and guide them through questionnaires and checklists to do so. The collected data will be send to Antea Group, which will perform a comparative analysis. In order to minimize the burden for case study stakeholders, we will compile all questions for the different work packages.
- **Target groups:** authorities across sectors and scales. Effective flood risk management needs to target *all* aspects of the flood risks. In concrete terms, we will focus on two sectors of authorities:
 - 1) **River basin management authorities;** with responsibilities in the implementation of Water Framework Directive (WFD) and/or Floods Directive (FD).
 - 2) **Disaster planning & Crises response authorities;** with responsibilities in disaster planning & response during flood events.

Both sectors operate at different scales, ranging from a local to a national scale. The roles, responsibilities and interactions at different scales before, during and after a flood event will be analyzed. For this purpose, we will organize workshops, questionnaires and interviews. The focus is put on what authorities can do to improve their own resilience and that of their communities. There is no need to question lay people; the challenge here is to integrate the different scales and sectors.

Concluding, for all three work packages indicators had to be selected that were: universally applicable, scientifically based and scale-proof. The scientific bases was established by a thorough literature review. This review not only resulted in a lot of variety concerning indicators, variables, but it also discerned a few indicators that were agreed upon by most scholars. In order to ensure practical applicability experts gave their opinion on indicators during the one-on-one interviews, and during the stakeholder meeting of FREEMAN early 2010. This process resulted in the following indicators:

Table 4: FREEMAN dimensions, main indicators and variables

Resilience Dimensions	Main indicators	Main variables
Risk communication and perception (WP2)	Communication of risk Communication during events Awareness of risk amongst residents Preparedness of residents	Early warning systems Social capital Internal institutions Awareness Worry Preparedness Insurance /susidy External institutions
Flood management tools (WP3)	Flood management plans	integrated river basin approach public awareness and participation - communication insurance retention of water land use zoning risk assessment flood emergency prevention of pollution legal aspects climate change sustainability

Resilience Dimensions	Main indicators	Main variables
	Flood early warning	monitoring forecasting technology knowledge of associated risks warnings dissemination and communication response capability uncertainty design integrated
Flood risk governance (WP4)	Vertical Integration	Financial and human resources Accountability Economic and criminal liability Transparency Inclusiveness
	Horizontal integration	Coordination between sectoral policies Involvement of civil protection in flood risk management Integration of vulnerability assessment into early warning system
	Review and adaptation	analysis of past events Database of impacts Mandated flexibility of policies Consideration of climate change

5.2 Flood risk perception and communication (WP 2)

5.2.1 Setting the scene: concept and theoretical framework

When managing human-environmental systems some sort of governance style is needed. Specifically flood risk management requires an integrated management approach that operates on a river basin level and includes upstream/downstream effects as a whole. On the other hand, the participation of communities and stakeholders on a local level ensures that the interests of residents and commercial enterprises are included. At this point a balance between the concepts of integrated water resources management (IWRM) (Loucks and van Beek, 2005) and adaptive water management (AWM) (Pahl-Wostl, 2009) may be applied. IWRM is based upon expert knowledge and the centralised integration of several sectors such as water resources management, disaster management, nature protection, urban planning and others, and aims for integrative and efficient solutions in water management. AWM is based upon integrative approaches, but goes a step further by seeking collaborative decision making, the management of problem at their sources instead of effects, decentralised and more flexible management approaches and more attention to human behaviour through “soft” measures (Krywkow, 2009). As a consequence, flood risk management should adopt the concept of AWM in order to implement the principles of resilience in planning, preparation and disaster management.

Subjectivity and ambiguity are inherent characteristics of sustainability. Governance approaches such as AWM describe how decentralised and multi-perspective actor networks have to be implemented at several policy levels. However, there are several approaches possible for interpreting and quantifying (if possible) multi-perspective risk management. For the incorporation of flood-risk perspectives, the psychometric paradigm according to Slovic (1987) has been selected to evaluate individual perspectives. Hereby individual judgements about the current and desired level of riskiness are identified. The essential risk characteristics are worry, awareness and preparedness. These characteristics enable empirical research to quantify and compare various perspectives on risk.

Flood-risk perception

In river basins, it is often an expert-based economic analysis of land use values that serves as the underlying estimation of costs of flood damage. Intangibles such as loss of natural areas, biodiversity and cultural heritage are difficult to include in the calculation. Furthermore, the judgement of what poses a hazardous risk varies significantly from one individual to the other. This variation cannot be easily quantified such as in econometrics. However, European policy explicitly requires the involvement of stakeholders in decision-making processes of water resources and risk management (European Commission, 2003; The European Parliament and the Council, 2007).

Yet, local or domain knowledge can be used to develop a realistic approach to include tangibles and intangibles of land use values, private property and common pool resources as well as developing new approaches to risk management. This can be important to developing appropriate solutions for increasing the resilience of flood-prone communities. The inclusion of both the probability hazardous events as well as their consequences is a presumption for any approach that includes individual perspectives on risk.

Risk perception is the subjective judgement of individuals about the characteristics and the magnitude of risk. Prevalingly these judgements are made in relationship to natural hazards such as floods, earthquakes or diseases as well as human-induced hazards such as nuclear power failure, airplane crashes or chemical disasters.

There are three main approaches to risk perception:

1. psychology approaches (heuristics and cognitive);
2. anthropology and sociology approaches (cultural theory); and
3. interdisciplinary approaches (social amplification of risk framework).

Cultural Theory was originally introduced by Douglas and Wildavsky (1982), and further developed by Thompson and Ellis (1990). Basically, Douglas and Wildavsky (1982) framed four actor types or ways of life including: Hierarchical, Individualist, Egalitarian, and Fatalist who judge, decide and act according to their perspective on the world. The scholars argue that social connectivity is reciprocal to the uniqueness of an individual perspective on risk. However, this theory is not widely accepted in risk research. Even Mary Douglas herself pointed out the danger of easily imposing favourable paradigms on a chosen sample of social entities. For an analysis of risk perspectives it is difficult if not impossible to parametrise the risk perception of these actor types.

The Social Amplification of Risk Framework (SARF) was first published by Kasperson et al. (1988). This publication succeeded the scholars' discovery that risk events estimated by experts as minor or relatively minor, were perceived as significant concerns by lay people or had significant societal and economic impacts. The SARF theory endeavours to analyse how processes of risk perception are amplified or attenuated during a public discourse. These modifications may result in substantial impacts upon society and economy. The SARF framework is an approach that attempts to link the technical assessment of risk with psychological, sociological, and cultural perspectives of risk perception and risk-related behaviour. One of the findings is that amplification occurs at two stages of risk communication: 1) the transfer of information about risk and 2) the response mechanisms of a community. Kasperson et al. (1988) assume that these mechanisms result in behavioural (or policy) responses and subsequently in secondary impact (of an event).

In view of psychological theory the psychometric paradigm (Slovic, 1987) and (Slovic, 2000) received most attention in risk research. Slovic (2000) and Gregory and Mendelsohn (1993) discovered that perceived risk is quantifiable and predictable. This distinguishes the psychometric paradigm from Cultural Theory significantly, and makes it attractive for case study research, especially when involving empirical methods in the risk assessment. Furthermore, Slovic (1987) demonstrated that the acceptance of risk depends on the benefits of an event or a product. Frequently, the example of purchasing and driving a car is used to demonstrate the acceptance of risk. In the field of water resources and flood risk management a benefit may be detected in the attractiveness of living near a river or a shoreline or having access to water resources. Residents often accept (or deny) the risk for the benefit of a high quality of life. However, risk-benefit tradeoff depends significantly upon intuition, experiential thinking, and emotions, and therefore rational choice theory as an optimisation approach should not be applied. As a consequence, bounded

rationality to achieve 'maximum satisfaction' instead of an optimum satisfaction may serve as an alternative.

Slovic (1987) distinguishes a variety of risk characteristics, related to perceptions and responses to risk. Due to a number of similarities among these risk perceptions all known risk characteristics can be condensed into three higher order risk characteristics: awareness, worry and preparedness (Raaijmakers et al., 2008).

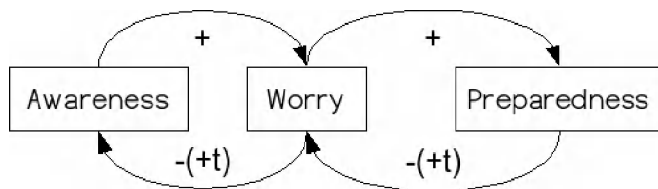


Figure 12: Risk characteristics and their relationship (Raaijmakers et al., 2008)

The relationship of these risk characteristics are displayed in Figure 12, and may be applied to flood risk events: subsequent to a disastrous event, directly or indirectly affected individuals have an increased awareness, resulting in an increased level of worry (depending on the risk-benefit trade-off) and, as a consequence, preparing for the following event. Raaijmakers et al. (2008) indicated that the degree of these risk characteristics strongly depends on the time that has lapsed since a disastrous event.

Information on risk perception may be collected with the help of knowledge elicitation methods. These methods comprise interview, questionnaire and survey approaches that belong to the consultation level of participatory methods (Krywkow, 2009). In a survey in the Dutch province of Zeeland, Krywkow et al. (2008) demonstrated, for example, the risk-benefit tradeoff taken by individuals is not independent of the flood risk policy of the responsible authorities. Despite a severe flood disaster in 1953 most respondents are aware of the threat but are not worried because of extensive flood protection measures implemented in the aftermath of this event.

Based upon the aforementioned literature, the FREEMAN project has conducted a series of interviews with responsible authorities within each of the respective case study areas. Furthermore, an online questionnaire was provided to all stakeholders of each of the case studies to assess flood risk perspectives. Two underlying premises were used:

1. the elicitation of the risk characteristics as well as the risk-benefit trade off of involved stakeholders may indicate a 'most desirable' set of flood risk measures among stakeholders including responsible authorities;
2. the expert interviews together with the online questionnaire may reveal inconsistencies between the flood risk perception of experts and of lay people with respect to the SARF approach. The identification and assessment of these discrepancies can help to improve the communication process or even suggest social learning approaches if required.

Identified flood risk characteristics together with an eventually detected gradient in flood risk perception must be compared with resilience indicators for the relevant river (sub)basin. The results might be, for example recommendations for the application of social learning processes to mitigate the perception gradient, and this way increase the acceptance of flood risk measures including stakeholder initiatives.

Flood-risk communication and participation

From the AWM perspective, collaborative decision making processes (that may include public and stakeholder participation) occur on three different levels or loops of social learning processes:

1. incremental improvement of established routines (e.g., raising dykes to an optimal level);
2. reframing (e.g., is the current flood protection practice sustainable?);
3. transforming (e.g., changing laws and regulations, paradigm shift in management practice and education (Pahl-Wostl, 2009).

Hence, the effort of introducing resilience into current flood management practice is primarily a matter of the second level of the so-called 'triple loop learning' scheme. On the operational level, however, numerous handbooks and best practice guidance have been provided within the past two decades. For example, the European FP5 project HarmoniCOP produced a handbook on the application of participatory methods in water management (Ridder et al., 2005). Practically-oriented guidelines for the proper use of methods for conducting public and stakeholder analysis are given. Another example is the European InterReg project TRUST which elaborated on the efficient and effective implementation of participatory processes, including their planning and evaluation in water management projects (Hare and Krywkow, 2005). The latter document provides guidelines for selecting the appropriate methodology with regard to local and regional communication infrastructure as well as cultural aspects of the flood-prone communities. Hence, applying participatory processes and social learning requires management and planning skills. In other words: participatory processes are not a series of random workshops, but an overall methodology from the level of information provision to consultation, social learning and public involvement has to be selected and planned carefully, in order to be efficient and successful.

A more elaborate and systematic approach to participatory methods is discussed in Krywkow (2009). Given a strict goal-oriented approach, a systematic appraisal of methods has been undertaken. Arnstein (1969) and Mostert (1998) have already introduced the term levels of participation. Krywkow (2009) enhanced this categorisation with classes of participation based upon the intensity of participatory processes from one-way information provision to intense social learning processes. The FREEMAN project prevalently applied knowledge elicitation methods, which is at the level of information provision and consultation.

5.2.2 Synthesis of the results for the Innerste case study, Germany

Work in the case studies was determined by two main methods:

1) desktop studies: exploring available documents, web-based reports, year books, newspaper clips, and relevant scientific and professional publications; and 2) empirical work including interviews, questionnaires and surveys. For the structure of the questionnaires the resilience indicators according to Shaw (2009) played the role of a guiding principle. The distinctive roles of the research groups in the particular case studies played a significant role for achieving quality results. Empirical research in the FREEMAN case studies may be distinguished in three parts:

1. **Expert interviews:** FREEMAN researchers applied semi-structured interviews for knowledge elicitation. The views of experts of the flood management performance in the case studies was explored. The intention was to elicit the heterogeneity of views and perspectives on flood management in the case study region including administrative issues of higher level institutions. Moreover, these interviews were used for a stakeholder analysis.
2. **Public survey:** residents of the two case studies were asked to complete an online questionnaire with questions related to resilience indicators. For this reactions to the domains of crisis communication and flood risk perception are relevant. The Innerste case study has only 25 complete answered questionnaires.
3. **Expert survey:** representatives of the relevant stakeholders (experts) (after stakeholder analysis) were asked to complete a questionnaire with questions related to the resilience indicators. One respondent filled in this online survey.

5.2.2.1 Flood risk perception in the German case study

A. Generic perception of risk

As in many other industrial countries the perception of risk in Germany is diverse, and generally not considered rational. Nor are these perceptions clearly ranked according to probability or severity of (negative) impact. As demonstrated in Raaijmakers et al. (2008) the risk characteristics of worry, awareness and preparedness after an event fade away with time. This holds true for residents as well as

institutions: responsible authorities, decision-makers, and media. The example of the Oder flood in 1998 is a prominent one in terms of changing perceptions of risk. The rapid accumulation of surplus water in the upstream area and the development of the flood attracted the attention of media. Elaborate television and radio broadcasting and newspapers reports accompanied this hazard from a very early stage to the 'all clear signal' and beyond. Researchers such as Schunicht (2008) demonstrate that the media coverage was out of proportion with the small population affected. The same author reports that this flood as well as the Elbe flood of 2002 became an election campaign topic and speculate that both floods had a significant impact on election results in both 1998 and 2002. These types of floods definitely receive much attention through media coverage with consequences for the activities of flood managers and disaster control/response units in general as a result of reorganisations. Since the Oder flood, a number of best practise guidebooks and companions have also been published in Germany.

The situation on the Innerste in 2007 was not as dramatic or seminal as the aforementioned two events. However, as a consequence of (comparatively moderate) damage on Infrastructure and, in particular, homes in the Innerste catchment, flood perception changed both among the residents as well as responsible authorities. The Innerste flood generated the highest gauge readings since the beginning of measurement records in 1952. Before this event most residents were not aware of such a threat, and many households were not prepared for inundation. For responsible authorities such as the Niedersächsische Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz (NLWKN), or the local/regional disaster management authorities, the flood probability of 1:100 is the definite threshold beyond which flood prevention and protection activities are implemented. According to previous calculations of the NLWKN the Innerste was sufficiently protected against flooding, so that the event of September 2007 came as a surprise. The gauges indicated an event risk of less than 1:100. Hence the official disaster response units were not mobilized. As a result the NLWKN founded the Flood Forecasting Centre (Hochwasser-Vorhersagezentrale für Niedersachsen in Hildesheim). Similar to the aforementioned authorities, the reservoir management authority of the 'Innerste Talsperre' applies its expertise to predicting the generation and development of floods. The managers of 'Harzwasserwerke' have to oversee the reservoir not only from the point of view of flood management, but also drinking water supply, tourism, nature protection and industrial water supply. In other words, Harzwasserwerke can not simply empty the reservoir in the case of a flood warning.

The FREEMAN online survey directed at residents was conducted after the Innerste flood of 2007. The results demonstrate higher flood risk perception after the event, which may be seen as a trigger for higher values associated with risk characteristics such as worry, awareness and preparedness. The questionnaires revealed that the majority of the respondents has relatively high levels of flood-risk perception. More the 90 % know whether or not they live in flood-prone areas. Most of them claim to be aware of what to do in case of a flood. Furthermore, the levels of worry are similarly high: almost all respondents see flood as a serious and growing problem. However, lower values are indicated for level of preparedness: only 60 % of the houses are prepared for floods and only 38 % are aware of an early warning system. The relative low preparedness level may also result from the fact that residents are only allowed to protect their homes on an individual basis rather than collectively. A joint wall or stabilised garden fence along a row of houses is illegal, since the water balance of the catchment would be influenced. Furthermore, people believe there are not sufficient resources available for flood protection in their communities.

Frequency and severity of risk and damage in Germany

Between 1970 and 2004, approximately 600 larger natural hazard events were recorded in Germany (Munich Re, 2005). These were mainly storms, flood events, as well as several (low magnitude) earthquakes. In 1998, the river Oder flooded, and in 2002 the rivers Elbe and Danube. A significant drought took place in the 2003 and a milder drought in 2005 both with considerable impacts on agricultural yields. The earthquakes that caused the most damage were Albstadt (5.7) in the Swabian Alps in Southeastern Germany in 1978, and Roermond (5.9) near Cologne in 1992 (Munich Re 2005).

The river Rhine does not flood annually but frequently enough to be of concern. However, this did not have a significant impact on flood policy in Germany until the inundation of the Oder river in 1998, reinforced by the Elbe flood in 2003. These two events triggered action among decision makers and water managers. Since that time, flood protection acts, flood measures and recommendations for coping with floods have shifted the paradigm from 'living with floods' to 'giving water more space'. Although economic pressure is high, urban and industrial development have essentially stopped in flood-prone areas.

The river Innerste does not have a long record of floods. The police archive (Polizeichronik Sarstedt, 2011) reports a flood in January 1915. Another severe inundation was reported in 1926. However, since records do not start prior to 1952, nothing is known about the impact and severity of this flood. Recently, in August 2010 the water level was almost as high as in 2007. Although no damage was reported, many residents commented on their discontent with contemporary flood management.

B. Drivers of risk

Responsibilities for flood risk management are strictly assigned in a hierarchical way. Higher instances of responsible authorities (federal government, governments and their departments in the federal states and the district authorities) are the setters of norms in the sense of setting and implementing rules and regulations, whereas the district level controls the implementation, and the municipalities have to implement measures. The interview with the relevant authorities in the municipality of Holle (11/01/2011) resulted in a number of statements that reflect the barriers to a consistent flood management throughout all institutional levels and sectors:

- the municipalities cannot take the decision to implement measures without consulting the district and NLWKN. This results in many cases in a deadlock. Planning efforts maybe rejected by higher level authorities without the implementation of necessary measures. This is the case in the Innerste catchment. No new flood protection measures have been implemented. For example, in 2007 the municipality of Holle provided a complete local flood protection concept. The district rejected this concept after examining it for one and a half years;
- planned measures have to be submitted not only to flood management authorities, but also to authorities responsible for other sectors such as agriculture, nature protection and infrastructure planning. In many cases these plans are evaluated based upon contradicting interests of various higher level departments. However, there is no overall coordinating body, which often results in a rejection of plans from one of the departments;
- in 2010 the federal state of Lower Saxony decided to eliminate the institutional middle layer called Bezirksregierung. From a general administrative point of view this promises the federal state government less bureaucracy, financial savings and more efficient administration. However, the responsible authorities for planning permits of all sectors are now separated, and operate separately on the district level;
- the municipalities could provide more generous permissions and support for individual flood protection of their citizens. An efficient and effective way would be a concerted action for the planning and implementation of flood protection measures of residents in flood-prone areas. However, this contradicts the interests of the river basin management authorities. Water retention capacity could be diminished. However, no bottom-up river basin management is applied, nor is there any serious effort to increase and enhance public and stakeholder participation;
- the municipality of Holle stopped any development in flood-prone areas since the last landuse planning in 1974. Housing at the neighbourhood called Michelswiese that are affected in 2007 were built in the 1960s.
- As a result of bureaucratic problems such as procrastination with the implementation of plans the municipality of Holle is reviewing whether or not illegal measures should be implemented to protect against events such as the flood of 2007;
- in 2007 the then Secretary for Environmental Affairs for Lower Saxony, H. Sander, promised citizens to implement flood protection measures in the Innerste catchment. Nothing has been implemented to date. The representatives of the municipalities as well as the affected citizens are more than disappointed.

In summary, municipalities and residents (as representatives of the lowest level of flood management) wish to comply with the rules. However, the bureaucracy intrinsic in these rules and regulations and their complexity causes residents to consider the installation of illegal flood protection measures to protect their homes.

Another theme being discussed was the role of the Harzwasserwerke as reservoir managers of the 'Innerste Talsperre'. Representatives of Harzwasserwerke explained the mission of their organisation and the 'multi-disciplinary' management of the reservoir including the limitations of flood management during several workshops with residents of the Innerste valley. However, these attempts to explain their limitations were not accepted by the residents of many of the Innerste valley. In addition, negative media coverage hampered the efforts of Harzwasserwerke to explain the management the reservoir in the upper catchment of the Innerste. This was stated during the interview with Harzwasserwerke on the 11th of February 2010.

C. Quotes and figures

The online survey in particular, revealed a trend concerning flood risk perception. However, representatives of relevant authorities as well as citizens have a diverse range of individual perspectives on flood risk management and the implications of hazards. In general, at the local level of flood management including municipal representatives and residents, there is a high level of awareness and willingness to prepare for floods. However, those groups identify bureaucratic obstructions as the main hindrance to an appropriate preparation for floods. Some quotes from citizens who responded to the online questionnaire highlight this:

"The inundations around the municipality of Holle in the year 1926 were more serious. However, intense development and use of housing increases vulnerability."

This respondent recognises the increase in vulnerability depending on land use and development.

"We are still waiting for the fulfilment of politicians' promises to design and implement a flood management plan for the district of Hildesheim."

Indeed the website of the NLWKN confirms that the flood management plan for the Leine catchment is being prepared but not finished (Hochwasserschutzplan Leine, 2011).

"Since this was for me the first time to experience such a flood, I observe the river Innerste during every intense rainfall event."

This respondent clearly describes the increase in his/her own awareness.

"What will be the result of the next flood? Nothing will be changing. Only the frequency of extreme meteorological events will increase."

This person expresses frustration about the lack of response after the Innerste flood of 2007, and fears that the impact of heavy rainfall events will be more severe in the future.

These quotes provide only a few examples of the views and perspectives of individual residents in the Innerste valley. There are more quotes mostly reflecting discontent with current flood management and protection activities.

5.2.2.2 Crises communication in the German case study

A. The alert/early warning system in Lower Saxony

The alert system in Lower Saxony is organised in a hierarchical way (Figure 13). The main responsible unit is the Upper Disaster Authority within the Federal State Department of Internal Affairs and Sports. The main responsibilities are delegated to the Lower Disaster Authorities in the districts. Usually the mayor or the corresponding chief executive of a municipality or district is the manager-in-chief of disaster response

and management. Disaster management in the case of floods is co-ordinated at this level. Decisions and their implementation are coordinated with police headquarters. The deployment of fire brigades, police units and emergency assistance organisations is co-ordinated through a crises team which includes representatives of the police and the district authority.

For general flood management, district representatives collaborate with the NLWKN on a regular basis. Information held by NLWKN including flood maps and prognoses are conveyed to the district authorities. Frequent face-to-face contact and email exchange play a significant role in this communication. Gauging data are published on an NLWKN website and are regularly updated. Furthermore, district authorities are members of the steering group for the preparation of flood risk management plans and the identification of types of risks in the district.

In the event of a hazard such as a flood the district is responsible for the mobilisation of the crisis team (Katastrophenschutzstab). The crisis team informs all relevant emergency and assistance organisations, municipalities and technical staff (e.g. weir and barrage managers who regulate discharge). The municipalities are responsible for warning residents especially those in flood-prone areas. In order to prepare for floods, residents are responsible for informing themselves and taking appropriate measures. After the flood of 2007, the district of Hildesheim started an exchange concerning flood management issues together with the NLWKN, the reservoir managers 'Harzwasserwerke' and a number of affected municipalities. However, this exchange faded out with time (interview with representatives of the district of Hildesheim, 15/11/2009).

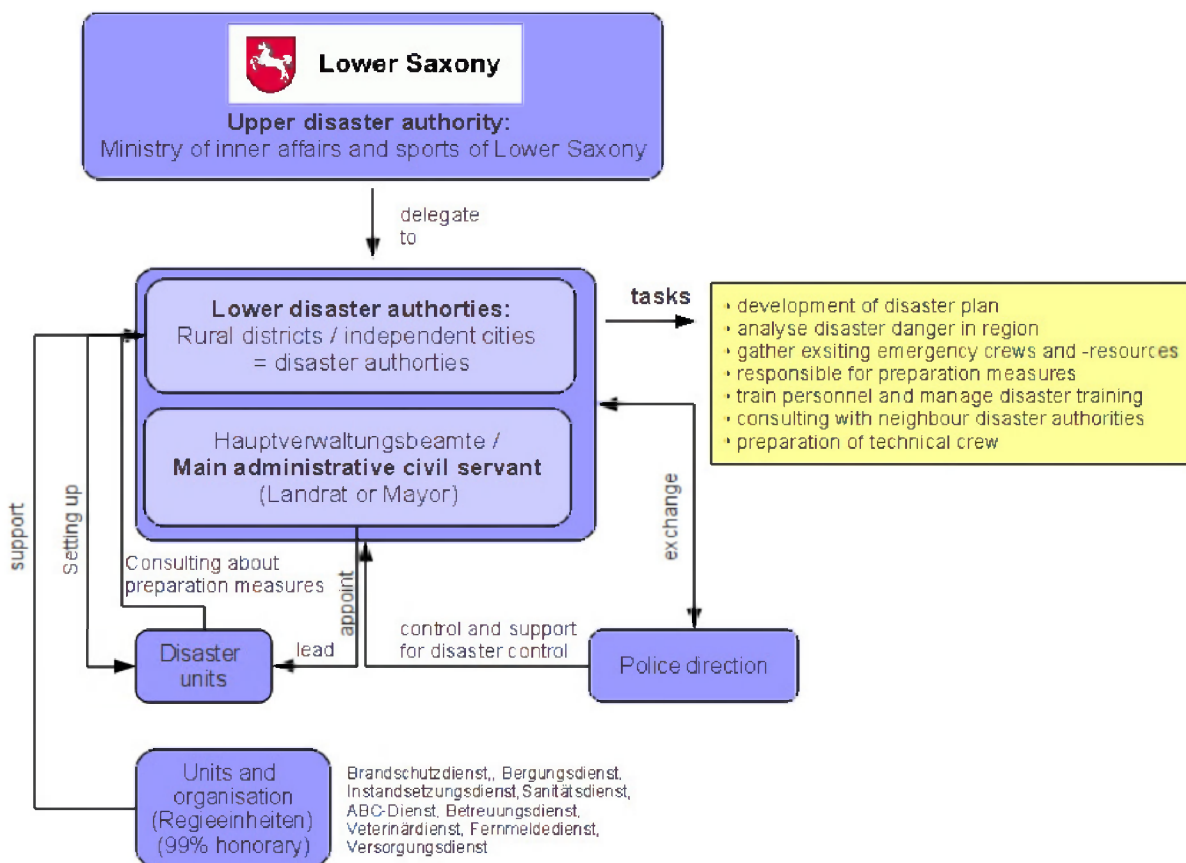


Figure 13: Schematic overview of the alert system in Lower Saxony

The early warning system

Each of the federal states in Germany has their own flood alert plan including warning levels (Meldestufen). Table 5 provides the warning levels for the federal state of Lower Saxony (Hochwasserportal, 2011).

Table 5: Warning levels in the federal state of Lower Saxony Hochwasserportal, 2011)

Level 1	Water at the edge of river banks, on the verge of spilling over. Beginn of warning services. (pre warning stage)
Level 2	Overflow mainly on agricultural and forest land cover.
Level 3	Inundation of large areas, solitary properties, roads and basements.
Level 4	Large-scale inundation including residential and commercial areas. (not yet defined in Lower Saxony)

At level 1 the district has to retrieve information about water levels. From level 2 the disaster authority is mobilised. This authority has to inform up to 50 local authorities such as municipalities or managers of water regulation facilities such as weirs and reservoirs about the water levels in the hazard zone. In addition, the NLWKN faxes water levels to the relevant authorities. The flood alert plan indicates who has to inform whom in the case of a level 2 inundation. Furthermore, the emergency services are informed. Thereafter, the crises team and police are mobilised. They instruct the municipalities and technical staff of weirs, water mills and sewage plants to adjust their facilities to the increased water levels. The mayor or chief executive is informed and, based on information, may announce a state of emergency (NLWKN, 2011; interview with the district authorities, 15/11/2011). No evacuation plans are known to exist in the district of Hildesheim, nor the municipality of Holle.

B. Newspaper coverage

The flood of 2007 was covered by the local and regional newspapers. Many topics related to the Innerste flood such as individual protection versus top-down protection measures, the role of the water reservoir 'Innerstetalsperre', the performance of the alert system, sectoral fragmentation and conflicts of flood protection with nature protection, the lack of gauging stations, the role of politicians and their promises and more were discussed. The newspaper clippings presented in this section can only give an impression of the newspaper coverage in the aftermath of the Innerste flood. However, these examples demonstrate how relevant issues are seen from various perspectives and the intensity and emotion in the discussion. The first clipping (Figure 14) reports on the foundation of an action group and their activities to expedite the implementation of more flood protection measures. This movement emerged due to procrastination on introduction of flood-protection measures by the official authorities and are a manifestation of growing discontent.

Holler haben weiter Angst vor einem neuen Hochwasser



Bürgerinitiativen in der Region

9. Umweltschutz in Hochschameln
10. Hochwasserschutz in Holle
11. Bürger gegen Strahlkraftwerk

Steckbrief

Name: Interessengemeinschaft (IG) Hochwasserschutz Holle
Ziel: Neue Dämme und Walle zum Schutz von Wohnsiedlungen in Holle, Hochwasserfrühwarnsystem für Gefahrenbereiche, Betrieb der Innerstetalperle, Vorrang für Hochwasserschutz vor Naturschutz sowie wirtschaftlichen Interessen
Mitglieder: vier
Start: November 2007
Ansprechpartner: Hartwig Gelse, Ruf. 05052 / 9835
Zwischenbilanz: Der Druck der IG wirkt. Ein neuer Wall wird in Holle von September an gebaut, der Langtag bearbeitet derzeit die Petitionen

Ob Hochwasserschutz, Mastställe, Gemmais oder Megamasten: Immer mehr Menschen mischen sich ein, wenn ihnen etwas gegen den Strich geht. In einer Serie stellt die IAZ Bürgerinitiativen aus der Region vor.

Holle (ara) Holle, das ist die hübsch im Grünen gelegene Gemeinde der Schlösser und Burgen. Aber auch der Dörfer, die von Hochwasser bedroht sind. Dieche sollen sie künftig schützen. Ein neuer Wall für Holle etwas, der Überflutungen eindämmt – mit Baueinsatz noch in diesem September. Darauf hofft in diesen Tagen die Interessengemeinschaft (IG) Hochwasserschutz Holle. Die kämpft seit zwei Jahren für die Sicherheit des Dorfes. Nach dem Jahrhunderthochwasser im Jahr 2007 gab es für die IG nur noch eine Deuse. Sofort handeln. Zunächst mit der Gemeinde Holle funktioniert selber die Zusammenarbeit nach Wunsch.

Sicherheit! schallte es aus Lautsprechern. Da bekam man es schon mit der Angst zu tun, erzählt Helfried Paschold, der auch zur IG gehört. 60 Haushalte mit 150 Menschen waren betroffen, das Wasser zerstörte Waschmaschinen, Computer und auch Haarrington. Schäden in Höhe von zigtausenden Euro, sagt Hartwig Gelse, der zu den Betroffenen zählt. Und neue Schäden befürchtet, die heutzutage immer wieder möglich sind.

Denn Innerste und Netze drohen im



Zeiten des Klimawandels, öfter über die Ufer zu treten. Mit Überschwemmungen mit unabsehbaren Folgen für Orte wie Holle ist zu rechnen. Und tatlos zu sehen, was Überflutungen Raub und Gut zerstören und Menschen gefährden, das kann für manche Holler nicht sein. Wir können doch nicht die Hände in den Schößen legen. Sondern wissen den Mund aufmachen, sagt Krauser. Zumal es eben vom Land bislang außer Lippenbekenntnissen keine Unterstützung gegeben habe. „Leere Versprechungen“, beklagt sich Gelse, ebenfalls Mitglied der IG. Die zählt zwar „nur“ vier Mitglieder, doch kämpft sie trotzdem unverdrossen um Hochwasserschutz. Damit die Menschen von der Michelstesse und der Straße „Am Rolande“ nicht wieder der Naturgewalt ausgesetzt sind. Darum schreibt die IG Briefe um Brief. 30 Schreiben in Höhe von zigtausenden Euro, sagt Hartwig Gelse, der zu den Betroffenen zählt. Und neue Schäden befürchtet, die heutzutage immer wieder möglich sind.



September 2007: Land unter in Holle, viele Straßen waren überflutet. Die Menschen bangen vor einem neuen Hochwasser mit katastrophalen Folgen. Archivfoto: Gosmann

Figure 14: Newspaper clipping: Residents of Holle are worried about a new flood (Gemeinde Holle, 2011)

Hildesheimer Allgemeine Zeitung vom 04.04.2008 Frühere Warnung bei Hochwasser? Land will Pegel in diesem Jahr technisch aufrüsten

Kreis Hildesheim / Hannover (abu). Noch in diesem Jahr will das Land die Pegel an den Flüssen technisch auf den neuesten Stand bringen. Damit wollen die Experten schneller und präziser vor Hochwasser warnen. Auch die Bürger können sich dann im Internet besser als bisher über die Lage informieren.

„Wie plötzlich das kam!“ Dieser Kommentar war bei Bürgern und Feuerwehrleuten immer wieder zu hören, als die Innerste im vergangenen Herbst quasi von Minute zu Minute stieg. Bei dem schweren Hochwasser Ende September und Anfang Oktober wurden Straßen im Bereich Sarstedt überflutet, zahlreiche Keller liefen voll. Im Innerstetal zwischen Holle und Groß Düngen stemmten sich hunderte Retter von Feuerwehr und THW gegen die Wassermassen, weil an mehreren Stellen die Deiche brachen. An vielen Orten im Landkreis lagen noch Wochen später Sandsäcke bereit. Die Hausbe-

Analogtechnik ausgerüstet. „Als sie in Betrieb genommen wurden, war noch keine digitale Technik dafür auf dem Markt“, erläutert Heyken. So ruft derzeit ein Server die Pegel in ganz Niedersachsen der Reihe nach ab, wobei auch die Übertragungstechnik älteren Semesters ist.

Doch im Lauf dieses Jahres rüstet der NLWKN alle Anlagen auf digitale Technik um. 2000 bis 5000 Euro pro Pegel lässt sich das Land Niedersachsen diese Aktion kosten. Künftig sollen die Messwerte dann digital übertragen werden. Mit Hilfe von GRPS-Mobilfunk und ISDN-Leitungen sollen künftig alle Pegel gleichzeitig und damit viel häufiger ihre Daten senden können. „Das reichen wir selbstverständlich an die Bürger weiter, sie können sich dann im Internet jederzeit über die aktuellen Pegelstände informieren“, verspricht Herma Heyken. Mit dieser Umrüstung spare das Land langfristig sogar

Figure 15: Newspaper clip: Earlier warning of floods (HAZ, 2008)

The second clipping (Figure 15) discusses the fact that the flood occurred very suddenly, without warning. There are now gauging station upstream of Holle, and this is planned to be changed, since the gauging stations at times of the flood were all downstream of the municipality of Holle, and hence could not give any indication of an increasing in time. Furthermore, this article discusses the costs and the technical issues of new gauging stations.

The clipping shown in Figure 16 examines the alert concepts of the responsible authorities, and interviews the head of the crisis team, who confirms that crisis communication did not work perfectly during the flood of 2007. For example, the chief executive of the emergency assistance organisations have to be contacted at an earlier stage of the flood hazard. This was improved in the concept for a new alert system for police and district authority. Furthermore, large scale exercises have been undertaken to train fire

brigades and emergency assistance organisations. The journalist also mentions the foundation of the newly planned Flood Forecasting Centre and a new (still in planning) flood protection plan for the Innerste.

Hildesheimer Allgemeine Zeitung vom 04.10.2008

Katastrophenfall Hochwasser - Konzept für Schutz fehlt

Neue Alarmpläne bei Kreis und Kommunen, aber noch kein Konzept / Hochwasservorhersagezentrale soll nach Hildesheim kommen

Kreis Hildesheim (uli). Genau ein Jahr ist es jetzt her. Da hatten die Hochwasserfluten aus der Innerste Teile des Kreises Hildesheim fest in der Hand. In Holle und Bad Salzdetfurth war es am schlimmsten. Mehrere tausend Rettungskräfte kämpften tagelang gegen das Wasser. Viele Menschen verloren Hab und Gut. Verletzt wurde aber glücklicherweise niemand. Dennoch: Was bleibt, ist die Sorge vor einem neuen Hochwasser.



2007: Das Wasser steigt, Helfer aus der gesamten Umgebung versuchen mit Sandsäcken, die Fluten einzudämmen. Archivfoto: Gossmann

Tagelange Regenfälle hatten die Wasserstände der Innerste und ihrer Nebenflüsse in die Höhe getrieben, die Deiche waren aufgeweicht. An diesem ersten Wochenende im Oktober 2007 stieg die Innerste so hoch wie noch nie zuvor. 6,75 Meter erreichte sie am Messpunkt Heinde. Die Deiche hielten dem Druck nicht mehr Stand. Auf einer Länge von 15 Metern brach die Innerste zwischen

Schulung teilgenommen“, freut sich Hartmann. Für das kommende Jahr plant die Polizeidirektion Göttingen, zu der Hildesheim gehört, eine große Stabsübung.

„Wir haben unsere interne Kommunikation verbessert, da hat nicht immer alles reibungslos geklappt“, räumt Hartmann ein. Überarbeitet wurde auch der Alarmplan. „Zum Beispiel werden bei einem erneuten Einsatz die Führungskräfte eher benachrichtigt, damit frühzeitig alles vorbereitet ist“, sagt Hartmann. „Wir haben unsere Schularbeiten gemacht“, ist er sich sicher. Doch ein Hochwasser verhindern könne das alles eben nicht.

Inzwischen ist es wieder Oktober und die ersten starken Herbstregen lassen nicht auf sich warten. „Das Risiko eines erneuten Hochwassers ist da“, sagt Achim Stolz, Sprecher des Niedersächsischen Landesamtes für Wasser-, Küsten- und Naturschutz (NLWKN). Doch nicht jeder stärkere Regen habe ein Hochwasser zur Folge. „Die Bedingungen 2007 waren extrem, es war außergewöhnlicher Starkregen vorangegangen“, erinnert sich Stolz. Die Wasserstände der Flüsse waren hoch und die Böden gesättigt. Doch natürlich könne das wieder so passieren. Deshalb soll die Innerste einen eigenen Hochwasserschutzplan bekommen. Die Vorbereitungen haben begonnen. In gut anderthalb Jahren soll er fertig sein, das Gefahrenpotential des Flusses aufzeigen und grobe Handlungsempfehlungen geben. Außerdem soll es eine Hochwasservorhersagezentrale geben. „Die Mittel dafür sind im Landes-

Figure 16: Newspaper clipping: Disaster 'flood' – no concept for flood protection (HAZ, 2008a)

Hochwasserschutz: Zusage fehlt

Gemeinde Holle wartet auf Geld vom Land, um neue Dämme bauen zu können

Holle (hs). Was wird aus dem Hochwasserschutz in der Region Holle? Dieses Thema stand im Mittelpunkt einer Informationsveranstaltung des SPD-Gemeindeverbandes Holle mit der umweltpolitischen Sprecherin der SPD-Landtagsfraktion, Petra Emmerich-Kopatsch, und dem SPD-Landtagsabgeordneten Markus Brinkmann im AWo-Raum.

Die Gastgeber klärten die Landespolitiker über die kritische Lage auf und wollten wissen, wie der Stand der Diskussion in den zuständigen politischen Gremien in Hannover sei und was von dort zu erwarten sein könnte. Der aktuelle Stand

der Dinge: Feste Zusagen aus Hannover gibt es bislang noch nicht.

Verwaltung, Politik und Anwohner in Holle haben gemeinsam in etlichen Gesprächen Überlegungen für einen Hochwasserschutz der betroffenen Gebiete angestellt. Die daraus entstandenen Planungen der Gemeinde sind weitgehend abgeschlossen. Ein wirksamer Hochwasserschutz schien gesichert, weil Landespolitiker Finanzhilfe versprochen hatten. Das bestätigte Holles Bürgermeister Klaus Huchthausen. Doch zwischenzeitlich seien zurückhaltende Signale aus den zuständigen Landesbehörden gekommen.

In der Diskussion ging es vor allem um gefährdete Bereiche der Michelswiese in Holle und bei Heersum. Bedauerlicherweise ergab sich aus Sicht der beiden Landtagsabgeordneten kein konkreter Hinweis, dass in den Haushaltsansätzen der Landesregierung die Holler Vorhaben aufgenommen seien, hieß es. In der Zwischenzeit signalisierten jedoch Umweltminister Hans-Heinrich Sander und Staatssekretär Friedrich-Otto Ripke, dass wohl doch Landesmittel in den Hochwasserschutz fließen, hieß es. Huchthausen dämpfte den Optimismus: „Noch gibt es keine verbindlichen Zusagen.“

Figure 17: Newspaper clipping: No permission for flood protection (HAZ, 2009)

The clipping in Figure 17 describes the struggle of the municipality of Holle to receive both a permission and promised financial resources from the government of Lower Saxony. However, politicians are cited that there is no definite confirmation.

C. Emergency management

The emergency management in the federal state of Lower Saxony distinguishes 4 alert levels (Meldestufen, s. table 5). Whereas level 1 (pre warning stage) and level 2 (overflow mainly on agricultural and forest land cover) do not result in activities of the responsible organisations (only a warning is sent after reaching level 2), level 3 (Inundation of large areas, solitary properties, roads and basements) triggers activities of the lower disaster authorities, police department and disaster units. This level is based upon measurements at the available gauging stations. For example, the gauging station 'Heinde' indicated 4.50 to 4.70m above regular level a few days before the 29th of September. This was classified as level 2. Emergency management, however, starts activities at level 3, which is 5.30m in Heinde, an event that occurs ones in a hundred years according to the calculations of the NLWKN. The development of the Innerste flood is a result of both long-term intense precipitation events from April through September 2007, and, in particular, intense rainfall during the days prior to the 29th of September 2007. The flood was not classified as 1:100 event, which resulted in the late (after breaching of the dykes and initial damage) emergency alert and initial meeting of the district crisis team.

Both expert interviews as well as the online questionnaire pointed to rather low quality forecasting and early warning systems. For example, during the 2007 flood the local police of Göttingen received only the relevant runoff data from the gauging stations. However, no prognosis was available.

During the interview of the 11th of January 2010, representatives of the municipality of Holle stated that representatives of the district water authority only once communicated with the municipality of Holle during the flood. No further action has been taken. Moreover, the same individuals confirmed that it is rather cumbersome to determine both the current values of the gauging stations as well as the water level of the upstream reservoir.

Prior to the initiation of an alert situation, the municipalities became independently active. For example, in the municipality of Holle representatives of the municipal authorities together with volunteers organised the procurement of sand and sandbags, which were filled and stacked by volunteers in collaboration with the local fire brigade. Both high social capital and informal but efficient social networks enabled the residents of Holle to act in a timely and appropriate way to prevent more severe damage in their town. According to representatives of the municipality of Holle (interview, 11.01.2010) the first basements were flooded on the 29th of September at 6 pm. The official alert was sounded on the afternoon of the 30th of September. During that time (and earlier) all activities in Holle were self-organised.

From then on all emergency assistance organisations including the local and district fire brigades were co-ordinated by the district crisis team. The district supported the municipality of Holle with sand after their own self-organised supply was expended.

The police department (PD) was involved after the flood alert was released. The PD disseminates information via their specialised police channels. The main recipient is the crisis team. The PD receives only gauging values of the relevant stations, but no prognosis. The representatives of the PD confirmed during the interview that the gauging values relevant for the municipality of Holle were not very useful. However, the experts from the NLWKN actively supported the PD. The PD does not receive information from the municipalities. This is co-ordinated by the responsible district authorities, especially the crisis team. As the municipality of Holle argued, the PD criticises the reservoir managers who did not provide enough water retention capacity during the 2007 flood. Furthermore, the reservoir is situated in area falling under the responsibility of another PD, even in another administrative district, which serves to hamper communication. Here the problem of the mismatch of administrative units versus eco-regions (river basin) is raised. This also holds for the values of the gauging stations that indicate water levels for the Innerste river basin. However, those are distributed over two administrative districts with two different responsible flood management authorities. Another communication problem for the PD is the lack of GIS licences. They cannot translate water level information into regularly updated digital maps, which would be useful for instant assessment and decision making. There are no financial resources for (expensive) commercial

GIS licenses, and open source is not accepted by German administrations. At time of the 2007 flood the PD had to rely on gauging data that were four hours old without spatial interpretation. The crisis team as well as the PD relies on the disaster management system NISIIPlus (<http://www.prodv.de/index.php>), which does not support a spatial analysis of floods. In 2007 false gauging data were communicated at one point, which almost resulted in inappropriate decisions. The PD raises the concept of crisis team life cycles. Usually, members of crisis teams meet not more than once or twice during their time in service. This means that these individuals accumulate little experience as members of a crisis team. The PD proposes more regular meetings to maintain experience and motivation for those individuals (the previous paragraph is based upon information of the interview with PD, 11.01.2010).

5.2.3 Synthesis of the results for the Demer case study, Belgium

5.2.3.1 Flood risk perception

A. Generic perception of risk

How important is flood risk ranked in the area. Individual perception of risk

In the flood prone areas of the Demer river around 3500 letters were distributed among the residents by post. Respondents were asked to fill out an online questionnaire. A response amount of almost 7 % was obtained. The sample size is therefore statistically significant. Respondents were asked about their concern or worries on behalf of different types of risks such as climate change, floods, pandemics, fires etc. The table below gives a summary of the top 3 answers (no at all, sometimes, regularly and frequently) of the respondents towards these different kinds of risks.

Table 6: Perception of respondents on different types of risks *

Answers of respondents	Not at all	Sometimes	Regularly	Frequently
Climate Change		Orange	Orange	Yellow
Floods			Red	Orange
Pandemy	Orange	Yellow		
Fire	Yellow	Red		
Criminality			Yellow	Red
Incident with big (chemical) company	Red			

*Red, orange and yellow colours represent qualitative results and correspond respectively with highest, second highest and top 3 responses of the respondents.

As can be deduced from Table 6, people regularly or frequently worry when it comes to floods and climate change. More precisely, thirty nine percent of all respondents indicate they sometimes worry about climate change, while respectively 36 % and 38 % of the respondents sometimes or regularly worry about floods. The response rates could be influenced by the recent flood event.

Numerous respondents indicate they are quite sure a flood will happen in their city within 10 years' time. More specifically, 38 % agrees with the statement, while 29 % fully agrees.

These percentages indicate respondents are aware of the flood risk within their town. This conclusion is verified by questioning the respondents whether they know if their home is located within a flood-prone area or not. All respondents answered this question and 62 % of all respondents confirm the statement. Some respondents are very experienced and experienced several floods in the past. Others indicate they are aware thanks to available information within the neighbourhood, or by looking for information on the internet.

Fifty percent of all respondents indicate their household is not prepared for a future flood event. Moreover, 62 % answers they did not take precautions to protect their residence. Only 16 % clearly indicates they can protect their homes with protective measures to keep out the water. According to 27 % of the respondents, people know they are prone to floods and are aware of the risk, but did not take further actions to protect their houses.

A remarkable answer given by the respondents is that 39 % of them agree that everyone should protect their home against floods (24 % claims to totally agree with this quote). Even more remarkable is that people mention not knowing how to protect their homes.

Questions, measuring several aspects were set up to assess the level of resilience or self-efficacy.

Question: Can you find a safe place in case of flood?:

Answer 1 : I need assistance

Fifty-four percent of all respondents indicate they need assistance in case an inundation occurs (respectively 45 % agrees and 9 % fully agrees) while forty-five percent of all respondents does not agree.

Answer 2 : I can find a safe place if necessary

A majority of the respondents, almost 75 % clearly indicates they can bring themselves into safety if necessary.

Answer 3 : I do not need assistance and I can help others if necessary

About 66 % say they don't need assistance and can help others if needed.

Presence of other sources of risk in the case study

Other sources of risk are not specifically surveyed as they fall outside the scope of the FREEMAN project. However, within Flanders, the Department of Environment, Nature and energy (Flemish Authorities) draws up some maps showing the large industrial risks (so called SEVESO firms). In contrary to other countries (e.g. The Netherlands), information on several risks is not centralized on one specific website, but merely scattered around several institutions.

Mayor events in the past: frequency and severity of risk and damage / Translation in casualties

Since 1988 the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED) has been maintaining an Emergency Events Database (EM-DAT). EM-DAT was created with the initial support of the WHO and the Belgian Government. The main objective of the database is to serve the purposes of humanitarian action at national and international levels. It is an initiative aimed to rationalise decision making for disaster preparedness, as well as providing an objective base for vulnerability assessment and priority setting. EM-DAT contains essential core data on the occurrence and effects of over 18,000 mass disasters in the world from 1900 to present. The database is compiled from various sources, including UN agencies, non-governmental organisations, insurance companies, research institutes and press agencies.

The tables below give an overview of the top 10 of disasters in Belgium during the last 30 years. They respectively present the total number of affected people, life losses and the actual economic damage costs. Based on the tables from the EM-DAT database, storms cause most economic damage costs. However, some storms can cause inundation, and it is not clear whether these are included in the category storm or flood. In Belgium floods cause – compared to other disasters – a relatively low amount of numbers of casualties. However, Table 9 clearly shows, floods affect a relatively high amount of people.

Table 7: Top 10 natural disasters in Belgium for the period 1982 to 2011, sorted by economic damage costs

Disaster	Date	Damage (1000 US\$)
Storm	18/01/2007	450000
Storm	25/01/1990	350000
Storm	25/02/1990	240000
Flood	11/11/2010	238146
Storm	03/02/1990	180000
Storm	28/02/2010	160000
Earthquake	13/04/1992	100000
Storm	21/01/1995	100000
Storm	28/02/1990	90000
Storm	07/02/1990	60000

Table 8: Top 10 natural disasters in Belgium for the period 1982 to 2011, sorted by numbers of casualties

Disaster	Date	No. casualties
Extreme temperature	01/08/2003	1175
Extreme temperature	jun/06	940
Storm	25/01/1990	10
Storm	21/01/1995	6
Storm	25/02/1990	5
Storm	26/10/2002	5
Flood	11/11/2010	3
Earthquake	08/11/1983	2
Storm	25/12/1999	2
Flood	24/12/2002	2

Table 9: Top 10 natural disasters in Belgium for the period 1982 to 2011, sorted by numbers of total affected people

Disaster	Date	No. total affected
Flood	11/02/2002	1200
Earthquake	08/11/1983	1030
Storm	14/08/1999	905
Storm	21/01/1995	800
Flood	11/11/2010	690
Flood	11/01/1993	600
Flood	27/01/2002	600
Flood	26/08/2002	600
Flood	10/09/2005	210
Flood	12/09/1998	140

Source: EM-DAT: The OFDA/CRED International Disaster Database / www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

B. Drivers of risk

The public is mainly concerned about the status in general of the waterways and tributaries. From the results of the questionnaire, residents are disappointed about the maintenance of specific waterways such as the Motte, a tributary of the Demer. Also, technical staff from the municipalities in the Demer valley quote that trans-boundary tributaries are less maintained, since responsibilities are saddled on from one province to another.

Based on the answers to the open questions, some residents seem to be quite aware of the flood risk. They express their concern about new building projects and the level of information obtained.

“When I was young, I lived in Scherpenheuvel-Zichem. We knew the area and were aware of the impact of the Demer and the risk of flooding. Every year we observed floods in the wetlands and agricultural fields close to the Demer. However, many neighbouring cities subdivided these grounds into parcel lots... I guess this aggravates the problem....”

“Because my husband already faced many floods during his youth, we have taken this into account during our search for a building lot. Many people do not realize they build and live in a flood plain until they are actually confronted with it... and then it is too late. The only solution should be a prohibition to build within these areas, however, there are many political influences. ”

"New residents should be better informed about the potential risks."

"Residents should not be given a building permit when the lots are situated in flood prone areas!"

"I would give people no building permit in case land is at risk, even if these lands were sold as building land! "

In Flanders spatial planning is now subject to a so-called water check (watertoets) that is implemented for each new building initiative. Still, the water check has some operational challenges that are reflected in the above mentioned quotations. Detailed information on the water check can be found in chapter 5.3.3.1 and 5.4.3.1.

C. Quotes and figures

Residents are generally concerned about weather-related disasters. Most respondents indicate they have worries about climate change and floods. Residents seem to be aware of the flood risk within the Demer Valley, but indicate they are generally not prepared for a future flood. Because the lack of information, only few residents take precautionary measures to protect their houses. The obtained percentages could be influenced by the recent event of November 2010.

Compared to the situation in 1998, similar bottlenecks were present during the 2010 events: fragmentation, lack and need of information, high economic damage etc. Though the floods do not cause huge amount of casualties, the level of economic damage remains high. During the 1998 flood, only the disaster fund ('Rampefonds') reimbursed residents and farmers for the damage. However, since 2005 (17 September 2005), damage caused by natural disasters like floods are coupled with fire insurance for residential buildings. Damage can be recovered through the 'Rampefonds', on condition that the government acknowledges the flood to be a natural disaster and in case the damaged houses were insured except in some very specific cases.

5.2.3.2 Crisis communication

A. The alert/early warning system

An early warning system is any system to empower individuals and communities threatened by hazards to act in time and in an appropriate manner to reduce the possibility of personal injury, loss of life, damage to property and the environment, and loss of livelihoods (NOAA,COMET 2010). More information on the definition of an early warning system can be found in chapter 5.3.

In Belgium, different institutions are responsible for managing coastal waters, navigable and non navigable waterways. The results of the early warning system (EWS) for non navigable and navigable waters can be seen on the following webpages respectively: www.overstromingsvoorspeller.be and www.waterstanden.be.

Respondents in the Demer basin were asked if they are aware of the existence of an early warning system. A vast majority of 76 % of all respondents were not aware of its existence.

Besides analyzing the awareness of the existence of an EWS, respondents were asked to indicate to what level they agreed (fully agree, agree, not agree, fully not agree) with the following quotes:

- “The existence of an EWS is important and consultable”: 50 % of all respondents fully agree, 47.60 % agrees. Only 2.4 % of the responds does not agree.
- “This system is useful to get prepared for a flood.”: 55 % agrees, 33 % fully agrees; only 12 % does not agree with this quotation.
- “The system is well accessible.”: 45 % agrees, 29 % fully agrees, .

Unfortunately, at case study level in Belgium, too little respondents are aware of the existence of such tools. However, some respondents were keen and mentioned very specifically both websites, from where they've obtained information during the last flood (November 2010). For the last two quotes, all respondents answered (including those that were not aware of the existence of such tool). Generally, they show a positive attitude towards the existence of such tools, but they want it to be accessible and it should function as a good guidance to prepare people to floods.

During the flood of 1998, the flood forecasting system did not exist. People were generally warned by means of messages by speaker phones or by police or firemen.

During November 2010, several areas in Flanders and Wallonia were hit by floods. At the Flemish part, the Flemish Environment Agency VMM communicated the existence of the EWS system and encouraged (lay) people to follow the situation on-line.

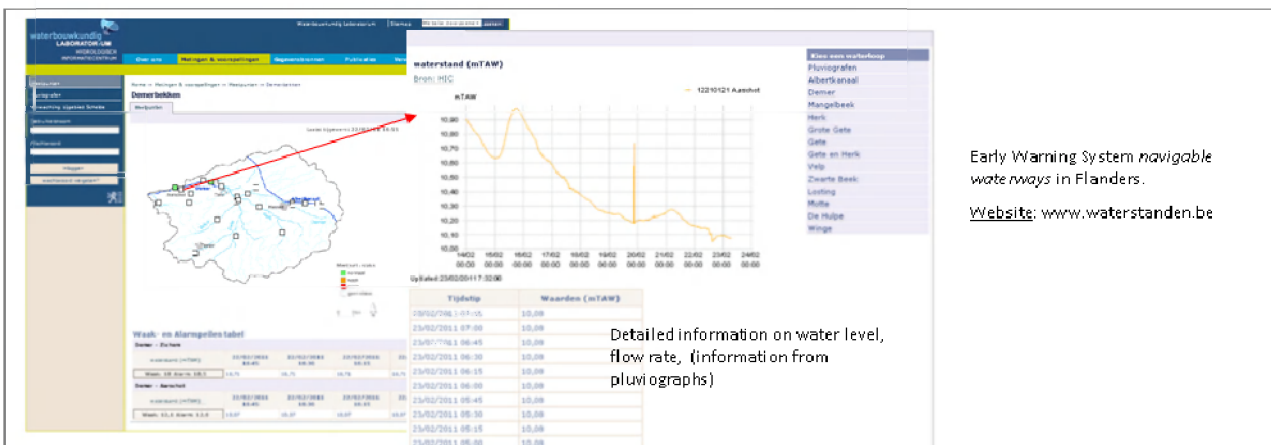
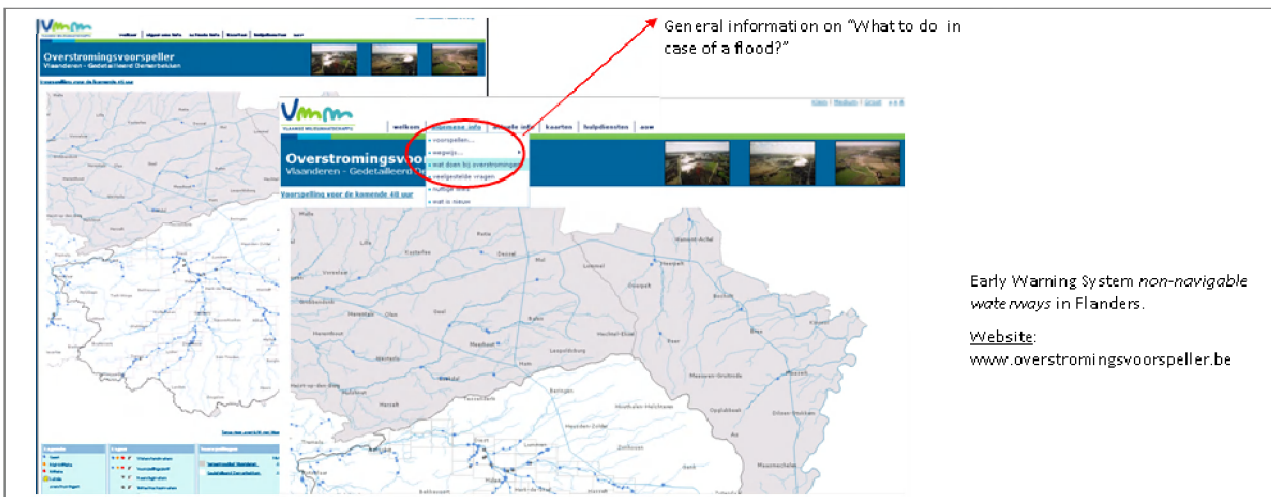


Figure 18: Screenshots of websites where EWS of navigable and non-navigable waterways can be observed

As can be seen on the screenshots above, there are no clear indications on what actions should be taken at a certain water level. This is an upcoming action and goal that will be achieved. The initial target audience of these websites were water managers who understand the implications of these different levels.

B. Newspaper coverage

Several newspapers from 1998 were retained within libraries. Besides the pictures, showing the high water levels, drawn animals and inhabitants dealing with the nuisance of the flood, some striking quotes are remarkable and worth mentioning:

Bouwen in overstromingsgebied: overheid kan niets ondernemen

BRUSSEL — „De minister van Ruimtelijke Ordening kan niet tegenhouden dat gebouwd wordt in gebieden met risico op overstromingen”, zegt een woordvoerder van minister van Ruimtelijke Ordening Eddy Baldewijns. „Als zo'n gebied op het gewestplan ingetekend staat als woongebied, kunnen wij daar niets tegen doen, of we moeten planschade betalen.”

Bij elke overstroming komen mensen in beeld die plots merken dat ze gebouwd hebben in een gebied dat al eeuwen bij elke planschade onder water staat. Maar de ge-

meente had hen niet verwittigd, de notaris niet, en ook hun architect niet.

„Het gaat vaak om mensen van elders, die niet beseffen waar ze bouwen, maar die aangetrokken zijn door de goedkope grondprijzen. Bij het opstellen van de gewestplannen hebben verkavelaars door handig lobbywerk bekomen dat die gronden als bouwgrond ingetekend werden. Nu verandert het Vlaams Gewest dat niet, omdat de planschade te veel zou kosten”, zegt Johan Van de Walle van de Bond Beter Leefmilieu.

Volgens het kabinet-Baldewijns wordt bij nieuwe woongebieden wél grondig nagegaan via het Ruimtelijk Structuurplan Vlaanderen of er problemen kunnen opduiken. Bovendien zijn bouwverordeningen op komst die eventuele problemen minder zwaar maken. Onder meer door regenputten te verplichten en waterdoplatende materialen.

De woordvoerder van de minister vindt dat de gemeenteraden de plicht hebben getuigende de bouwers grondig in te lichten.

—B.M.

With every flood attention goes to people who suddenly see they have build their house in areas that are flood sensitive for centuries...but they were not informed by the municipality, the notary, nor their architect. “The municipalities are responsible to inform candidate contractors;”

Figure 19: Newspaper clip: Building in flood prone areas, authorities cannot do anything about it (Het Volk, 16th September 1998)

The text mentions: “The problem is the straightening of the rivers and tributaries Old reservoirs and wetlands are occupied by agriculture and industry..... Engineers have not realized the consequences of their interventions.”

The minister pleads for space for rivers.

Figure 20: Newspaper clip: Flemish minister wants rivers to meander again (Het Volk, 16th September 1998)

Vlaams minister wil weer bochten in de rivieren

Bewezen schade:
8 miljoen frank.
Teruggekregen
van het
Rampenfonds:
1,7 miljoen frank.

The interviewee: "In Belgium there are real chatters, but nothing actually happens".

Residents feel down and not pleased with the received financial compensation, compared to the suffered damaged.

Figure 21: Newspaper clip: Proved damage: € 200.000, Received from the disaster fund ('Rampenfonds'): € 40.000 (Het Volk, 18th September 1998)

During the flood of November **2010**, similar messages reappeared: about the building of new houses within flood prone areas, spatial planning in general and about the level of refunding.

In contrast to the flood in 1998, residents were better informed beforehand on the existence of the webpage (www.overstromingsvoorspeller.be / www.waterstanden.be) and how to get prepared by television and newspaper messages.

The following headlines illustrate the severity of the flood.

Even in 2010, new houses have been built in flood prone areas. Although in 2005 for every building permit, the increased flood risk needs to be assessed. Local, provincial and regional governments that are involved in suspending building licences for new projects can refuse permits or enforce to take appropriate measures.

However, "mayors and chairmans often yield to the superior power".

Although the advice of the water check is negative, they still suspend a license. "The individual interests of propertied classes triumph".

In Geraardsbergen, the new houses were built, even though there was a negative advice. As a consequence, these new houses were flooded in November 2010.

Ruimtelijk wanbeleid

Volgens de Vlaamse sociaaldemocratische parlementariër Bart Martens betaalt België "de tol voor decennialang wanbeleid op het vlak van de ruimtelijke ordening". Door de verharding van oppervlakten en de "recht-trekking en inbuizing" van waterlopen zou minder water in de bodem infiltreren en zou deze zijn sponsfunctie verliezen. Via gemengde rioleringen en collectoren wordt het water te snel afgevoerd naar ingesnoerde rivieren die op de verkeerde plaatsen overstromen. Ook zijn te veel bouwvergunningen afgegeven voor huizen in overstromingsgebieden en opgehoogde "waterzieke gronden" (gebieden die vaak overstromen). "Steek onze rivieren in een ruimer jasje", is Martens' advies.

Figure 22: Newspaper clip: Floods in Belgium: result of spatial disorder? (H2O, December 2010)

In Flanders spatial planning is now subject to a so-called water check (watertoets) that is implemented for each new building initiative. Detailed information on the water check can be found in chapter 5.3.3.1 and 5.4.3.1.

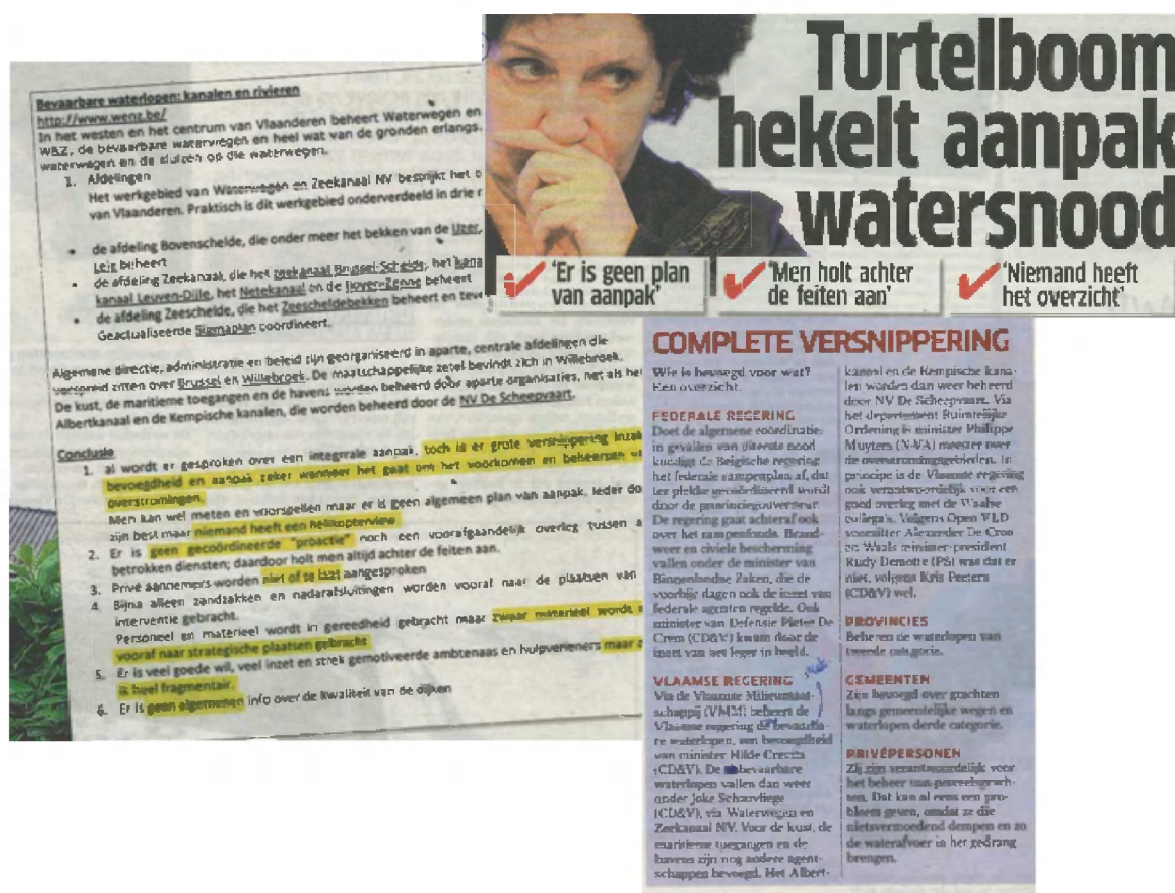


Figure 23: Newspaper clip: Complete fragmentation: Minister of Internal Affairs (Turtelboom) criticizes the way the flood crises was managed/approached (De Gentenaar, 18th November 2010).

"Te weinig geld, te weinig ruimte" voor water

do 13/01/2011 - 15:33

Er zijn in Vlaanderen te weinig gebieden waar water tijdelijk gebufferd kan worden. Bovendien gaat er niet genoeg geld naar veiligheidsmaatregelen voor overstromingen. Dat zijn de conclusies van de Coördinatiecommissie Integraal Waterbeleid (CIW) na de zware wateroverlast van eind november.



Figure 24: Newspaper clip: Not enough money, not enough space for water (De Redactie, 13th January 2011)

After a period of 13 years, floods are still a source of discussion in Belgium. It is clear that floods are still a very contemporary problem.

Similar messages have appeared within the newspaper.

In Belgium, emergency management and planning follows strict guidelines. This is elaborated on in the paragraphs below (chapter 5.4).

Newspapers remain an important source of information for residents. Despite the guidelines, the reporting does not always contain all correct information, as illustrated in the news item below (**De Gentenaar, 18th November 2010**).



Figure 25: Newspaper clip: De Gentenaar, 18th November 2010

Within the news item (Figure 25), the names of the ministers are wrong: combinations are VMM – ‘onbevaarbare’ 1st category (non-navigable waterways) - Minister Schauvliege and W&Z – ‘bevaarbare’ (navigable waterways) - Minister Crevits. More detailed information on the responsibilities, management and authorization can be found in chapter 5.4 (more specifically see chapter 5.4.3).

C. Emergency management

To allow a fast and coordinated assistance during an emergency situation, plans are drawn up at three different levels (mayor, governor and the minister). An emergency plan is a policy tool which is meant to deploy a fast enrolment of available resources and means. The availability and enrolment of different means are guided by an optimal coordination. Emergency plans are essentially drawn up to ensure the protection of the population and the environment

The scheme presented in Figure 26 gives an overview of the different types of emergency plans.

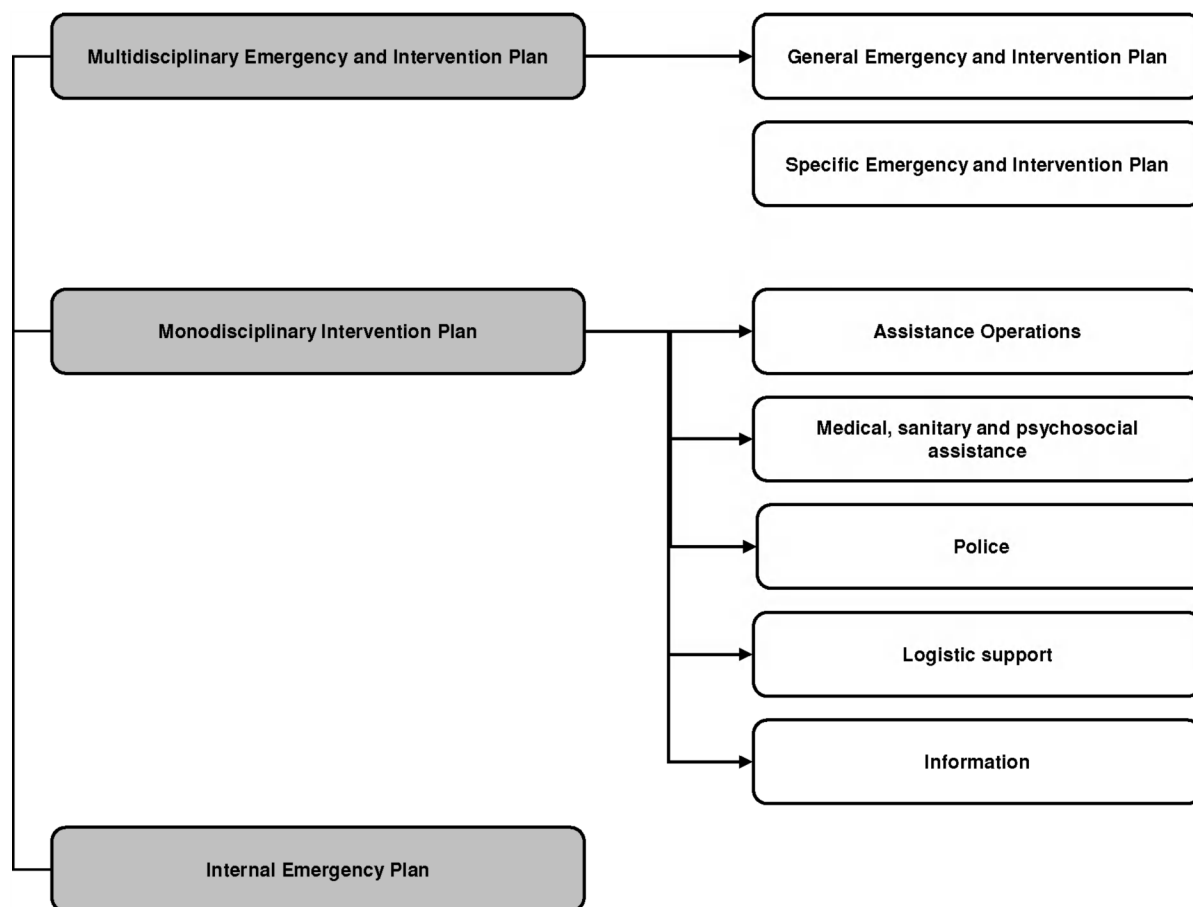


Figure 26: Different types of emergency plans in Belgium

The lowest level or *internal emergency plans* are developed and set up at the level of specific companies or institutions. The plan contains e.g. organisational emergency measures in order to limit the possible harmful consequences of specific emergency situations within the company or institution.

The next level or the *mono-disciplinary intervention plans* regulate the intervention modalities of each of the disciplines in consistency with NIP (Emergency Intervention Plan). More specifically, the plan regulates the arrangements concerning alert, the scaling up procedure, division of tasks, etc.

The highest level, or the development of *NIPs (Emergency Intervention plans)* contains guidelines and necessary information to ensure proper management of every emergency situation. Procedures and methods within these plans are in principle the same as within mono-disciplinary intervention plans.

In the plans the tasks of the different services are clearly delimited and classified within five functional disciplines (also indicated within the figure above):

- discipline 1: assistance operations
- discipline 2: medical, sanitary and psychosocial aid
- discipline 3: the police force of the place of the emergency situation
- discipline 4: the logistical support
- discipline 5: information

For each of these disciplines, a mono-disciplinary intervention plan is drawn up.

The following paragraphs provide an overview on discipline 5. The bulk of information is extracted from professional literature and guidance documents set up by the Ministry of Internal Affairs.

Crisis communication & the structure of discipline 5: emergency management system from a communication perspective

It is of utmost importance to ensure an appropriate communication during emergency situations and to maintain and adjust the communication regularly in function of the course and development of the emergency situation. During the emergency situation the population will be informed as soon as possible about the status and possible precaution measures to be taken or other measures. The target groups for crisis communication are both internal employees, victims or potential victims, their surroundings and the general public.

Besides, it is also important to inform the media accurately. They can play a very useful role in transmitting the recommendations of the government to the threatened population. In some cases, population in adjoining countries are also informed. The information flow should be aimed at responding questions of the involved citizens.

Discipline 5 is responsible to inform and communicate to the population. The discipline is established by the respective security warrants on local and provincial level. The scheme below gives an overview of the composition of this discipline. As seen, the discipline is responsible for a series of communication tasks. As such, a reliable support is necessary.

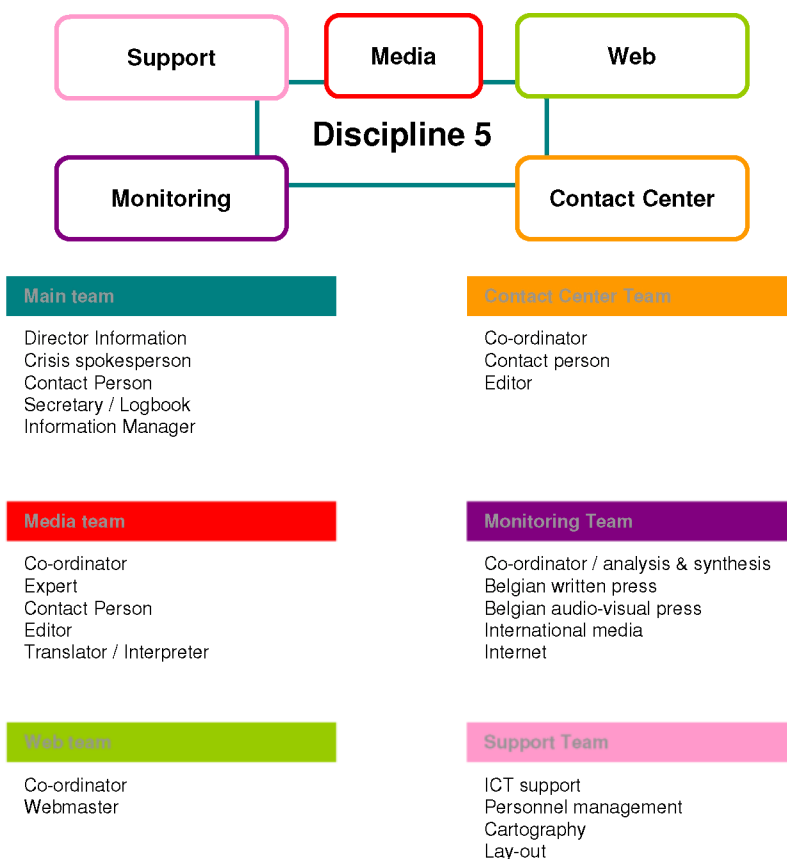


Figure 27: Schematic overview of the composition of discipline 5

Some issues are prepared, described and stipulated within the mono disciplinary plan of discipline 5. Good examples are for instance, how the population can be informed, how the communication with the press is organised, which information numbers are released, where the communication centre is established, who is responsible for the function of information director (Dir-Info) during the emergency situation and who coordinates the information with the information that is given by discipline 2 concerning victims.

The mayor is responsible for informing on the emergency situation at the municipal stage, whereas the governor is at the provincial. In case of the federal phase the competent minister (Minister of Internal Affairs) will be responsible for the coordination of the general information to the population. The governors and the mayors will take this into account when they inform the population concerning the necessary protection measures.

Once the emergency situation is terminated, utmost care is spent on informing people to return to the normal situation.

The communication scheme is illustrated in the figure below.

	Local facts	Local interpretation	National facts	National interpretation	Empathy	Symbolic function
Operational services	x				x	
Mayor	x	x			x	
Governor	x	x			x	
Minister			x	x	x	
Prime Minister					x	x
King					x	x

Figure 28: Scheme of communication during emergency

Communication plan for emergency situations

Annex 1 in this report gives an example of a mono disciplinary intervention plan for discipline 5 (in Dutch). Important mentioning is that this document is only a guide and offers a number of instruments at which municipal, provincial and national level can contribute to a harmonised approach to inform the population during emergency situations.

5.2.4 Synthesis of the results for the Soverato/Vibo case study, Italy

Research activities described in this section shed light on the understanding and perception of flood risk, its drivers, and impacts (section 5.2.4.1); and the extent of preparedness to flood disaster, in terms of the early warning system and emergency plans in place (section 5.2.4.2).

The methodologies applied include 1) series of semi-structured interviews, successively analysed qualitatively; 2) focus group discussions; 3) text analysis of collected newspaper articles; 4) normative analysis of risk alert systems and emergency plans; and 5) desk review (see further down in this section for more detail). In the point (1) above the conducted research deviates slightly from the description of work (DoW). Initially, it was planned to apply a questionnaire with answers on Likert scale and a combination of closed and semi-opened questions. To avoid replication/redundancy with the research conducted in the context of UR Flood project in the same region, we have applied semi-structured interviews instead allowing qualitative insights about the risk perception.

The CMCC project team conducted a series of more than sixty (60) semi-structured interviews with representatives of flood risk management institutions, citizens and experts in Calabria. The interviewed persons included representatives of the River Basin Authority; Reclamation Boards; Corp of Forest Engineers; Prefect; Layers and Attorneys; Regional and Provincial Government; Local administrations; Civil Protection, Regional Nature Protection Authority; Corp of Fire-fighters; Entrepreneurs; Civil Society Organisations and others. In addition, local experts, rescuers in the analysed flood events, and victims – survivors of the flood and/or their families were interviewed. The interviews lasted from 30 to over 120 minutes. Often several individuals were interviewed at the same time. If consented, the interviews were recorded and transcribed (the records were deleted afterwards), otherwise notes were taken. The interviews have been conducted in the disaster-hit localities Soverato and Vibo Valentia, neighbourhood and other areas suffered from recent hydrogeological disasters (including Maierato famously known for the 2010 landslide). Additional interviews have been conducted in Catanzaro (the capital of the region). All transcribed interviews were analysed qualitatively. The frame analysis described in Gray (2003) was applied in order to identify categories of how the interviews characterise risk (risk characterisation frames), the community and themselves (identity frames), how they describe other parties' interests and motivations (characterisation frames) and what they suggest to do about the risk (risk management frames). In addition, a set of auxiliary frames such as social engagement, whole story, power, and resources were identified.

A focus group discussion was organised with a randomly chosen set of 14 citizens from Catanzaro, Soverato and neighbourhood communities. Compared to the individual interviews, the focus group discussion allowed for dialogue and exchange between the participants, and collective responses to the questions posed. The overarching topic of the focus group discussion was the concept of resilience and flood risk perceptions in Calabria.

For the scope of this project, a large number of newspaper articles were collected from the regional office of the newspaper 'Gazzetta del Sud', online and other sources. The desk study analysis included additional documents not listed above such as legal proceedings, legislative documents and gray literature.

5.2.4.1 Flood risk perception

A. Generic perception of risk

Copious literature is available on flood risk perception but we have found none conducted in the specific cultural and historical context of Calabria. From among the previous studies shedding light on perception of risks different from flood, Chester *et al.* (2000) analysed on volcanic risk perception and the way it is influenced by religious belief. Other studies not referring to Calabria or only marginally include perceptions of health threat (Prati *et al.*), waste disposal (Sessa *et al.*), environmental risks (Irene *et al.*), volcanic risk (Nave *et al.*).

The history of Calabria and living memory of its community members is punctuated by memories of many disasters, with more or less devastating effects. Not surprisingly, the interviewed community members showed high awareness and appreciation of threats posed by multiple hazards to which the region is exposed. Some of the interviewees remembered the shattering floods in the 70s or even 50s and highlighted the regular occurrence of significant disasters every 20 or so years, with many more localised and 'painful' events in between. The collective consciousness of natural hazards is best expressed by the frequent referenced to Giustino Fortunato, a renowned writer, historian and politician, who compared Calabria to a sliding bulge over a sea ('sfascium pendulo sul mare'). From the ancient times, the nature in Calabria had been hardly ever 'good and carrying mother' (Zizek, 2010).

We have found that the flood risk perception is closely embedded in the recognition of community as a whole, with the perception of individual and common property, and the precarious economic and social conditions. The ubiquitous perception of isolation is determined by the geographic separation from the rest of the country, by the mountains to the North and the sea to the other directions; the notoriously underdeveloped and -dimensioned infrastructure that makes mobility in and out of the region difficult; and the belief the federal government does little to alleviate the economic and social inequalities experienced in the region.

The economic and social costs caused by natural disasters are one among many hardships the community has to endure. Calabria is one of the poorest regions in Italy; both in terms of GDP produced and average income. The high unemployment rate and the lack of career development prospects made many young and talented people leave the region. Many interviewees believed that the region cannot escape the underdevelopment trap without the help from the state and the national attention drawn by natural disasters is a good opportunity to stress the precarious situation of the communities. The past federal economic growth and development programmes, targeted to the less developed southern regions of Italy, were acknowledged as beneficial for the land reclamation and disaster defence infrastructure, despite their notoriously bad management and control. In the absence of the supplementary financial aid, the existing infrastructure is not sufficiently maintained and stops fulfilling its role.

The perceived state of abandonment geographic and cultural distance to the other parts of Italy, and the 'weak authority' of federal instructions gave rise to a distinct culture in which the individual or family-confined concerns intertwines with shadow institutions of vested interested, favouritism, embezzlement or even corruption. Against this background, it is not surprising that the organised crime gained ground, for many a distinct feature of the Calabrian community. The defining characteristic of this culture, as highlighted by nearly all interviewees, is the disregard for common property, including environment, and a weak compliance with the urban development legislation.

On the other hand, the extraordinary readiness to help others and generosity of the people counteracts the community 'bads' outlined above. Many interviewees – actor or witnesses of the disaster strikes analysed in this report, stressed the persistence and bravery of the rescue workers trying to help the flood victims.

B. Drivers of risk

Calabria is among the Italian regions most prone to natural hazards including earthquake, floods, tsunami, drought and volcano. In fact, Calabria suffered many strikes of a capricious nature, including the devastating earthquake in 1908, and the major floods and landslides in 1931, 1951, 1953 (Reggio Calabria), 1972-73, 1996 (Crotone), 2000 (Soverato) and 2006 (Vibo Valentia). The area at significant hydro-geological risk because of the exposure or territorial sensitivity amounts to 29,517 km² (~9.8 % of the Italian territory) (MATTM 2008). These risk-prone areas are spread over ca. 82 % of the municipalities (6,633). In six out of twenty administrative regions all (100 %) municipalities show high exposure to landslide, flood or both: Calabria, Autonomous Province of Trento, Molise, Basilicata, Umbria and Valle d'Aosta.

Nearly all interviewees were very conscious about the many social drivers that amplify the flood risk.

As discussed in the section 5.3.4.2, due to the orthographic, meteorological, hydrological and geological conditions, Calabria is particularly exposed to flash floods. More than 41 % of the territory is mountainous and the region has the 6th highest forest surface of the nation (ISTAT 2004). Because of the short distance between mountain chains and the sea, several rivers show characteristics of **fiumare**, ephemeral

streams characterised by huge sediment loads and violent flash floods (Petrucci *et al.* 2009). Because of the lack of plain areas and low awareness of natural hazards, several urban settlements have developed in flood- and landslide-prone areas.

The social drivers of flood risk include building in areas prone to flood and rainfall-triggered landslides; land use change uphill, driven by deforestation, bush fire and land abandonment; insufficient maintenance of river courses; exploitation of the floodplains or even riverbeds; soil impermeabilisation (sealing); insufficient drainage and sewerage; and unlawful disposal of waste in the courses of water.

In 2009, there have been some 716 (affecting ~7.206 ha) registered bushfires in the region, down from 1.280 (~17.996 ha) in 2008 (WWF). Only a small proportion of them have been caused by natural causes or by human carelessness, most were deliberately started by arsonists for economic benefits but not only. This widespread practice has many roots among which the interviewees the careless attitude towards common property and environment. Bushfires reduce the retention capacity of soil, thus water regulation, which in cases of intense precipitation lead to increased and quicker surface runoff. Another widespread practice, the unlawful disposal of waste, together with the perennial vegetation in riverbeds increase the transported debris and create obstacles and small dikes that eventually break and, through a cascading effects, increase the volume that discharge at once. The role of one of such dams created under a bridge situated upstream of the camping site Giare at the Beltrame/Soverato torrent was subject of review during the trial.

5.2.4.2 Crisis communication

A. The alert/early warning system

In Calabria, the Regional Crisis Alert System was mandated by Legislative Decree 112/98, Law 401/2001, Regional Law 4/97 and Prime Minister Directive of 27th February 2004 and the Head of CP National Department note n. 0046570 of the 20th September 2005.

The Article 12, Law 225/1992 of 24 February 1992 compels the regional authority to set up and guarantee operation of civil protection mechanism, in accordance with the State legislation, and within the invested and delegated power. Activities of civil protection are to safeguard human lives, property, settlements and the environment against the threat posed by natural disasters and catastrophes.

According to the Law 4/1997, the Regione shall carry out the coordinating functions of civil protection activities falling within their responsibility through the Regional Civil Protection Committee, the Technical and Scientific Civil Protection Committee, the Regional Emergency Operations Committee and the Regional and Provincial Operations Rooms. The regional civil protection premises shall host the "Regional Operations Room" where technical coordination and supervision activities are carried out as part of the Regione's civil protection responsibilities. The Operations Room is under the direction of the official responsible for Civil Protection and is active 24 hours a day. The regional civil protection premises shall host the "Provincial Operations Room" where news gathering, ordering, coordination, communication, supervision and monitoring activities are carried out as part of the Province's civil protection responsibilities. These Operations Rooms are decentralised in the areas of each Provincia and are hosted in the regional civil protection premises.

It is a part of the responsibility of the Region to establish an early warning, forecast and prevention programmes and emergency plans (for the sectors lying under its responsibility), to allow prompt and efficient disaster response and contribute to Government-led rescuing operations. Regional forecast and prevention programmes and emergency plans are implemented through annual plans on a proposal from the regional civil protection bodies.

In terms of organisation of regional operations, the President of the Regional Council, or a delegate, is responsible for directing regional civil protection activities and for their coordination with the activities carried out by State, Province, and municipal authorities, as well as by the other civil protection bodies that are operative in the region.

The Calabria Functional Centre was established on September 2000 by the CP Decree n.3081 of 12th September 2000, mandated by the 2004 Prime Ministerial Directive of 27th February 2004. The latter Directive established a Network of Functional Centres was created to deal with hydrogeological and hydraulic risk as it emerges and evolves in emergency situations. The initiative arose in the aftermath of very serious disasters such as those occurred in Sarno in May 1998 and in Soverato in September 2000. It was funded as part of the financial provisions made for Law 267/1998 (Sarno Law) and Law 365/2000 (Soverato Law), as well as from money collected from the 0.8 % donations from personal income tax (IRPEF).

The Network of Functional Centres is composed of the Regional Functional Centres, a Central Functional Centre managed by the National Civil Protection Department and by a number of Competent Centres for technical-scientific support.

As part of regional warning systems, Regional Functional Centres shall i) provide weather forecast for the relevant region; ii) ensure efficiency of the Weather-water-rainfall Regional Network and of the weather radar network, collecting the quantitative and qualitative data provided by them; iii) carry out weather and hydrological surveillance and a preventive assessment of the impact on land of adverse weather conditions, and issue weather Bulletins; iv) develop technical and scientific support structures for hydrogeological and hydraulic risk prediction through research projects, analyses and the implementation of mathematical and expeditive models for the assessment of impact on land.

Functional Centres share standard procedures and data exchange methods; however, they maintain their autonomy in decision-making processes and in the management of emergencies within their region. The Network of Functional Centres shall collect, concentrate and integrate the following i) qualitative and quantitative data produced by the weather-water-rainfall networks, the national weather radar network, as well as by the various satellite platforms available for earth observation; ii) territorial hydrological, geological, geomorphological data, as well as data from landslide monitoring systems; iii) weather, hydrological, hydrogeological and hydraulic modelling.

The network provides an ongoing monitoring service which is active every day of the year and, where needed, 24 hours a day, to assist civil protection operations and support decision-making processes by the authorities responsible for warning systems and emergency management.

Regional Alert Warning System is an assembly of tools, plans, legislation, programmes and procedures, which can contribute to reduce damages for people and goods in case of meteorological or hydrological event particularly intense. For the scope of the EWS, Calabria is divided in six Warning Zones, territorial areas particularly homogeneous for kinds and gravity of the expected events, both meteorological and hydrological intense, and the respective effects.

B. Newspaper coverage

The flood and landslide disasters receive large newspaper coverage, both locally and nationally. Newspapers plays a important role in fact interpretation, public opinion building and agenda setting. The 2000 Soverato flood received high attention because of the high number of casualties and the fact that most of the people who died in the flood were physically impaired (disabled). The emotionally laden articles (see figures below) attract the attention primarily on the victims, heroism of the rescuers, alleged wrongdoing – culprits accountable, at least partly, for the flood impacts, details of the emergency operations, and early details of the criminal investigation. The 'story' is explored from various angles, with increasing details and preliminary, often wrong, account of the facts. Focusing on the facts, and later on the interpretation of the responsibility and accountability, the newspapers influence the perception of risk but also the efficiency and obligation of government during the recovery.

SOVERATO / Morti per salvare i disabili intrappolati dal fiume di fango
Alto tributo di sangue dei volontari Unitalsi

Su 10 vittime identificate 5 appartengono all'organizzazione assistenziale. Ancora incerto il bilancio definitivo: tra 16 e 17. Ascendono a 800 miliardi i danni nella fascia ionica flagellata dal maltempo
Il governo su richiesta di Loiero decreta lo stato di calamità per i comuni calabresi maggiormente colpiti

Figure 29: Gazzetta del Sud 12/09/2010, the title highlights among the victims are volunteers of the association UNITALSI, a charity organisation. The costs of the flood events along the Ionian Sea cost is estimated to ca. 800 millions Euro

SOVERATO / Il fango non ha lasciato scampo agli ospiti del camping che dovevano partire nella serata di ieri
L'onda assassina li ha sorpresi nel sonno

A monte del torrente ha ceduto una diga formata da i detriti degli alberi bruciati nei giorni scorsi



LE VITTIME DEI FURBI

SOVERATO - I volontari della Croce Rossa e della Protezione Civile sono stati travolti dal fiume di fango che ha investito il camping di Soverato. Le vittime sono state identificate in un'area di emergenza. I soccorsi sono stati avviati immediatamente. Le autorità hanno decretato lo stato di calamità per i comuni colpiti.

Figure 30: Gazzeta del Sud 11/10/2010: The title of the article highlights the fact that the flood reached the camping site in early morning hours, while the visitors were asleep.

NUBIFRAGID KILLER / La tragica, commovente storia di Rosario, un ragazzo catanzarese che assisteva nel camping di Soverato i genitori disabili
Morto a 17 anni per salvare il padre
Era in salvo, ma è tornato indietro ed è riuscito nel suo intento prima di essere travolto



IL COMMENTO
LA NATURA È CIECA? NO, I CIECHI SIAMO NOI

di Francesco Geronzi

Un ragazzo di 17 anni, Rosario, è morto per salvare il padre, un uomo con disabilità. La storia è commovente e tragica. Rosario era in salvo, ma è tornato indietro per aiutare il padre e ha perso la vita. La natura è cieca, ma noi siamo ciechi se non aiutiamo chi ha bisogno di aiuto.

Gli amici della Croce Rossa e della Protezione civile dopo il recupero di una delle vittime

Il dramma nei racconti dei soccorritori: «Trappola senza scampo, sono passati dal sonno alla morte»
La lotta impari contro il mare di fango

Figure 31: Gazzeta del Sud 11/10/2010. The title tells the story of a boy 17 years old who died in the flood while trying to save his father, a disabled person staying in the camp.

SOVERATO / Primi sviluppi dell'inchiesta sulla strage del camping coordinata dal procuratore Spagnuolo

Ci sono dieci persone indagate

Si tratterebbe di funzionari del Genio Civile e della Prefettura

Vincio Leone //

CATANZARO - La Regione attraverso il Genio civile catanzarese, la protezione civile locale, la Direzione generale delle entrate con gli uffici territoriali, il Comune di Soverato e probabilmente anche la prefettura di Catanzaro. In questi uffici sarebbero stati individuati i primi dieci indagati per la strage di Soverato dove il 10 settembre morirono tredici persone.

Si tratta di dieci nomi e cognomi iscritti al registro degli indagati dal pool di inquirenti guidato dal procuratore aggiunto della Repubblica Mario Spagnuolo e composto dai sostituti Sandro Dolce e Simona Marazza. È la svolta nell'indagine sulla sicurezza delle campings "Le Giorre" provocata dall'esondazione del torrente Beltrame, ancora senza responsabili. Un'indagine che muove soprattutto una frase pronunciata nella serata di giovedì 11 settembre scorso dal direttore della Protezione civile Franco Barberi nella



Il prefetto Gallitto

no, e l'imprenditore pagava regolarmente alle Finanze la concessione (circa 70 milioni l'anno). Anche il Comune soveratese ha autorizzato il camping a restare lì.

Il Genio civile catanzarese, che ha il compito di controllare i corsi d'ac-

qua, inizialmente aveva dato parere negativo alla struttura perché sull'alveo c'è un fiume. Poi però dopo una perizia di un docente universitario d'irrigazione, l'ufficio regionale ha detto sì al camping.

In questo modo era andata bene per più di vent'anni. Nessun turista in tenda s'era mai chiesto perché quel camping se ne fosse adattato a letto di un torrente che di estate era poco più d'un rivolo. Poi la catastrofe.

Dopo due giorni ininterrotti di piogge torrenziali, alle 5 del mattino arriva la piena che travolge ogni cosa. I turisti si salvarono quasi tutti. A essere la peggio, per ovvi motivi, sono i disabili dell'Unità 31. Ce n'erano quaranta nel bungalow. Cinque di loro hanno perso la vita, insieme ad altrettanti accompagnatori volontari. Un doppio pesante sacrificio per i volontari unitali: non solo si sono prodigati ad assistere gli infortunati, ma per salvarli hanno perso la vita. Resta



L'ingresso del camping della strage a Soverato

però un unico punto oscuro di cui gli inquirenti si sono preoccupati: visto il maltempo, perché i responsabili del gruppo di volontari non ha levato le tende in tempo?

Un altro interrogativo inquietante viene fuori analizzando le carte della

prefettura catanzarese e incrociandole con quelle della protezione civile regionale guidata da Barberi. A sollevare la questione, il giorno stesso della sciagura, è stato il ministro Bianco: da Roma sono partiti due avvisi alla prefettura per segnalare le

previsioni di maltempo eccezionale, ma solo lunedì era venne inviato per fax al Comune di Soverato. Il prefetto Vincenzo Gallitto ha risposto più volte le sue ragioni. C'è da chiedersi comunque se l'invio del secondo fax sarebbe bastato ad evitare la strage.

Figure 32: Gazzetta del Sul, 09/12/2010: Article about the first persons hold responsible for the flood deaths and the course of investigation

C. Emergency management

At the time the interviews were conducted, the both events laid back in time of 4 and 10 years. We have found no analysis of rescue and recovery operations.

Emergency plans are mandated by the Directive 'Regional Alerting System for the hydrogeological and hydraulic risk in Calabria'. After being alerting, the actors envisaged (at the local level the mayors) for this task by the directive put in place the provisions of the plans. The emergency plans for flood risk are produced at regional level by the regional administration, at provincial level by the provincial administration and at the local level by one or more associated municipalities. As a provisional rule of the directive, the municipalities without a emergency plan were obliged to produce one within 30 days. The plans contain i) identification of the flood prone areas according to the different scenarios of risk, ii) identification of the model of intervention which specifies the actions to be taken and by whom. The areas prone to risk, in absence of more detailed studies, are those identified in the flood management plans edited by the river basin authority (see section 5.3.4). The plan includes the name and full contact details (including phone number) of the responsible person and his/her substitutes, the room that can be turned into Operational Room (equipped with fax and landline phone), list of the municipal technical mobile units (unita' tecniche mobili comunali) including their basic technical characteristics; identification of the shelter areas, persons and technical means that can be mobilised, and the measures indented for guaranteeing the safeguard and/or rescue help to the affected population.

5.2.5 Conclusions

In the case studies 'Demer' and 'Innerste' most of the involved stakeholders and responsible authorities acted appropriately and this way more damage was prevented. Furthermore, in both case studies available means of risk communication were reviewed and consequences are drawn.

The nature of the disaster of the Italian case study, however, was different from the two others. The event came without any warning, and was over as sudden as it emerged. For this reason crisis management and communication was reduced to the post-event phase: response and recovery.

Differences are detected in the way residents perceive the performance of crises communication including responsible authorities and lay people. In general, there is more trust in the activities of the Belgian authorities. Only 15 % of the online questionnaire respondents believe that the responsible authorities perform well. The mistrust against these authorities is already expressed during the interview with the municipality of Holle. The entirety of interviews and face to face contact with residents and authorities in the Belgian Demer valley, however, revealed more trust in the decisions and activities of the authorities.

On contrary, many residents of the Innerste valley trust in the social capital of the communities. About 75 % of the respondents believe in an effective neighbourhood support and mutual help. Almost non of the Belgian respondents answered this question. However, the German respondents do not believe that their municipality has sufficient financial resources for flood protection measures.

Many residents of both case studies are not familiar with early warning systems: 38 % of the Innerste residents and only 24 % of the Demer residents is familiar with the available early warning system. Here much capacity building is required.

In the Italian case study residents are very aware of the frequently occurring natural hazards and the related disasters. However, in general there is rather a fatalistic view on these events with little effort to protect and maintain their homes nor common pool resources of their community.

EWS in the Belgian and the German case study show different performance. At times of the Demer inundation in 1998 there was no EWS. Soon after this event the authorities produced websites that instantly provide both numerical and spatial information about the water levels in the Demer valley. For the Innerste there is still no comparable source of information available.

The local community of the Italian case study does not have an EWS or an on-site monitoring system. In the view of the types of events such as flash floods and land slides, EWS and monitoring in the sense of traditional inundation warning do not make sense. Moreover, the economic situation of the region does not permit to purchase and install an these systems.

Table 10 displays significant differences in flood risk perception between the case study *Innerste* in Germany and *Demer* in Belgium. In general the scores for all risk characteristics are higher in Germany than in Belgium. However, whereas differences in *awareness* and *preparedness* are obvious with score differences of about 3 points, *preparedness* does not show that distance in score points (here it is only 1 point).

Table 10: Comparison of resilience indicators for flood risk perception

Indicator	Variable/question	Innerste	Demer
Awareness	Do you know whether you live in a flood-prone area?	0.92	0.62
	Does every individual in your household know what to do in case of a flood?	0.88	0.37
	Does at least one person in your household know an escape route in the case of flood?	0.84	0.47
	Does at least one person know a safe place to go to in the case of flood?	0.54	0.55
Worry	Will there be a similar or worse flood event in the future?	0.85	0.65
	Flood is a serious and growing problem	0.96	0.54
	Climate change impact as cause for increasing damage	0.65	0.36
Preparedness	Have you protected your house against flood	0.61	0.4
	Does every individual in your household know what to do in case of a flood?	0.88	0.33
	Do you know an early warning system, and do you know how to use it?	0.38	0.24
	Do you have an insurance against flood?	0.46	-
	Does the municipality have enough means to manage and be prepared against floods?	0.15	0.21
	Do you expect support from municipality, district or province for preparation against floods?	0.08	0.48

In both case study residents have an increased awareness after flood events in recent years. However, atop of that the flood events of 1998 and 2003 at the rivers Oder and Elbe have created a 'collective' awareness within Germany. These events may be seen as a turning point not only concerning awareness and worry, but also in politics and administration. Since then a number of regulations and laws have been issued in Germany. As an example: development is not allowed in flood-prone areas any more. The interview with representatives of the municipality of Holle (Innerste river basin) confirmed that.

In addition higher levels of worry and awareness in Germany are often associated with cultural and behavioural phenomena. For instance, the disaster of Fukushima marked a turning point in Germany energy policy, both in public opinion as well as in politics. In general, recently public discussion do not imply whether or not nuclear power station should be switched off in Germany, but when should this be accomplished. Although the impact of the Fukushima event is virtually the same all over Europe, this discussion does not take place in countries such as France or Great Britain.

In contrary to the Western Europe case study individual flood-risk perception of local residents has completely different dimensions. Moreover, the research effort in Calabria did not apply variables and indicators that resulted in scores (Table 10) such as in the two other case studies. Only a qualitative assessment is available. This assessment concludes that in general there is a high awareness of natural disasters since they occur frequently in several types. Apart from flash floods and land slides geo hazards are common in the region, and they also have a long history in the memories of local people. However, this high awareness does not result in mentionable preparation activities. Building permissions seem to have no restrictions, and buildings are put up in the hope that a new event will not occur in the near future. In the case of the destroyed camp site there was experience with flash floods at this side, but no consequences are drawn.

Furthermore, even if residents and businesses or the municipality want to prepare, the economic situation of many individuals, families and businesses does not permit investments. Any opportunity for (unsustainable) earnings must be used to maintain the livelihood of the people in a desolate landscape. Moreover, phenomena such as deforestation and the general disregard of common pool resources including their potential functions for the mitigation of hazards aggravate the situation for the resilience of this flood-prone community.

The comparison of flood *preparedness* of the case studies 'Demer' and 'Innerste' reveals a sharp contrast between individual preparedness and the preparedness of responsible organisations and institutions. Whereas the individual level of preparedness is higher in Germany, the perspectives on the institutional preparedness are reverse. The reason for the first phenomenon was discussed above. Moreover, individual property is highly valued. The reason for the low score of organisations and institutions in Germany is the lack of trust. Experience with institutional failure, long decision processes and pious promises of politicians resulted in increased individual initiatives in the post-flood period. In contrast: Flemish residents trust the local, regional and provincial governments to appropriately manage the flood problem. From the provincial level downwards institutional co-operation as well as public-private partnership is established and rather centralised.

If identically applied, the chosen resilience dimensions and indicators enable scientists to compare case studies with a set of consistent factors. Recommendations can be given for flood managers no matter of how a governance regime is structured. Moreover, these indicators may be used to provide specific indication for trans-boundary learning effects. Cultural differences as barriers for comparison are overcome. This may be seen as one of the central results of the international FREEMAN project.

5.3 Flood management tools (WP 3)

5.3.1 Setting the scene: Concept and theoretical framework of the work package

Work package 3 (WP3) 'Flood Event Management Tools' aims to identify and optimize strategies and measures improving flood resilience as a direct outcome of the actually available flood management tools. The latter will have an impact on the overall flood event management processes. We focus on two types of available tools in this work package:

- 1) flood event management plans and,
- 2) flood forecasting or early warning systems.

Within the work package a methodology for assessing flood management plans and tools was developed.

Flood management plans are tested for their effectiveness and robustness. Both evaluations are focused on enhancing flood resilience. The evaluation of flood management tools (flood forecasting and warning) puts emphasis on the *effectiveness of risk communication and planning* and *robustness of flood mitigation measures*. The analysis comprises technical aspects (accuracy of outputs, level of flood protection, type of maps) as well as social aspects (comprehensibility & readability, access to plans in function of target groups etc.).

The purpose is to provide recommendations for a more effective risk communication and hence a more resilient community.

The methodology, as earlier described in sections 3.1 and 5.1.1, has been tested on case study level. Input data gathered for WP3 came from two different sources: semi-structured interviews and questionnaires held amongst representatives from different authorities and stakeholders.

5.3.1.1 Theory and indicators

Effectiveness and robustness in a flood management plan can only be assured by developing the plan according to sound guidelines. One of those guidelines is the 'Guidelines on Sustainable flood prevention' of the United Nations and Economic Commission for Europe (UN/ECE, 2000). This guideline was subsequently updated in 2003 by the EU Water Directors, during the informal meeting of Water Directors of the European Union (EU), Norway, Switzerland and Candidate Countries held in Denmark Copenhagen, 21-22 November 2002 and subsequently published as "Best practices on flood prevention, protection and mitigation". The soundness of such recommendations is recognized by institutions like the European Investment Bank (EIB).

The main idea behind the use of flood forecasting tools is developing an early warning platform towards the reduction of personal injuries, losses of life and damage to property and environment. The tools help to prevent flooding by steering the capacity of flood-prevention structures (such as polders or reservoirs) and minimize the impact of flooding by increasing preparedness of civilians and civil protection. To be effective, the tools need to be 'people centred' (UN, 2006): "The objective of people-centred early warning systems is to empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner so as to reduce the possibility of personal injury, loss of life, damage to property and the environment and loss of livelihoods" (EWC III, 2006). Initially Flood Forecasting and Warning systems (FFW) were conceptualised with two modules: measurements and forecasts. Former FFW systems concentrated mainly on technical aspects. Currently, along with the idea of a people-centred system, this has expanded into a more integrated view. Four modules are now considered: monitoring, forecasting, warning and response. In the last two modules of warning and response, social aspects (such as communication, organisational and community aspects) are given specific attention.

Basic early warning systems are based on recorded rainfall or water levels from upstream regions at gauging stations. Those observations are subsequently used to infer critical conditions further downstream, mostly through empirical correlations and/or thresholds. Each time that measurements exceed pre-established thresholds, a warning event is triggered (manually or semi automatically) aiming at setting appropriate people or instances into action.

More sophisticated systems rely on automated monitoring, numerical forecasts models and automatic warning protocols, using diverse communication channels. These systems deduce the flood event on the basis of gauged and forecasted data. The main advantage of such systems is that forecasted data (by means of numerical modelling) increases the lead time and enables to react with an appropriate response towards an upcoming flood event.

According to the guidelines above, flood management plans and tools should comprise the key elements that are mentioned in Table 11.

Table 11: Key elements (indicators) to assess flood management plans and tools

Indicator flood management plans	Indicator flood management tools
Integrated River basin approach	Monitoring
Public awareness and participation & communication	Forecasting
Insurance	Technology
Retention of water	Knowledge of associated risks
Land use zoning	Warnings
Risk assessment	Dissemination and communication
Flood emergency	Response capability
Prevention of pollution	Uncertainty
Legal aspects	Design
Climate change	Integrated approach
Sustainability	

5.3.1.2 Description of the indicators

Flood management plans:

- **Integrated river basin approach** : An integrated river basin approach is consistent with the EU Water Framework and Floods Directive. This means that flood defence measures and crisis management have to be organised based on the river basin, with international and trans-boundary cooperation arranged where appropriate. On the one hand this means that for flood prevention a good combination of structural, preventive and operative measures is necessary. On the other hand, the reduction of flood risks has to be based on the principles of solidarity and precaution together with an interdisciplinary co-operation at all government and local levels.
- **Public awareness, public participation**: Stakeholder consultation is essential. Every person living in a flood risk zone is a legitimate stakeholder in decisions taken on FRM, and an even wider population is affected by any measures taken. Some actions will demand sacrifices of specific sections of the population and it is important to get a wide degree of support for such measures. Public awareness and participation is essential to proper flood risk management. Public engagement and support for FRM should be promoted by appropriate use of the media, civic education, schools and publicity based on flood hazard maps, GIS data, etc. Preparedness for flooding inevitably involves local communities, their networks and institutions. The general public should be encouraged to take personal FRM measures, when and where appropriate. The public should become aware that there is a need to adapt or even restrict uses in areas at risk of flooding to reduce the potential for damage. Information about special measures required and restrictions on construction in flood areas should be easily accessible and easily understood. The information concerning flood prevention and protection plans should be transparent and easily accessible to the public. As such, public participation in decision-making is a cornerstone for the successful implementation of integrated action plans.
- **Insurance**: There should be clear principles about compensation and insurance. Financial compensation to flood victims should cover the cost of damage, disruption and distress. They can either be provided by society, through grants and soft loans, or from insurance policies operated by private (or public) companies. There is no consensus about the appropriate role of these sources. Policies should be clear, consistent, and humane, and avoid "moral hazard". Insurance can be an important factor in increasing the awareness and reducing the financial risk for individuals or enterprises or societies where natural hazards are concerned. Moreover, certain incentives (e.g. an increase of insurance rate or a deduction of refunds) in case certain precautionary measures are not implemented.
- **Retention of water** : Non-structural measures play an important role. The natural storage of water by vegetation, soil, ground and wetlands should be recognised and promoted. Preservation and enhancement of vegetation, forests, wetlands and floodplains should be a priority. Some examples are flood retention areas and dry polders, restoring natural floodplain storage, the provision of additional floodplain storage, the removal of flood defences in certain areas, the restoration of the connection between river and floodplain as well as the creation of new flood retention areas and dry polders.
- **Land use zoning** : Spatial planning has to balance choices between land use and flood risk management (FRM). Flood-prone areas are often economically productive and attractive for habitation. This creates a tension between economic and social uses, on the one hand, and minimising flood risk, on the other. The more intense and the less suitable land uses are present in the basin, the greater the potential and actual damage of a flood. Measures should be realistic: inhabitants need to be made aware of flood risks to which they are exposed and should be encouraged to become "flood compatible". New buildings in flood risk areas should be discouraged where there are feasible alternatives. The water management policy and spatial planning efforts in the long run must concentrate towards attaining an equilibrium stage between economic development and urbanisation and the needs to allocate more space to water for water retention.

- **Risk assessment:** Besides these strategies towards the future planning of land use, efforts should be made to improve knowledge concerning extent and evolution of floods and water related problems. This can be done by simulating different high water levels, studying and comparing zoning scenarios, and integrating risk assessments into land-use, emergency and rescue planning policies through identification and mapping of hazards and high-risk areas. This allows assessing effectiveness, thus prioritising measures for flood protection in the flood prone area.
- **Flood emergency:** Flood emergency plans should be developed. Comprehensive national and local contingency plans dealing with flood emergencies are necessary. These plans should cover the crisis management before, during and after the flood event. The integrated flood defence plans should collect all important technical and other data. A system of regular inspections and further actions should be installed to improve maintenance and preparedness. This should include regular joint exercises and feedback from actual events.
- **Prevention of pollution :** Pollution is inevitable, and one of the worst results of flooding. Floods disrupt water supply and sewage disposal. Alternative solutions should be considered and implemented to guarantee the operation of water distribution and sewage systems. Water run-off is often highly polluted and could be toxic. Reducing the risk of pollution, stocked goods of all kinds (industrial, domestic and agricultural) must be judged by their toxicity, their inflammability and explosiveness as well as their eco-toxicity. International and regional monitoring, reporting and warning specific systems should be put into operation and aimed at ensuring warning timely in case of trans-boundary pollution.
- **Legal aspects:** Floods cannot be managed effectively without understanding the laws from local regulations to international treaties. An effective legal framework identifies and protects the interests of all stakeholders, including establishing transparent and predictable mechanisms (legal rules and institutions). The institutional response of governments, nationally and internationally, can be clearly identified and governments motivated to act under a mandate, created within a legal framework. At the government level - whether national, regional or local -decision taking must be coordinated in such a way that decisions take account most impacts on flood management and control. Relevant bodies must be aware of their functions and role in flood management, and individuals must also be made aware of their responsibilities, rights and powers with respect to flood management whether at the planning stage, during flood events themselves, or in the post-event appraisal process. Standards of performance, along with clear delineation of duties, rights and powers of the various bodies involved, and appropriate for their respective functions, should all be set out in law. Flood management calls for the seamless interaction between various disciplines, government departments and various sectors of society.
- **Climate change:** Flood magnitude depends on many characteristics like precipitation intensity, volume, timing and its phase. A number of climate related parameters likely to be affected by climate change, are precipitation, wind storms, storm surges and sea level rise. Climate change poses a major conceptual challenge to water managers. There are inherent uncertainties in various inputs that determine the risks, both at the hazard assessment stage as well as at the impact assessment stage. The scientific debate concerning climate change is still ongoing. Therefore, it is difficult to assess future risks. Use of an adaptive management strategy is essential. It involves planning, acting, monitoring and evaluating applied strategies, as well as incorporating new knowledge. Monitoring and evaluation forms are an integral part of this approach. Results are used to modify management policies, strategies and practices.
- **Sustainability :** In the past, in most countries, the focus has been on controlling the floods with little or no attention to the long-term policies. Recently, increasing trends in flood losses have drawn wide attention of the policy makers. Management is needed to more effectively guide future development and ensure resource sustainability. Therefore, future opportunities to develop water resources will have to be consistent with:
 - The competing needs of other water uses already in place;
 - Sustainability and/or restoration of the ecological status of rivers and water resource bodies for the present and the future;
 - River basin management plans.

Monitoring of basin conditions before, during and after the implementation of the plan is essential to check its sustainability and help take corrective measures. Appropriate performance indicators have to be established and the threshold values assigned. If adverse affects beyond the specified threshold values are observed, modification and adjustment in the plan should be carried out.

Flood management tools:

- **Monitoring:** Once an early warning system (EWS) is operational, a number of factors are important towards its success. Flood warnings will be more readily adopted and be more accessible by the public if they are fitted into a multi-hazard approach. Using many specialized techniques in an EWS requires centralising of expert services in national centres. However, forecasting and warning should be easily accessible at lower levels, where more knowledge is available on the local situation. Studies within the framework of the European Flood Alert System (EFAS) have proven that alerts can be used with a lead time of up to 9-11 days, and with some signals up to 3 weeks ahead (Thielen, 2009). Although the precision of these forecasts are too low to take any action yet, they raise preparedness within the responsible services. High resolution models can then be applied as the event approaches. Nowadays tools are available to present powerful situation displays: online, real-time, map based. It requires an advanced monitoring network and powerful database system, but has a large added value. In most cases, these systems are developed, published and controlled by governmental institutions.
- **Forecasting:** The operational lead time of a warning system has a strong impact on its efficiency to reduce the flood impact. Lead time is for a large extent defined by the available lead time of the underlying and essential weather forecast. With the most advanced medium-range numerical weather prediction (NWP) forecasts of 10-15 days are available. Also monthly and seasonal forecasts are available, but these are currently of limited use for operational flood forecasting. Besides, the operational lead time of an EWS is further influenced by delays such as time needed to transfer data from one component to another, processing time of grid-based maps, obtaining the necessary observations, non automatic approval of generated warnings by an operator or response time towards mails or phone calls. In order to define a sufficient lead time a balance has to be maintained between the necessary reaction time to take preventive measures and the decreasing accuracy of forecasts with increasing lead time. One way of handling this could be to use a second system, less accurate, but with higher lead time, to produce pre-warnings. These pre-warnings raise the alertness, without any direct actions been taken. The quality of the hydrological model can further be characterized by its accuracy: the number of hits vs. false alarms or misses will have an impact on the trustworthiness of the system for end-users. Issuing false warnings too often may result in disregard of the system by end-users. The model also needs to be accurate on location, timing, extent and severity of the events. Model extent and temporal and spatial resolution are also important aspects of the system.
- **Technology:** The technical part of an early warning system consists of several components with diverse functions. Some components may gather data from sensors, others run the hydrological model, or communicate warnings or publish data on the web. They are not always incorporated into one system, but consist of a number of communicating systems. Each of these systems usually has its own system requirements and may be developed using different IT-concepts, platforms or languages. This usually results in a complex environment, which poses difficulties for testing, auditing, understanding or documenting. To ensure proper functioning of the EWS, the system needs to be built using standard ICT practices (e.g. robustness, redundancy (of servers), backup, maintenance). Downtime of the system (or any of its components) due to failure should be minimal. On software level, each component should be designed in a robust way, so that unexpected errors or rare conditions are handled in a proper way. Sufficient and targeted testing should prove that the system will also work during rarest events. At the highest level the results need to undergo further testing and verification to improve the quality of the forecasts. This requires dedicated research on the hydrological processes, interpolation algorithms and optimization routines. With the spread of GIS-programming and EPS-forecasting, meteorological and hydrological models nowadays have a need for sufficient computation power. Where the first warning systems could be run from a simple desktop, there is now a need for small data centres with multi-noded computing clusters and exponentially growing storage.

- **Knowledge:** Risks arise from the combination of hazards and vulnerabilities at a particular location. Risk assessments and maps help to motivate people, prioritise early warning system needs and guide preparations for disaster prevention and responses. For floods this includes information about the type of floods (static, dynamic, coastal etc.), the probability of a particular flood event, the flood magnitude (expressed as flood extent, water depth or flow velocity), and finally, the probable magnitude of damage. Flood maps are indispensable tools to provide information about hazards, vulnerabilities and risks, and to implement the necessary preventive and preparedness measures (Excimap, 2007). The EU Floods Directive anticipates this need for knowledge, by requiring the member states to produce the necessary flood maps by 2013. The hydrological model and connected GIS-tools can be used to explore different scenarios (e.g. dike breaks, to delineate flood extent and vulnerable zones) to test flood protection strategies. Social surveys should locate the most vulnerable residents, and economic studies can reveal the most costly assets. Flood maps help to design proper flood management plans and can also be fed back into prioritizing and designing structural solutions. By storing it in a central database for reference, it also becomes a great help during a disaster. GIS formats allow to generate maps, that can be overlaid with other information during crisis. Technical tools should be made flexible enough so they can be used for testing purposes before applying them during crisis. Hazard and vulnerability data should be available for government and public.
- **Warning:** A forecasting system needs to translate the forecasted situation into warnings that are relevant for the end-users. A balance has to be found between detail and conciseness, between graphical and textual representation, between specialist and non-specialist terminology. Training sessions with end-users ensures that they understand the warnings, but also provide feedback on how these warnings are perceived by them, and how they can better be steered to their needs. Warnings can be sent out automatically based on predefined conditions, but usually they have to be approved by a skilled operator before publishing. This immediately eliminates the most obvious false alarms, and gives the possibility to obtain second-opinions from local experts. In this case forecasting should at least have someone on duty at all time.
- **Dissemination & communication:** Formal communication channels have often been established and tested to pass messages from forecasting centre to civil protection or local administrations. Often this is tied in with more general hazard mitigation plans. It remains important to test and evaluate these channels at a regular basis, as there are quite some cases where flaws in the communication during crisis result in no or wrong interventions (EWC III, 2006). It is assumed that increased warning can reduce the impact of flooding. Reducing the impact calls for using multiple communication channels, both actively pushing information to the public and publishing information for residents seeking information. Studies show that involving the public in the warnings will reduce the cost of flooding. In EWASE (CRUE, 2008), an early warning system was seen to have a significant potential to transfer responsibilities from the state to the individuals. Especially for the economic sectors, they demonstrated a high potential for damage reduction due to early warning. However, when it comes to dissemination of warnings to the general public there is still some reluctance to publish all available information. To assure warnings are most effective, the staff at a warning centre must establish trusted partnerships among international organizations, governmental agencies, community leaders and organizations, businesses, and local citizens prior to issuing a warning. Of course warnings and flood information are only one aspect of communication during crisis. They will be complemented with messages of empathy and political statements.
- **Response capability:** Communities should know how to react. Residents should be informed on available escape routes and know the associated risks and options for safe behaviour. It is essential that communities understand the risks; respect the warning service and know how to react and how to avoid damage and loss to property (EWC III, 2006). Education and preparedness programmes play a key role. Disaster management plans should be well practiced and tested. Often local communities know better how to react to certain hazards, as long as they are provided with correct information. In this way individual residents, civic groups or traditional groups can contribute to the reduction of vulnerability. Communities should be trained to respond to the flood warnings.

- **Uncertainty:** At the core of most warning chains is a meteo-hydrological model that processes the observations and produces forecasts. In most cases these models still have a great deal of uncertainty and errors. Uncertainty has different sources: data uncertainty (measurement errors), model uncertainty (insufficient representation of real processes in the model) or parameter uncertainty (poor estimation of model parameters). End-users should be made aware of these limitations. One should communicate the uncertainty, but always keep in mind the (mis-)interpretation that people may make of the uncertainty. Techniques such as EPS or uncertainty analysis can help to quantify these uncertainties. However, in many cases they are not yet applied or given the necessary attention. Partly due to prioritisation, but definitely also because of the difficulty of communicating uncertainty and using it to take decisions. Until recently, a deterministic way of thinking has prevailed, where decision makers preferred a simple 'yes' or 'no'. Responsibility plays an important role here: a simple yes/no warning puts the blame for errors with the forecasting centre, while with probabilistic forecasts the responsibility of making a decision shifts to local leaders or residents.
- **Design:** Many existing early warning systems used to be designed from a hydrological point of view. Effort was mainly put upon providing an accurate hydrological forecast. The resulting warnings may limit themselves to the hydrological part of the story and using a corresponding terminology. However, flood warnings issued by a forecasting centre may trigger a range of actors and stakeholders, each of them having individual needs for information or specific questions. To accommodate this EWS needs to develop from a supply-oriented to a demand-oriented approach. As a base for the design of any early warning system all relevant stakeholders and actors need to be known, and for each of them the specific questions and triggers listed. In a design phase these requirements will be translated into a solution consisting of technical elements (monitoring, modelling, forecasting) and procedural elements (communication of warnings, response by actors, training). End-users should be involved in this phase as much as possible and also in the later testing by giving feedback on the products. Of course the political and financial context will put limitations on this design. It may be possible that several systems exist next to each other, each having a different scope of end-users, operators and goals, usually operating on different spatial scales. In this case the design should take into account the existence of these other systems and define the interfaces or exchanges between them.
- **Integrated approach:** Flood warning systems (FWS) have to be sufficiently integrated into disaster risk reduction strategies at levels from local to supra-national, in order to ensure the necessary financial, legal and political support. Their role should be defined in e.g. national disaster plans and basin management plans. This should also ensure the necessary cooperation at higher levels, e.g. exchange of data between countries for international rivers. Research on EWS should no longer focus on the technical part only, but also include the social and economic aspects. At the same time a bottom-up involvement is needed where local knowledge and concerns of local communities be translated back into development of the warning system. Local communities should become an active player, rather than merely executing higher-level's decisions. E.g. in Swedish legislation this principle is laid down in legislation as 'proximity' saying "Major emergencies should be managed locally where they occur by authorised public personnel at the lowest possible decision making level, only supported by regional and national levels when necessary" (Norbert, 2010).

5.3.2 Methodology applied and a synthesis of the results for the Innerste case study, Germany

5.3.2.1 Health check

Flood management plans (FNP)

Currently, there is no FNP (Hochwasserschutzplan) for the river Innerste nor for the pre-flooder Leine is finished. The responsible organisation for designing an FNP is the NLWKN (Niedersächsische Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz, Betriebsstelle Hannover-Hildesheim), sub organisation of the Ministry for the Environment in the federal state of Niedersachsen. The NLWKN started the development of an FNP for the Leine river at the 5th of March, 2008, half a year after the inundation events at the Innerste river. At this day a meeting was organised where the minister of the environment in Niedersachsen introduced the plan for an FNP in front of representatives from the district (Untere Wasserbehörde), the (potentially) affected municipalities, the agrarian sector and water boards. An important basis for the FNP is the water law of the Federal state of Niedersachsen (NWG, 2007). The aim of the all FNP in Niedersachsen will be to minimise the impact of floods with a 1:100 probability. The basis for the design of all FNP in Niedersachsen is the Compendium for the design of FNP (NLWKN, 2009).

Flood preparedness

In general the inundation of the Innerste in 2007 was a turning point in terms of flood preparedness. The last flood in this river basin occurred in 1948, so that the awareness of living with a relatively high likelihood of inundation has faded out throughout a 'flood-free' period of about 60 years.

Although the probability of this flood was considered to be below 1:100, a number of assets, especially houses were damaged. This has to do with unconsidered urban planning in past years in the shade of little awareness. However, the mayor of the municipality of Holle confirmed that his municipality as responsible planning authority would not permit housing and business development in flood-prone areas any more.

The online questionnaire revealed a high awareness of living in a flood-prone area. Figure 33 displays that 38% of the respondents did not protect their homes at all and 46% have only prepared the necessary in their basements. Only a minority (15%) of the respondents have their homes fully protected.

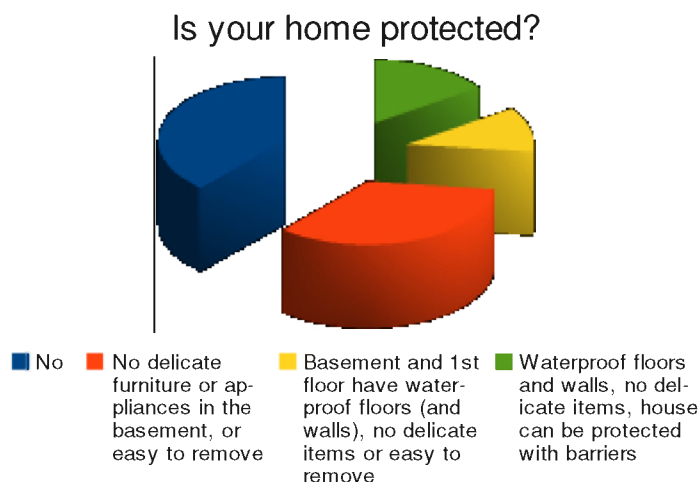


Figure 33: Did residents protect their homes?

Only 12% of the respondents are not prepared and do not know what to do in the case of a flood. The majority (54%) knows how to act in the case of a flood and has prepared a minimum set of supplies. About 35% is fully aware of what to do in the case of floods, and has all tools and preparations at hand (Figure 34).

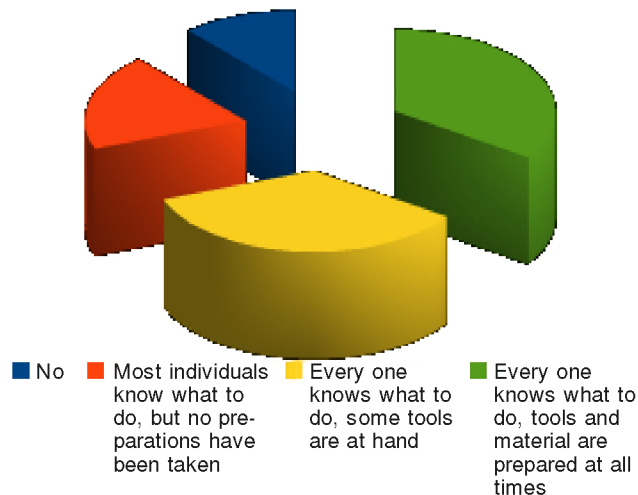


Figure 34: Are residents prepared for floods?

Almost every respondent is aware whether or not they live in a flood-prone area. Interestingly, of all persons who are aware to be living within a flood-prone area still more than one third is not protected against floods.

There is no correlation between the damaged households, the value of the damage and the level of protection of these homes. The highest damage 65000 EUR occurred in a house with highest protection standard. This example may be seen as demonstration of the high uncertainty of risk within a river basin.

All interviewed authorities claim to be fully prepared. However, the threshold for starting disaster management is at the flood probability of 1:100. In the case of the Innerste inundation the district police department (Polizeidirektion Goettingen) did not become active before one and a half day after the first basement was flooded.

For the municipality preparedness means to have sufficient communication among all responsible organisation such as the fire brigade, aid organisations and others. Informal communication and personal contacts play a significant role for a successful disaster management within the municipality. Informal networks among individuals who have responsible positions in aid organisations emerge from memberships in sport clubs and other associations. In the case of the municipality of Holle this network increased the efficiency of disaster management within the municipality significantly.

Integrated approach

The integration of flood risk management with other sectors is difficult, since, according to the representatives of the municipality of Holle there are no clear priorities for implementing measures among the sectors (water management, nature protection, agrarian sector, urban planning and settlements). If flood-protection measures are supposed to be implemented, the municipality is responsible to propose and design plans. However, the approval must be given by other instances within various levels of administration from the district (Untere Wasserbehörde) to the federal state government (NLWKN). Flood-risk management suffers from a two-dimensional fragmentation:

- sectoral fragmentation: flood-protection and prevention measures must be approved by several sectoral authorities such as water management, agriculture, infrastructure, nature protection and others; and
- structural-administrative fragmentation: the federal system in Germany provides authorities on several levels with independence and responsibility. Decision may be taken independent from other organisations on several institutional scales or federal laws, by-laws and recommendations may be interpreted in various ways. When the municipal authorities have an executive function, however depend on decisions of higher-level institutions, decision lock-ins may emerge from the absence of institutional integration and the absence of clear priorities.

Furthermore, Germany does not have river basin management authorities based upon natural boundaries such as watersheds. If a (sub) basin stretches throughout two or more administrative districts, decision processes become even more complicated up to a stagnation of the decision process.

Even the 2007 flood event did not result in a fast implementation of flood protection measures. An integrated decision for appropriate measures as well as the allocation of financial resources could not be accomplished for the Innerste sub basin to date.

The fragmentation and the lack of consensus of authorities reflects conflicts of interests among the related sectors.

Monitoring

Monitoring of the Innerste river relies on two gauges as well as the water level in the water reservoir of the upstream Innerste in the Harz mountains. However, the municipality of Holle as well as a number of citizens complained about the difficult access to these data at times of the 2007 flood. Representatives of the municipality claimed that an Austrian kayaking website is better up to date and accessible than any official website of the responsible authorities of the Innerste river basin. This includes the water level of the water reservoir. Furthermore, there is no gauging station upstream of Holle (except the water reservoir with limited relevance for the municipality of Holle) and on the Innerste tributaries.

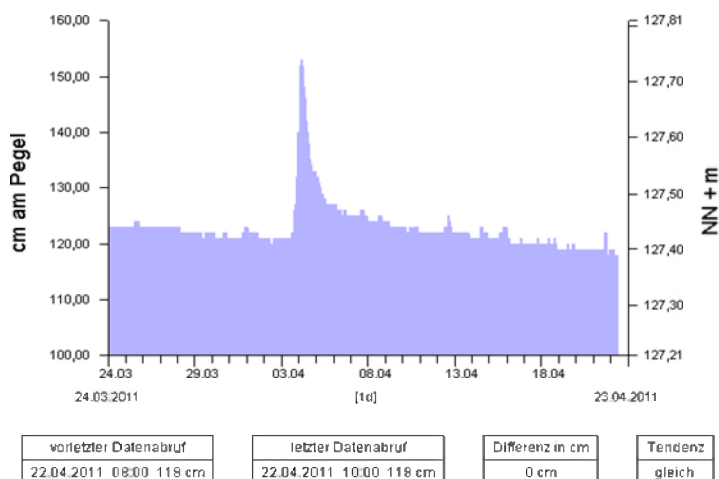


Figure 35: Hourly runoff for the gauging station Groß Rüden/Nette river

Figure 35 displays the hourly runoff curve at the gauging station Groß Rüden. This station is not far from the municipality of Holle, but the measured runoff at this station passed already the municipality of Holle.

Prevention & reducing risk

Prevention and reducing risk has two dimensions: 1) top-down due to the planning of the river basin management authorities. This is in the case of Germany the 'Untere Wasserbehörde' at district level. As aforementioned administrative districts are not congruent with watersheds. These authorities are responsible for measures that are effective within (parts of) sub basins. In the case of the Innerste river basin the prevailing measures are dikes and retention areas, that are effective on a (sub) river basin level. Here as well, conflicts of sector-based interests have to be solved; 2) bottom-up by individual households who intend to protect their assets. The municipality of Holle, for example, supports house owners in flood-prone areas to protect their houses. However, as soon as house owners co-operate on one common protection measure such as a small dyke that protects more than one individual property, this interferes with top-down flood protection measures such as retention capacity. At time of the interview the municipality of Holle was evaluating whether or not bottom-up co-operation of individual households has legal consequences.

As an example of a conflict of interests: a dike was built along the river to protect a flood plain from being affected by lead and other heavy metal caused by historical mining activities upstream in the Harz mountains. A backward relocation of the dike would result in a gradual pollution of the flood plain with heavy metals.

In 2007 the Municipality of Holle provided a complete planning for flood-prevention and protection measures. After on and a half years of a decision-making procedure both the district and NLWKN rejected the plan. This resulted in frustrations, since the affected households were hoping for the planning and implementation of appropriate flood protection measures. The district already communicated the implementation of measures before the decision was taken. Yet, the affected citizens could have taken measures right after the 2007 flood.

If the municipality wants to build dikes around the most vulnerable neighbourhood (Michelswiesen), a balancing out of the lost retention space has to be provided with 500 m downstream by law. This would cost about 100000 Euro, which is not available. In addition to surface water, the neighbourhood 'Michelswiesen' suffers from intruding groundwater due to highly permeable sediments in the adjacent floodplain. Risk reduction and prevention from groundwater is almost impossible without an increased financial effort.

Financial provisions

The municipality of Holle supported affected residents who applied for financial support from the federal state. The municipality has no resources for financial support. Donations for affected families with little financial resources have been collected and distributed at several occasions not only in the affected region. Furthermore, local residents donated money for the local fire brigade.

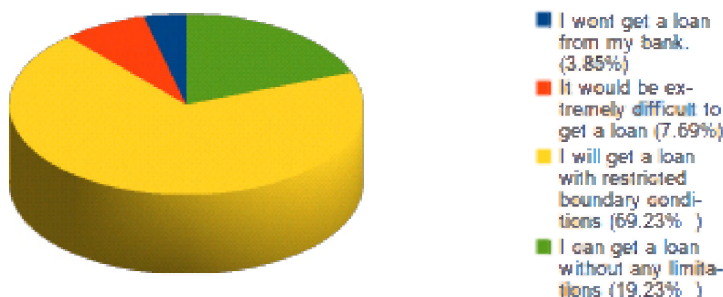


Figure 36: Can residents receive a loan for post-flood recovery?

Most residents who answered the online questionnaire will be able to receive a loan for recovering from flood damages (Figure 36). There is no correlation with the employment situation.

Forecasting & warning

Both expert interviews as well as the online questionnaire revealed a rather low quality of forecasting and early warning systems. For example, during the 2007 flood the police department of Göttingen received only the at that time relevant runoff data from the gauging stations. However, no prognosis was available. Since the 1st of October 2009 a flood forecasting centre (Hochwasservorhersagezentrale) has been established in Hildesheim for the Leine catchment. The centre is still in a testing phase. One of the main tasks is to provide flood warning data to the municipalities in time. The municipalities are responsible to inform their citizens.

Technology

In general technological facilities such as infrastructure, software, databases or communication networks are highly developed and maintained in most regions in Germany. Accessibility is only impaired for economic, legal or bureaucratic reasons. During the expert interviews it turned out that for example the police department does not have licences for GIS software. GIS-based flood monitoring and prognosis was not possible. The application of open-source software is not possible because the police department would not get certificates for this software.

Uncertainty

The expert interviews as well as the online questionnaire revealed some awareness about the unpredictability of rainfall events such as in 2007. As stated by the mayor of the municipality of Holle: flood can never be entirely prevented. However, still much work has to be done to convey this message to potentially affected residents. A number of factors such as initial soil moisture, consecutive days of rainfall, spatial distribution of precipitation or the rainfall intensity play a role in the process of generating a flood within a river(sub) basin.

Uncertainty has many facets within flood risk management, and can involve technical failure (e.g. malfunction of a gauging station, dike breach, or interruption of communication facilities), human failure (e.g. mis-interpretation of information, wrong decisions or lack of relevant knowledge) or an incidental concatenation of undesired effects. The municipality of Holle was not considered to be struck by a 1:100 flood event. This is based upon gauging stations further downstream. This diminishes both the accuracy of the measurements and the prognosis for the development of water levels.

5.3.2.2 Conclusions

To date, almost four years after the Innerste flood of 2007 there is no up-to-date flood management plan (FMP) effective. Although municipalities of the Innerste valley invested in flood protection planning these plans are in many cases ceased in a jungle of bureaucratic regulations without receiving building permission (e.g. example of the 1.5 year long unsuccessful planning effort of the municipality of Holle). An FNP would provide guideline for the flood protection effort of the municipalities in the Innerste valley, but no binding guideline with increased certainty for planners on the municipal level is available to date.

The probability threshold for alert situations of 1:100 appears to be a subject for debate. The flood of 2007 was not classified as a 1:100 event. However, in a number of municipalities significant damage is recorded. At this point the significance of the 1:100 value is questionable. Especially, in the light of possibly more frequent intense rainfall events due to climate change impact, a so far 1:100 flood may occur more often than once a hundred years. Or vice versa, a 1:100 year flood nowadays might have a significantly higher water level than what was originally calculated. The discrepancy between the 1:100 probability and the recorded damages in the Innerste valley in the course of the 2007 flood may be reason for rethinking the use of these (static) threshold values.

The flood event of 2007 changed the awareness for this risk significantly, both among responsible authorities and affected residents. However, as a consequence not all households are protected appropriately. Here more pro-active consultation and guideline by responsible authorities is desirable. More financial resources should be provided for this purpose.

The sectoral fragmentation of authorities from the district to the federal state level was already alluded. Long decision processes do not support an increase of resilience of a flood-prone community. Moreover, even the application phase of planning procedures is costly since the expertise of professionals such as engineers or hydrologists must be consulted. A de-fragmentation of the installation or an integrative instance that mediates among sectors may be useful. The mechanistic structure of planning measures bottom-up and granting permissions top-down is not efficient. A long-term and well-organised stakeholder process may provide solutions.

The monitoring process is not sufficient yet. The planned flood forecasting centre in Hildesheim may provide improvement. However, based upon the 2007 flood experience a strategic distribution of new gauging stations is required. Furthermore, a way should be found to include the monitoring effort of lay people (including weak signals). This, of course, may be expanded to other types of risk, and professionals should judge, interpret and intervene observations of lay people.

The Innerste catchment has a heavy metal problem. Especially, mobilised lead, that is eluted from abandoned lead and silver mines in the Harz mountains and deposited in the sediments of flood plains, is a problem for the environment and human beings. This problem can only be solved in an integrated way including experts from sectors such as water management, nature protection, agriculture and infrastructure planning.

The issue of integration remains a problem in the organisational structure of authorities in Germany. The sectoral fragmentation was repeatedly mentioned throughout this document. Both the spatial incongruence of river basins with district boundaries and the sectoral fragmentation are bureaucratic obstacles for flood management. These are neither conducive for responsible authorities in flood and crisis management nor for the involved municipalities and stakeholders. Solutions such as an integrative instance (the recently eliminated administrative middle layer had an integrative function) are proposed.

Examples are given for the conflict of interest between flood management on a river basin scale on the one hand and municipalities as well as stakeholders on the other. For instance, when planning a dyke, an area for the compensation of lost retention capacity has to be designated within 500 m downstream river stretch. In the case of the municipality of Holle this would cost more than 100000 Euros. The municipality has no financial resources for the compensation measure. In other words the homes in the flood-prone area cannot be protected with a feasible financial effort. This problem can only be solved with a closer collaboration between the different layers, sectors and responsible authorities and stakeholders in a river basin. A mechanistic rule compliance does not help to solve these problems.

In the Innerste river basin as well as in many other river basins and administrative units in Germany there is no generic concept of compensating flood victims. In the case of the 2007 flood, donations and the resourcefulness of residents covered some of the costs for flood recovering. Most municipalities in Germany have no financial resources for flood recovery of their residents. Risk sharing should be part of an FMP, and therefore must post-flood recovery be part of such a plan including guidelines for allocating financial resources.

In general, flood-risk management in the Innerste valley is a top down approach driven by rule compliance. Especially, the interests of vulnerable stakeholders and residents seems to be difficult to incorporate. The lack of integration with other sectors can make decisions difficult to implement.

5.3.3 Methodology applied and a synthesis of the results for the Demer case study, Belgium

5.3.3.1 Health check

Water management plans

The EU Water Framework Directive (WFD) of 22 December 2000 provides a uniform framework for the water management in the entire European Union. The objective is to secure water availability and water quality in Europe and the reduce the effect of floods and droughts.

The WFD was transposed to Flemish legislation by the Decree on Integrated Water Policy of 18 July 2003. It describes the juridical and organizational framework for integrated water policy in Flanders. Flood risk management and other water related items were from the beginning incorporated in this Decree, although not required by the WFD.

The EU Floods Directive has been transposed to Flemish legislation more recently although some measures and instruments had already been integrated in the Flemish water policy over the last couple of years. The Flemish Government has chosen to integrate the Floods Directive into the existing Integrated Water Decree. The amended decree has been approved on July 16th, 2010. Flood risk management plans will be integrated into the river basin management plans.

The Decree provides in the creation of basin management plans for each of the 11 basins in Flanders (part of 2 international river basins, Scheldt and Meuse) and further for about 100 subbasins of these basins. These plans start from an integrated approach and contain measures for:

- the recovery of costs for water services, as water delivery and water sanitation;
- the promotion of sustainable water use;
- the prevention and reduction of water pollution;
- the restore of the hydromorphological structure of watercourses and the polluted water beds;
- the protection and the enhancement of protected areas;
- the management of flood risks.

A general methodology was made available to explain the practical compilation of the plans¹ (Afdeling water, 2004), explaining the participative process, with contributions of stakeholders, sectors and water authorities.

For each basin an organisational structure exists with a board (coordination of policy), secretary (daily activities and design of basin management plan) and committee (stakeholders providing advice). For the subbasins a similar organisation exists, led by the Province and often bundling a number of subbasins.

The first Demer basin management plan was approved on 30 January 2009 by the Flemish Government. It spans the period 2008-2013 and can be consulted on <http://www.bekkenwerking.be/de-bekkenbeheerplannen/downloadsperebekken/het-bekkenbeheerplan-van-het-demerbekken-2008-2013>. It contains a number of specific actions with timing and budgets.

Water test (Watertoets)

Instruments for an integrated water policy are also described in the Decree (20th July 2006). Related to flooding, the 'Water test' (Watertoets) is one of the key instruments. In 2006 criteria were approved for the application of the 'Water test'. It is a tool used to assess possible negative impact of proposed initiatives on surface water, groundwater and the aquatic ecosystem. This includes the assessment of possible

¹ Methodologie voor het opmaken van bekkenbeheerplannen – boegbeeld voor integraal waterbeleid

increased flood risk. The implementing order² gives guidelines for the application of the 'Water test' to local, provincial and regional governments involved in suspending permits for new projects. They can refuse permits or enforce to take appropriate measures. However, mayors and chairman often yield to the superior power. Although the advice is negative, they still suspend a permit.

In Flanders spatial planning is now subject to a so-called water check (watertoets). Each new initiative, for instance a building permit, is subjected by the approval to the water check. The water check is consultative and evaluates whether an initiative (e.g. building plan or programme) causes a detrimental impact on surface water, the groundwater or nature. The result of the water check is incorporated as a water paragraph in the permit or in the approval of the plan or the programme. In cases the water check shows the initiative can cause significant damage, alternatives or compensating measures are necessary (e.g. infiltration measures). Still, the water check has some operational challenges. The document has no binding force. The water check is done at the level where the permit is given however advice often comes from another level.

There are 7 schemes to assess the decision-making in the 'water test' (Watertoets). This is further described in 5.4.3. A tool on www.watertoets.be is set up for that. If the water test is positive according this tool, a permit can be given on condition that the decision is recorded in a 'water paragraph'. When the result of the tool is negative, advice must be obtained. However, as mentioned earlier, the advice is not binding. Still, the water test has some operational challenges as permits are given at local level whereas the water test is done at regional level.

To define the possible impact on flood regime, maps with flood risk zones are available. These maps can be publicly consulted on the "Geoportal of the Flemish Community" (<http://geo-vlaanderen.agiv.be/geo-vlaanderen/watertoets>). For all properties within the flood risk zones the issuing body needs to seek advice from the relevant water authority. The advice is non-binding, but it needs to be mentioned in the water paragraph of the building permit.

There are two types of flood risk zones: zones with effective flood risk and zones with potential flood risk.

- Zones with effective flood risk are a combination of modelled floods (MOG) and recent occurred floods (ROG), showing the envelop of both. The modelled floods (MOG) are a combination using all models available within the Flemish water authorities. Flood probability equals or is less then 1:100. The flood extends are based on the high-resolution Digital Height Model of Flanders, with a resulting resolution of 5x5m. No minimal flood depth is used. The maps with recent floods (ROG) is compiled using all observed floods since 1988, using field observations, areal imagery, TV-imagery. Floods are digitised using topographic maps of scale 1/10000. 44.793 ha were delineated as recently flooded. Because the ROG version 2005 is not always accurate and sufficiently detailed, a semi-automated correction was applied, by filtering with DEM. The Watertoets used this enhanced version (ROGDHM2009).
- The zones with potential flood risk are all natural flood areas (NOG, minus cities and portzones), potential flood areas (POG) and mine depression zones (MVG). Natural flood areas (NOG) used to be flooded regularly, but are now protected from flood by human interventions. However, in extreme situation or due to failure these zones may be subject to flooding. Potential flood areas (POG) are zones defined in the Sigmaphan (protection of estuarine Scheldt against floods) to be potentially converted in designated flood areas. Mine depression zones (MVG) are depressions due to mining activity without natural drainage.

² Order of the Flemish Government of 20th July 2006 (Besluit van de Vlaamse Regering van 20 juli 2006 tot vaststelling van nadere regels voor de toepassing van de watertoets, tot aanwijzing van de adviesinstantie en tot vaststelling van nadere regels voor de adviesprocedure bij de watertoets, vermeld in artikel 8 van het decreet van 18 juli 2003 betreffende het integraal waterbeleid)

Insurance policies

On 1st of March 2006, the automatic covering of natural disasters by the fire insurance came into force. Two articles were added to the law: one on land insurance and the other on damage repair due to natural disasters. Within the first article, flood risk zones are defined as places that were or can be exposed to recurring floods. Within the second article, it is defined how these zones are delineated by national legislation.

In the according national Royal Decision (12 Oct 2005) flood risk zones are defined as follows:

- having a recurrence period of 25 years
- with a modelled or observed water depth of minimal 30 cm.

Zones that suffered twice a flood in the last 10 years are included. As a result, the areal extent is more limited than for the water test (watertoets), but is more effectively risk zone. The risk zones were delineated by Royal Decision of 28 February 2007. These maps are publicly available at <http://geo-vlaanderen.aqiv.be/geo-vlaanderen/overstromingskaarten> and include ca. 2.74 % of the total area in Flanders.

For properties, lying within these risk zones, insurance companies can define higher insurance rates (maximal rates have been defined). For recent buildings, insurance companies can refuse a policy. For those who are refused a policy, a governmental body (so called “Tariferingsbureau”) can provide coverage, at maximal rates.

5.3.3.2 Results

Based on the indicators defined and questions developed, several key figures of water management were invited to fill out an online questionnaire. This resulted in two completed questionnaires; one by province and one by a water authority. The scoring was done by expert judgement, based on the scoring by experts, their comments, factual knowledge of the situation in Flanders and information from the structured interviews. For the Belgium case study we also could count on the expert judgement of 3 senior flood modellers with an extensive expertise of more than 20 years in flood risk management. Furthermore, it was considered important that questionnaires were answered by senior flood risk management experts rather than a large amount of people with less experience. The table below (Table 12) shows the overall results for the 21 indicators selected for the evaluation of the flood management plans (11 indicators) and for the evaluation of the flood event management tools (10 indicators).

Table 12: Belgian case study (Demer Valley): indicator results

Indicator	Standardised score
integrated river basin approach	0,75
public awareness and participation - communication	0,36
insurance	0,88
retention of water	0,75
land use zoning	0,50
risk assessment	0,50
flood emergency	0,75
prevention of pollution	0,83
legal aspects	0,50
climate change	1,00
sustainability	0,50
monitoring	0,92
forecasting	0,71
technology	0,92
knowledge of associated risks	0,70
warnings	0,67
dissemination and communication	0,50
response capability	0,50
uncertainty	0,67
design	0,25
integrated	0,00

Indicators having a score less than 0.25 score are interpreted as very weak, followed by weak (scores between 0.25 and 0.5), moderate (scores between 0.5 and 0.75) and good (scores greater than 0.75). Taking into account the indicators measuring the functioning of flood management plans, 9 % scores weak, whereas 27 % scores good. A total of 64 % of all indicators scores moderately.

For the Belgian case, the indicator on 'public awareness, participation and communication' scores weak (indicator score: 0.6). Local communities are less prepared for flooding. Information about floods and subsequent actions are provided mainly on strategic level, rather than to the public. Information concerning available flood management plans is not transparent. Different website exist, but these are not always clearly available. For example, the Coordination Commission for Integrated Water Policy (CIW) publishes information concerning basin management plans, but has less information on flood crisis plan or on early warning systems. The development of a portal website, containing all available information, should be developed.

Most indicators score moderately. The scores indicate some measures and actions regarding flood management plans have already taken into account for the Belgian case study.

Flood risk management is not always taken into account within spatial planning policies. However, spatial planning has to resolve difficult choices between land use and flood risk management. Flood-prone areas are often economically productive and attractive for habitation, creating a tension between economic and social uses, on the one hand, and minimising flood risk, on the other. The more intensively and the less suitably the flood basin is used, the greater the potential for damage and the actual damage when the flood occurs. The questions developed within this work package, as well as those in work package 2, reveal that this policy is not always implemented. In Belgium, the lack of knowledge among residents remains high. Residents still buy new land sections in flood prone areas. This could be avoided by informing residents about spatial planning issues and decisions made. The available water test (watertoets) should be more accessible to the public. Today, this advice is non-binding.

The risk assessment indicator reveals that efforts are made to improve knowledge on the extent and the evolution of floods and water-related problems. For the Belgian case, these efforts are mainly made for larger waterways. No effort has been put in studying and comparing different land zoning scenarios. Here, it would be advisable to select the best scenarios and integrate these into land use, emergency and rescue planning policies.

Flood management calls for a seamless interaction between various disciplines, government departments and various sectors of society. There is a need for a change in the sectoral outlook of development so that the synergies between the actions of various stakeholders are maximized for the most effective implementation of an integrated flood management approach. To be successful it should be based on a firm legal framework and supporting institutional arrangements. For Belgium, there is a legal framework but it needs important improvements. In other words, the framework does not increase the effectiveness of flood management in its current state. Interdisciplinary cooperation at government and local levels should be further improved.

After the implementation of a flood management plan, monitoring of the basin condition before, during and after the implementation of the plan is essential. This monitoring allows to check the sustainability of the plan and to take corrective measures where necessary. Appropriate performance indicators, suitable for various level of management, have to be established and the threshold values assigned. If adverse affects beyond the specified threshold values are observed, modification and adjustment in the plan should be carried out. For the Belgian case, the answers to this indicator revealed a moderate score. Experts indicated monitoring is done, but the further processing within models is still limited.

Basin management plans are organised per river basin at several relevant levels within Belgium. International catchment plans for Flanders include chapters about flooding. In 2015 these plans will be used as flood risk management plan for the Floods Directive.

Considering water retention, a policy to restore natural floodplain storage exists, but the implementation is rather limited. This means that only a few measures are considered and further implemented. To improve the river basin land use and prevention of rapid runoff (measures are being implemented to slow down run-off and increase infiltration (adapting land use practices, land cover, restoring wetlands...), the water test (watertoets) proposed mitigation measures on infiltration.

The flood emergency indicator scores moderately. Emergency plans in Belgium do not cover all the phases within the management cycle. Specific plans for floods do not exist and should be developed. Various aspects of the plan are regularly inspected to keep the plan operational, but this is not done on a regular basis. Moreover, no integrated exercises are not performed.

The indicators, reflecting issues on 'prevention of pollution', 'climate change ' and 'insurance' obtain a high score within the Belgian case study area. The impact of climate change on discharge regimes for the Flemish rivers have been investigated. From those studies, no real conclusions can be made for winter periods. For summer periods, more droughts are foreseen. Additionally, more rain events are expected to occur. According to the experts, the flood management plan is sufficiently adaptive. The emergency plan is regularly evaluated (every 5 years), the basin management plan is evaluated every 6 years. As explained above, there exists a Belgian Law on insurance of natural disaster. Financial compensation to flood victims is mainly covered by private insurance companies. Moreover, specific subsidies are available to residents who take preventive measures. A good example exists for the separation of waste water and rain water or for specific infiltration measures at property level. Those measures also increase the prevention of pollution. Additionally, waste water collection is generally protected from flooding. However, during heavy rain events, the sewage system may flood. Further measures to separate waste water from rain water exist in Belgium, but implementation is relatively slow.

The overall result for the flood management plans and associated indicators is illustrated in the figure below (Figure 37). The representation by means of spider diagrams allows the comparison among the different case study areas. This will be discussed further below (see chapter 5.3.5).

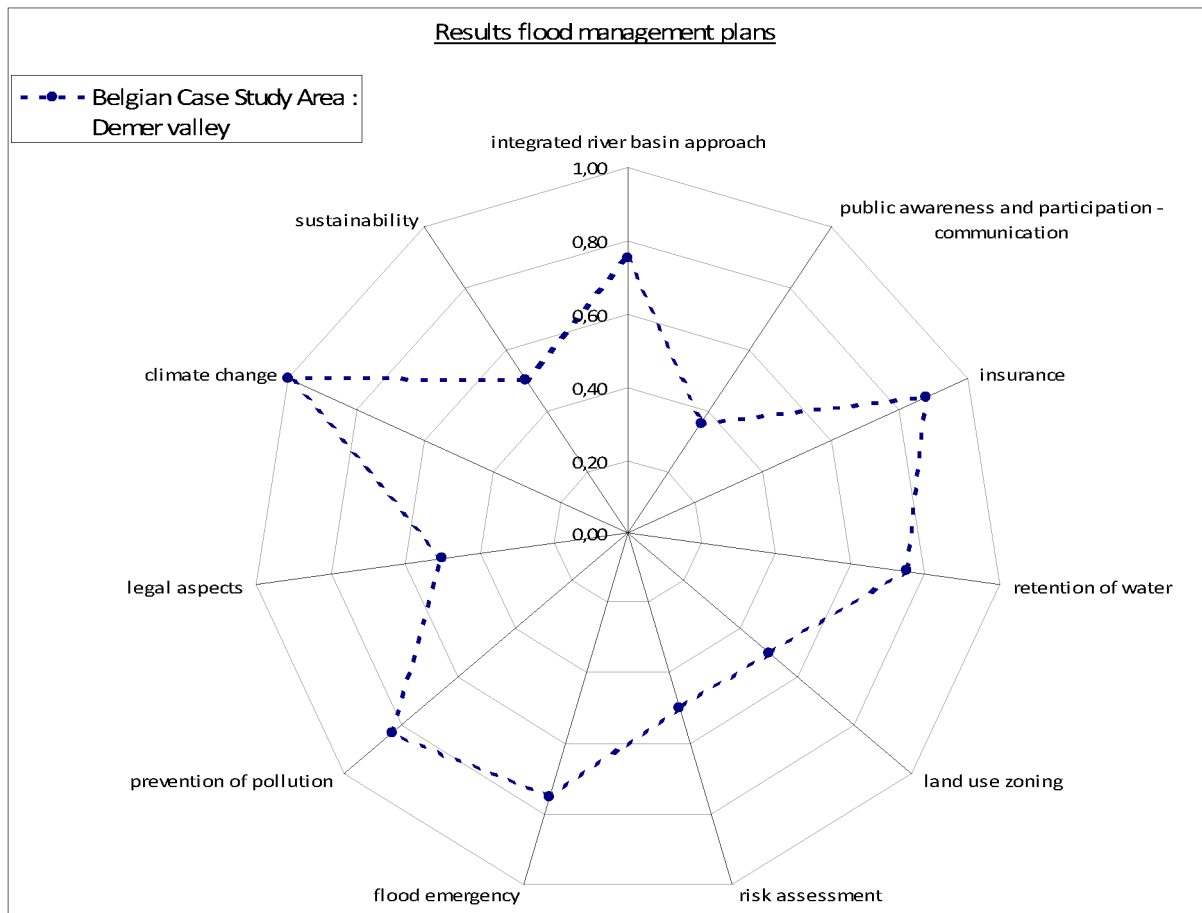


Figure 37: Results evaluation flood management plans (Belgian case)

Ten indicators were considered to evaluate the status of the flood management tools. Most indicators score moderately (60 %). Twenty percent of these indicators score very weak (i.e. ‘integrated’ and ‘design’) and another 20 % scores good.

The indicators ‘Integrated’ and ‘Design’ score very weak for the Belgian case study area. This is also reflected within the spider diagram. In contrast to the answers given, designing an early warning system should be a bottom up-approach, ideally including a range of actors and stakeholders. In other words, the design should be integrated.

Sixty percent of the indicators score moderately. Escalation procedures (dissemination & communication indicator; score: 0.50) document the chain of communication to be followed in different events. Escalations need to be tested regularly for everyone to know them and to weed out unnecessary hitches. For the Belgian case escalation procedures exist. They are part of general disaster management but have not been sufficiently tested, or are not sufficiently known.

Warnings are widely distributed, using several channels to reach the maximum number of persons. All possible channels are used, but they are subjected to procedures. Escalation procedures do not tie in with general hazard management plans: there is an escalation procedure and hazard plans but they contradict. Hazard plans are typically local (community-province-federal) but floods are a regional responsibility.

Minimizing the risk or the impacts of floods should be evaluated both from the residents point of view and water experts point of view. However, this is in contrast to the results from work package 2. Residents ought the authorities to do whatever is possible to prevent flooding. Moreover, respondents do often not know how to prepare for floods. More than 76 % of all respondents are not aware of the existence of an early warning system in Flanders. However 'response capability' scores moderately (indicator score: 0.5 and balances between weak and moderate score), there is much room for improvement.

Uncertainty of the forecasting system is an inevitable aspect of modelling and forecasting (indicator score: 0.50). However, it remains difficult and cumbersome to exactly quantify uncertainty. Therefore, for the Belgian case, experts deal with the uncertainty in a qualitative way. These uncertainties are semi-quantitative included in the warning.

Knowledge of associated risks scores moderately for the Demer case. Forecasts and warnings should be backed by sufficient knowledge on the risks of flooding. For the Belgian case risk assessments have mainly been made for the hydrological aspects, less for the impact on economy, cultural heritage, ecology or vulnerable groups. According to the experts, lack of knowledge hampers the integration of economic risks with ecology, cultural heritage and social factors.

The impact of urbanisation, land use, ecosystem degradation on flood risks are being studied. All these factors and their changes can have an impact on the potential of flooding. For the Belgian case, this is being studied and to some degree known and included in risk assessments. Also different types of floods have been documented in order to meet the Floods Directive.

Flood forecasts are received and consulted on a regular basis. Training on interpretation of warnings is organised regularly or at least when there is a need for it. This training is not organised within an integrated way, but only per water authority. A pre-warning system is operational. This system can raise awareness for imminent problems, before they are indicated by the own warning system. The warning centre is operated full-time; when floods are expected there is permanency (24/7). According to the experts, warnings are confusing or difficult to understand. Local experts are contacted before sending out a warning.

The indicator measuring the value of forecasting scores moderately (indicator score forecasting: 0.71). Forecasts run automatically. This means the system can automatically handle the whole chain from data gathering to delivering forecasting results and warnings. For the Belgian case, predictions are not published before manual interpretation by an operator. The model is updated regularly and reflects changes in the basin. Also, the quality of the forecast is known and checked for a number of events. The lead-time of the forecasting and warning system (i.e. how many days/hours can the model look ahead in time) is sufficient (>2 days). The forecast predicts events accurate enough in time and place but could still be improved. According to the experts, forecasts from external providers are not reliable as they are published without eliminating outliers. Moreover, there are different ways of communicating.

Many efforts have been put in the technology behind and early warning system (indicator score: 0.92). Early warnings systems exist and these are based on recently developed or updated technology. Standard ICT practices are implemented in the server centre. The whole chain behind the EWS is tested regularly. Moreover, the model has been tested for extreme and rare events. The experts indicate both historical data and theoretical data are used to simulate these events.

Also many efforts have been on monitoring requiring maintenance, permanent system calibration and updates over time (indicator score = 0.92). The network of gauging stations for precipitation and discharges is sufficiently developed for the Belgian case. Moreover, the gauging data is available in real-time. The experts recommend to extent the network where necessary and needed. Also, all necessary data is easily obtained and exchanged among neighbouring institutes or countries. Water levels and flood risks are accessible to managers, decision takers and to the public. However, the experts stress this data is not available in a centralized way. The current situation is published on websites showing actual precipitation and hydrological situation, but also here they recommend the integrated view. Today, information from different websites needs to be combined.

The overall result of the evaluation is illustrated in the spider diagram below (Figure 38).

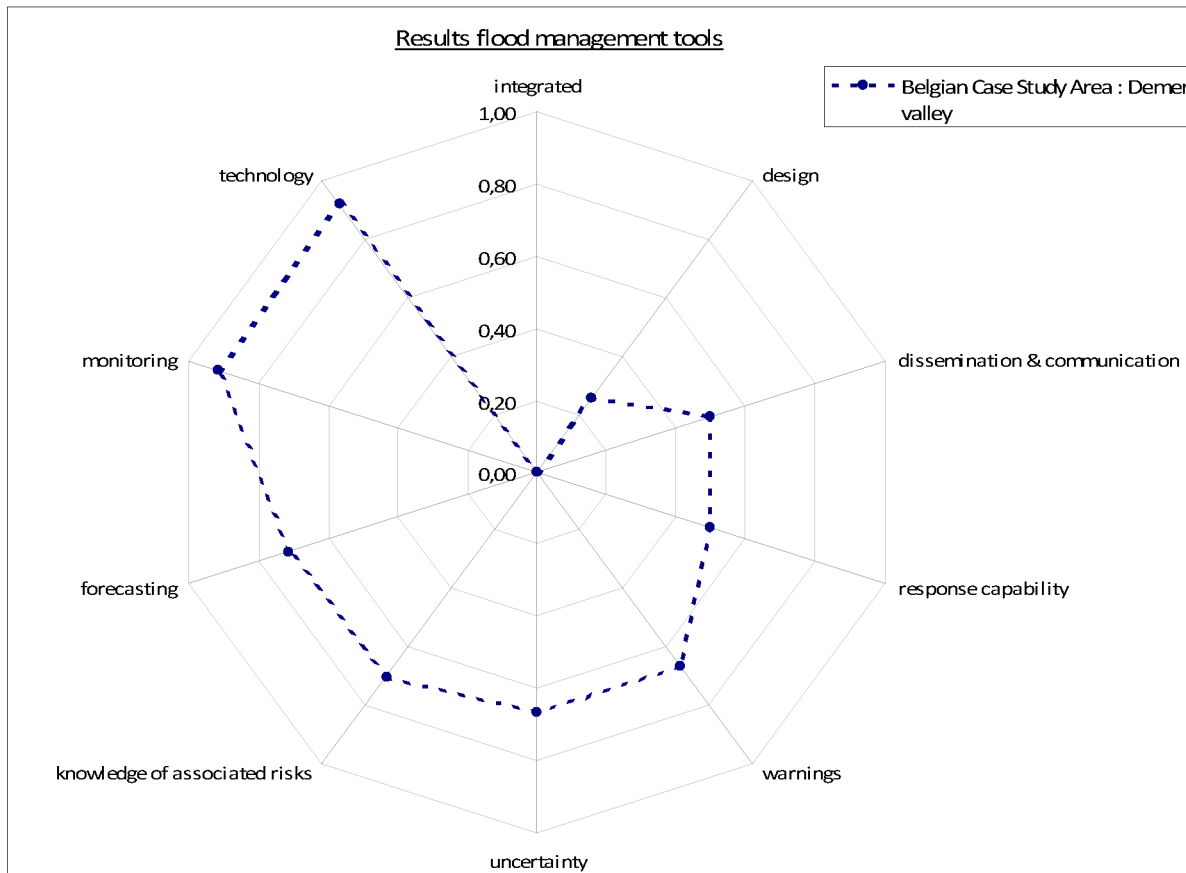


Figure 38: Results evaluation flood management tools (Belgian case)

5.3.3.3 Conclusions

Results show that Flanders scores well on organisation of insurance, prevention of pollution or measures on water retention. Risk assessment (especially the social aspects), the surrounding legal framework and the public awareness score relatively low.

For the flood management tools, monitoring and design obtain a fairly high score. Flanders could do better when it comes to social and communicative aspects of early warning (i.e. dissemination, response capability, incorporating end-user requirements in design or the integration of early warning systems in flood management).

Particular weaknesses mentioned by the experts were:

- There is still little coordination between the water authorities. Flood control areas are not used optimally, while upstream communities often try to get rid of the water as soon as possible, rather than retaining it.
- Despite the potential tool of the “Water test” (Watertoets), construction in flood-prone areas still continues, for political or local reasons. The policies exist, but there is no instrument to enforce a good usage.
- Hazard plans are organised via local-province-federal scales, while flood management is a regional responsibility.

- Forecasting is not incorporated in a legal or juridical framework, the escalation procedure is not legally binding, but once the warning has reached a certain level, formal procedures as established in emergency planning become active.
- Two forecasting centres are forecasting in parallel, the forecasts are not available in one central location. VMM refers to HIC forecasts in the FAQ-pages), HIC refers to VMM on the page with external links (also to international and Walloon forecasts) and in the messages everywhere VMM data or interpretations are used
- According to experts few to some residents know the flood risk. There is no structured information to people that want to live in flood-prone areas (should go via notary).
- Few residents know the existence of any early warning system.

Other recommendations, based on the results of the questionnaire are:

- Develop a portal website integrating all available information.
- The water test (watertoets) should be more established.
- The water test should be more accessible to the public.
- Risk should be assessed in a more integrative way.
- The interdisciplinary cooperation should be improved at different levels and scales
- The monitoring of the basin condition before, during and after the implementation of a flood management plan should be further improved by including this in models.
- Water retention measures should be further developed.
- Emergency plans should cover all phases of the flood management cycle.
- Emergency plans are not inspected on a regular basis. This could be improved (e.g. integrated exercises).
- Implementation of separated sewer systems (waste water and rain water are collected separately) should be accelerated.
- Use of a bottom-up approach (including actors and stakeholders) to design an early warning system is desirable.
- Escalation procedures must be known and tested extensively.
- Response capability should be improved: residents should be more informed
- Attention should be paid to uncertainties in warning systems, preferably by quantifying them.
- Risk assessment should be more integrative: gain knowledge of economic risks, together with ecological and social factors, as well as of cultural heritage.
- Training on the interpretation of warnings should be organised regularly and in an integrative way (by including all involved authorities).
- Further investment is needed in improving forecasting events accurate enough in time and place.
- It is recommended to extent the network of gauging stations for precipitation and discharges where necessary.
- Work should be done to centralise the data

5.3.4 Synthesis of the results for the Soverato/Vibo case study, Italy

5.3.4.1 Scope and methodology

The work package 3 of the FREEMAN project set to analyse the flood management tools, particularly the early alerting and warning systems (EAWS) and flood risk management plans (FRMP), and their contribution to a better preparedness (or resilience) of communities to disaster strikes. With the reference to the flood events 2000 in Soverato and 2006 in Vibo Valentia in Calabria, we have scrutinised 1) the role of the EWS in anticipating the intense precipitation that had triggered the floods, and 2) flood management plans that identify the areas at risk and ensures the appropriate level of prevention and protection for the relevant risk scenarios. Furthermore, two distinguished experts with ample knowledge of the practical flood risk management in Calabria and Italy were engaged in reviewing the EWS design.

The section 5.3.4.2 briefly discusses the 'health assessment' of existing flood management tools. The individual sections are later described more in depth. In particular, the section 5.3.4.3 introduces the challenges of flood forecasting in Calabria. The Early Alert System (EAS) is an assembly of tools, plans, legislation, programmes and procedures, together contributing to reducing harm and damage in case of extreme meteorological and hydrological events. Part of the EAS is the Flood and Landslide Early Warning System (EWS), operated by the Functional Center and closely embedded in the operation of the National Civil Protection Service. The EAS is described in section 5.2, here we focus on the EWS designed to monitor rainfall, creek flow, and water levels 24 hours a day, 365 days a year.

The section 5.3.4.3 analyses the role of uncertainty and predictability of the hydro-meteorological conditions that have led to the analysed flood events. The analysis draws on the expert testimonies submitted in the course of the trial. We have requested and obtained the access to the legal proceedings of the Soverato case, concluded in 2009. Our quest to access the legal proceedings of the Vibo Valentia case was turned down. The reason for this is twofold: first, the court of law questioned our legitimate interest in the case; and second, the criminal investigation into the case has not yet been completed. We are committed to analyse the material shall we be granted the access to the legal proceedings in the remaining time or after the end of the FREEMAN project.

The section 5.3.4.4 extensively discusses the role of uncertainty in general, and the experts' disagreements about the scientific estimates of the return period or recurrence interval. The return period is an estimate of the interval of time between hazard events such as floods of certain intensity. Likelihood is often described in terms of frequency, derived from observation, how often a certain event may occur. A one-hundred-year flood is described as a level of flood water expected to be reached or exceeded once in a hundred years on average. It is also referred to as the 1% flood, expressing the probability that the flood will occur in any single year.

Finally the sections 5.3.4.4 summarises the flood and emergency management plans and their role in the flood risk management. We describe the evolution of the normative framework and the practical difficulties to put translate them into practice. In particular, the flood risk management plan, although compelled by law 183 back in 1989, was completed in Calabria only in 2001, after the 2000 Soverato flood.

5.3.4.2 Health check

Flood Management Plans: The evolution of the flood management plans in Italy and Calabria is summarised further down in the document, in section 5.3.4.4 To sum up, the obligation to develop a flood management plans have been introduced in 1989. Through the successive legislative reforms, the deadline was participated until April 30, 2001. In meantime, the most flood-risk prone areas have been addressed by the extraordinary flood management plans that have been completed by October 31, 1999 for the most part of the Italian territory.

In Calabria the extraordinary plan had been adopted in 1999 (Resolution of Regional Committee 3410/99) and the ordinary plan in 2001 (Resolution of Regional Committee 115/2001), in the aftermath of the Soverato flood analysed in this project. For further detail see section 5.3.4.4.

Flood preparedness: The Early Alerting and Warning System (EAWS) in Italy and in Calabria is extensively described in 5.3.4.3. The disaster alerting procedures were introduced by the Resolution of Regional Committee 172/2007. The Resolution describes the role of the many actors involved, introduces the obligation to adopt emergency plans and describes their requested content. Part of the EAWS is the Function Center (Centro Funzionale) established in Calabria in September 2000 (CP Decree 3081/2000). The role of the Functional Centre is to constantly monitor the meteorological conditions and in case in which these could cause emergency, to inform the Regional Civil Protection Agency. For further detail see section 5.2.

Integrated approach:

The Flood Management Plans described above and in the section 5.3.4.4. are fully integrated in the territorial development plans. For the areas identified as prone to flood risk the territorial development plans introduce limits or exclusion of construction. Furthermore, for these areas the measures have to be put in place reducing the damage in case of flood, and protecting life, environment and property. The decree 49/2010 which transposes the Floods Directive integrates the preparedness and emergency operation of the civil protection with that of the river basin district authority.

Monitoring: The Functional Centre disposes with an extensive network of the pluviometric and hydrometric stations, fully integrated in the EAWS. Based on the weather forecast and continuously collected on-ground data, the alerts are issued according to the empirically established thresholds of situation that have led to emergencies in the past.

Prevention & reducing risk:

Since 1996, the method Versilia is applied in Italy to deal with flood risk. This method foresees that in the intermediate aftermath of the flood, first the areas prone to flood risk (affected by flood) are delimited and flood protection measures are put in place that may include the exclusion of all construction activities. Only after having excluded any risk to population, the affected area can be reconstructed. The territorial development and flood risk management plans are subsequently updated.

Financial provisions: In order to implement the flood protection measures identified in the flood management plans, the Financial Law 2010 (adopted by the law 191/2009) has earmarked 1 billion Euro. These resources complement the existing financial endowment for flood risk protection. Although the above resources may seem substantial, these are not sufficient to remove all criticalities related to flood in Italy. Between the 1944 and 2008 the costs inflicted by hydrogeological and seismic risks in Italy are estimated to top 213 billions Euro. The costs of hydrogeological disasters between 1951 and 2009 exceeds 52 billions Euro. To tackle the hydrogeological emergencies of 2010 alone, some 650 million Euro have been allocated.

Forecasting and warning :

The models deployed in the EWS are divided into four classes according to the level of detail they can provide on the considered phenomenon. From the hydrological point of view the system is very well defined and the use of different model levels is a very interesting approach that try to organize in a systematic way, and for operational purposes, the know-how developed in the hydrological and hydrogeological research fields. The use of meteorological prediction as input for hydrometeorological forecasting chain, for hydrological models or hydrogeological procedures such as those considered in Calabria, is a common practice for operational forecasting system. In Italy many "Centri Funzionali" (CF) of the Italian Civil Protection system operationally use hydrometeorological forecasting chain that consider also the meteorological input to extend the forecasting lead time of severe ground effects. This is the case of Piedmont, Emilia-Romagna but also of regions such as Valle d'Aosta and Liguria that have hydrogeological issues (small steep basins with reduced response time and likely to suffer flash floods and landslides) that are very similar to those that affect Calabria region.

Uncertainty:

The section 5.3.4.3 discusses extensively how uncertainty in flood forecast and estimation of return period has been handled by court of law particularly in the Soverato 2000 case. In general, and as described repeatedly in this report, Calabria is exposed to flash floods that are difficult to predict with certainty. The response time of basins to a rainfall event are of few hours (or less) and it is not possible to wait for observing the precipitation event at rain gauges for issuing an effective alert to the population. For this reason it is crucial to include a Quantitative Precipitation Forecast (QPF) among the element that compose the modelling part. We are not aware of any analysis of the skills of the prediction models and tools.

5.3.4.3 Challenges to flood forecasting and estimation of return period of the extreme events

Calabria is among the regions most prone to natural hazards including earthquake, floods, tsunami, drought and volcano. Hardly anyone described the precarious situation of Italy's end-of-a-boot region better than Giustino Fortunato, a renowned writer, historian and politician, who compared Calabria to a sliding bulge over a sea ('sfasciume pendulo sul mare'). In fact, Calabria suffered many strikes of a capricious nature, including the devastating earthquake in 1908, and the major floods and landslides in 1931, 1951, 1953 (Reggio Calabria), 1972-73, 1996 (Crotona), 2000 (Soverato) e 2006 (Vibo Valentia) that rewrote the land topography.

More than 90% of the region's 15.079 km² is covered by hills and mountains that belong to Apennine Mountain Range. Due to the rough orography of this region and the quick hydrologic response of most watersheds, the floods develop rapidly during the rainy season and suddenly inundate the areas downstream.

The longest rivers include Crati (average discharge 36 m³/s, length 91 km and basin area 2.440 km²) and Neto (15 m³/s, 80 km, 1.073 km²), both flowing into the Ionian Sea. The major rivers discharging into the Tyrrhenian Sea include Amato, Mucone, Savuto and Lao. Most of the water courses, however, are short and of torrential nature, called fiumara. Dry most of the year, they can get swollen quickly in case of intense precipitation and inundate the ample riverbed downstream. For the scope of the EU Water Framework Directive (WFD), the whole region is a part of the Southern Apennines (Appennino Meridionale) river basin district that extends on 67.537,55 km² and includes parts or whole territory of other 6 regions.

The flood events analysed in the FREEMAN projects include the Soverato 2000 flood and Vibo Valentia 2006. Although different in nature and consequences, both events have considerably influenced the flood risk governance in Italy. Soverato is a small town on the Ionian coast. It is home to almost 10.000 inhabitants but visited by many more during the summer season. The town was initially established on hills close to coast but moved gradually nearer the coast after the devastating earthquake in 1783. Triggered by intense precipitation lasting for several days, an otherwise innocuous torrent Beltrame/Soverato turned early morning on September 10th, 2000, into a monster destroying anything in its way, including a camping site Le Giare situated in the least appropriate place, the bed of the torrent close to the outlet into the Ionian Sea.

Vibo Valentia is the capital of homonymous province, home to almost 34.000 thousands, situated on hills and near the Tyrrhenian Sea, with some suburbs extending up to the coast. On 3 July 2006, the suburbs of Vibo Valentia - Vibo Marina, Bivona and Longobardi were hit by flood triggered by torrential precipitation uphill. The flood claimed three casualties, and severely damaged property and industrial buildings. The death of thirteen victims, mostly physically impaired persons sparked a public outcry that unsettled the disaster risk governance in the country.

Both flood events were triggered by precipitation events whose intensity was difficult to anticipate with sufficient precision. Back in 2000 during the Soverato flood, the region did not dispose with a early warning system able to anticipate the adverse meteorological conditions. It wasn't until after the event, and as a response to the Soverato disaster, that a EWS was established and later integrated in the state-wide network of early warning systems (Centri Funzionali) integrated in the system of National Civil Protection Service. Similarly, the 2006 flood in Vibo Valentia was not anticipated early enough to allow

alerting the population. The flood triggered criminal investigation against 11 persons, including high-level officials of the National Department for Civil Protection, for environmental disaster, personal injuries and manslaughter.

The legal wrangle about the criminal liability for the deaths in the aftermath of the Soverato flood ended only in March 2009 (see section 5.4.4 for more detail). The court of first instance back in 2001 commissioned a review of the exceptionality of the precipitation event on September 10th, 2000, and the torrent's discharge at the peak flow. The reports of the court's legal consultants (consulente tecnico di ufficio, CTU) differed substantially from those submitted by the defendant's commissioned experts (consulente tecnico di parte, CTP). In order to reconcile the different views expressed in the earlier experts' testimonies, the Supreme Court mandated another expert review (hereafter referred to as SC-CTU). The SC-CTU reviewed the earlier testimonies and expert review and conducted additional analysis, informing the reconciled view on what was the approximate probability (return period) of the precipitation event and the likely river discharge at the peak flow.

The experts of the first instance estimated a return period of the precipitation to 25 and 74 years respectively. However, according to SC-CTU the estimated return period was higher than 100 years. His estimates show that maximum daily rainfall has a return period of around 110 years, while the event is considered exceptional in terms of total rainfall volume, with a seasonal return period of around 300 years. The estimated return period regarding daily rainfall (110 years) is also confirmed by the estimate regarding hourly rainfall. The SC-CTU decided to consider only pluviometric observations from the only rain gauge station (Chiaravalle) situated in the basin of the torrent. Other experts considered also the data collected from the rain gauge stations outside the river basin but sufficiently close. The decision was justified by the general recognition of the rainfall event as convective in nature and, therefore, as very intense and localised. The estimates provided by CTU and CTP differ because in the former frequency analysis is based on the area-average rainfall during the event. The estimates consider data from rain gauges outside the basin, where - according to SC-CTU - the event was less intense.

The peak discharge estimates also vary considerably, with an estimated discharge of 547 m³/s for the CTU report and 834 m³/s for CTP. The difference is due to considerable uncertainty margins in flood estimates, such as those carried out by CTP. Estimates regarded a portion of the river bed lying upstream of the Enel diversion dam. Estimated peak discharge for CS-CTU is 417 m³/s. The return period for peak discharge, as estimated by CTU, is between 25 and 60 years. SC-CTU estimates a return period of at least 100 years. According to SC-CTU, the validity of his calculations is further reinforced by its coincidence with the rainfall return period.

These estimates are based on the return period which can be associated with maximum rainfall in a three-hour time span (time of concentration for the Beltrame river basin), which is 100 years if estimated yearly, and above 100 years if referred only to the period of the seasonal land use licence. Furthermore, since water absorption capacity of the land is likely to have decreased following the rain of the days preceding the disaster, the return period for peak discharge can be supposed to be the same as that of the rainfall that caused it (i.e., 100 years).

Taking into consideration only the period of the year for which the land use licence was granted, CTP estimated a rainfall return period of more than 1,000 years. According to CS-CTU, however, the shift from estimates based on the complete calendar year to those based exclusively on the summer months is not acceptable. He claims that the methodological foundations of such shift are invalidated by empirical data. As for the technical report by Mr. Marone (Vitale's expert advisor in the hydraulic permit application), SC-CTU states the absolute lack of scientific grounding for the assumption that, since summer rainfall is one tenth of rainfall in the rest of the year, the return period for the summer months can be obtained by multiplying the annual return period by 10. If anything, more statistical observations should be carried out on the specific period of the year under consideration. For a correct estimate of the event's frequency probability in a specific period of the year, an analysis is needed of maximum rainfall in that period each year. In spite of these limitations, CS-CTU provides an estimate of the return period of the event based on its occurring in a specific period of the year. The analysis shows that rainfall return period is around 35 years. The difference between this estimate and that provided by Marone (of 200 years) can be ascribed to the characteristics of the surveying data available at the time of Marone's study, as well as to the rugosity coefficient used in that analysis, which Barth considers inadequate to the area. SC-CTU's analysis considers two factors: daily rainfall typical of the period of the year and hourly rainfall.

5.3.4.4 Flood risk management plans

The concept of flood risk management plan (FRMP) (piano stralcio di dissesto idrogeologico) was first introduced the law 183/1989, extensively described elsewhere in this document (section 5.4.4). The RBPs (and the law 183/1989) had been in many respects precursors of the flood risk management plans (and the Floods Directive 2007/40). The law divided national territory (including minor islands) into river basins and identified 11 national river basins, 18 international river basins, while all others basins were classified as regional river basins. Calabria was divided into three interregional river basins: the Sinni basin (Basilicata and Calabria) on the Ionian side, and the Noce and Lao basins (Basilicata and Calabria) on the Tyrrhenian side. The FRMPs were to become a part of the holistic river basin plan (RBP) that constituted a part of the territorial development plan.

The HRMPs were set to areas prone to flood and landslide of different intensity (R1 – R4). R4 classified areas are prone to highest risk that comprises potential loss of life or significant injuries, sizeable damage to buildings and infrastructure, and large damage to economic activities. R3 refer to areas prone to risk of harm to humans, property or lifelines. R2 and R1 encompass minor or limited risks with no direct threat to persons and economic activities.

The development of the river basin plans, and FRMP as their compartments, proved to be more time and resource demanding than initially expected. In 1993 a modification of the law (Law Decree 398/1993) allowed to develop RBPs in piecemeal way, making it possible to adopt the HRMPs before the river basin plan was completed.

Initially, there was not strict deadline until which the river basin plans, and their hydro-geologic risk management components, were to be adopted or implemented. In the aftermath of the 1998 Sarno flood and landslide disaster, a deadline for the adoption of the FRMP was set initially to December 31, 1998, and later extended to June 30th, 1999 (Decree Law 180/1998 and Law 267/1998). The latter required the RBA to identify and map areas subject to hydrogeological risk; and indicate the infrastructures and buildings subject to hydrogeological risk. Based on those indications, the Regioni were to establish incentive measures to encourage property owners to carry out infrastructural changes and relocate businesses and private homes outside the area subject to flood risk.

Not only the strict deadline was introduced, the law 267/1998 empowered the Prime Minister and the Council of Ministers to take actions, in case the responsible river basin authorities (RBA) fail to adopt the PAIs. In such a case, the Council of Ministers, in agreement with the State and Regions Conference, would define a programme of urgent measures, including maintenance of RBDs, aimed at reducing hydrogeological risk in the areas where high levels of geological instability are associated with greater risks for people, goods and environmental heritage, with priority given to the areas for which a state of emergency has been declared in accordance with Art. 5 of Law 225/1992 of 24 February 1992. To this end, the Regioni, having sought the opinion of relevant local authorities, should have set up a plan of infrastructural changes with the indication of a suitable deadline and with priority assigned based on risk levels. The plan shall include financial incentives for the relocation of businesses and private homes which were built in accordance with urban planning legislation or benefited from building amnesty.

A later modification of the deadline was introduced by the Law Decree 132/ 1999, which became law 226/1999. The new deadline for the approval of the FRMP was set for June 30th, 2001. However, the obligation to develop extraordinary FRMP for the areas at highest risk (piani straordinari per l'individuazione delle aree a rischio idrogeologico più alto), i.e. the R4 and R3 areas, was set to October 31st, 1999. The RBA were obliged to extraordinary plans aimed at removing the hazards determining highest hydrogeological risk, including the proposals from Regioni and local authorities. High priority was given to the areas - subject to hydrogeological risk, for which a state of emergency has been declared in accordance with Art. 5 of Law 225/1992. Within six months from the adoption of the indicated provisions, civil protection bodies shall set up urgent emergency plans for the areas subject to hydrogeological risk, giving priority to those where high levels of geological instability are associated with greater risks for people, goods and environmental heritage. The above plans were to contain measures for the protection of the populations exposed to the risk, including pre-warning and warning systems, as well as preventive evacuation.

In the aftermath of the Soverato 2000 flood (case event of the FREEMAN project), the deadline was delayed once again, to April 30, 2001 (Decree law 279/2000 which became a law 365/2000). To

coordinate the adoption and implementation of transitional plans and to ensure coherent design of river basin and land use planning, the Regioni shall convene a planning conference, with separate provincial sessions attended by representatives of the relevant Province and municipalities, along with the Regione and a representative of relevant RBD Authorities. The conference shall give an opinion on the provisional plan, especially focusing on the integration of different local plans at the level of Province and municipalities, and setting up appropriate hydrogeological and urban planning regulations. In ratifying the plan, the institutional committee referred to in Art. 12, par. 2, subpar. a) of Law 183/1989 of 18 May 1989, shall take the recommendations arising from the conference into consideration in terms of the integrated river basin planning. Furthermore, the Article 2 establishes that, within 120 days from the date of entry into force of the Law, exceptional monitoring and reconnaissance operations shall be carried out along waterways and relevant floodplains, as well as on public lands, and inspections shall aim to identify the areas displaying greater hazard and impending or potential danger to persons and goods and to determine the most urgent maintenance measures. The same deadline is set for the completion of a survey of the state of preservation of the reinforcement works carried out on sloping ground. The survey shall include an indication of the necessary maintenance actions with a view to creating a comprehensive hydrogeological protection system resulting in the widespread reduction of risk levels especially for plain areas.

The Article 67 of the Environmental Act - Decree 152/06 (TU Ambiente) - makes provisions for the transitional plans for the protection against hydrogeological hazard and for protection measures in high-risk areas. It is established that, for a transitional period before RBP approval, RBD Authorities shall adopt transitional FRMP (PAI, Piano di assetto idrogeologico) which, inter alia, identify areas subject to hydrogeological risk, map the areas in need of protection measures and establish protection measures to be taken. The main objective of FRMP is hydrogeological risk mitigation to levels that are compatible with existing land use with a view to safeguard personal safety and minimise damage to goods exposed to the risk.

FRMP consolidates and unifies river basin planning in terms of hydrogeological structure: it coordinates provisions from previous transitional plans and exceptional plans and, if necessary, specifies and modifies them to ensure integration and relevance of all actions within RBPs. When compared to previous plans, PAI shall contain the following indications for the whole river basin: i) a full outline of intensive structural interventions on sloping ground and watercourses; ii) identification of intensive structural interventions; iii) definition of non-structural interventions on the basis of provisions and restrictions on land use in areas subject to hydraulic and hydrogeological risk, and therefore complete definition of floodways for the main watercourses of the basin; identification and definition of hill and mountain areas subject to hydrogeological risk.

5.3.5 Comparing the case studies

5.3.5.1 Comparing the case studies

Table 13 and Table 14 below summarise the results of the three case studies. The tables allow comparing among the different cases, as all scores of the variables and indicators were standardised (scores between 0 and 1). E.g. flood emergency scores best in the Italian case, followed by the Belgian and the German case. An overall average score has been annotated to the table.

Considering the flood management plans, the Belgian case obtains the highest score, followed by the Italian and the German case study area. The Italian case study area scores best for the flood management tools.

Table 13: Standardised scores for the evaluation of flood management plans

Indicator (flood management plans)	Score Belgian case	Score German case	Score Italian case
integrated river basin approach	0.75	0.25	0.75
public awareness and participation - communication	0.36	0.43	0.64
insurance	0.88	0.00	0.63
retention of water	0.75	0.00	0.50
land use zoning	0.50	0.50	0.50
risk assessment	0.50	0.17	0.33
flood emergency	0.75	0.50	0.88
prevention of pollution	0.83	0.00	0.67
legal aspects	0.50	0.50	1.00
climate change	1.00	0.17	0.33
sustainability	0.50	0.00	1.00
Averaged score	0.67	0.23	0.66

Table 14: Standardised scores for the evaluation of flood management tools

Indicator (flood management tools)	Score Belgian case	Score German case	Score Italian case
Monitoring	0.92	0.08	0.75
Forecasting	0.71	0.21	0.86
Technology	0.92	0.08	0.75
Knowledge of associated risks	0.70	0.20	0.70
Warnings	0.67	0.06	0.83
Dissemination & communication	0.50	0.30	0.90
Response capability	0.50	0.25	0.50
Uncertainty	0.67	0.00	0.50
Design	0.25	0.00	0.25
Integrated approach	0.00	0.00	1.00
Averaged score	0.58	0.12	0.70

The graphical presentation of the different cases by means of a radar diagram, reveals large differences as can be seen in Figure 39 and Figure 40.

Careful interpretation is needed as these differences may be due to the different methods followed in the application of the scoring scheme. The proposed methodology has been designed to question different target groups such as emergency responders, policy makers, managers, experts or the general public.

When applied on a sufficiently large sample of respondents, insights can be gained with regard to the general knowledge on flood management tools and plans for each of the target groups and corrections can be proposed were the interpretation of the answers is deviating from one group to another in function of the assessed level of expertise. In addition, respondents are asked to add a motivation of the scores in a comment line for each variable.

It is suggested that the methodology would be improved by adding information of respondents such as area and years of expertise, profession, employer and others.

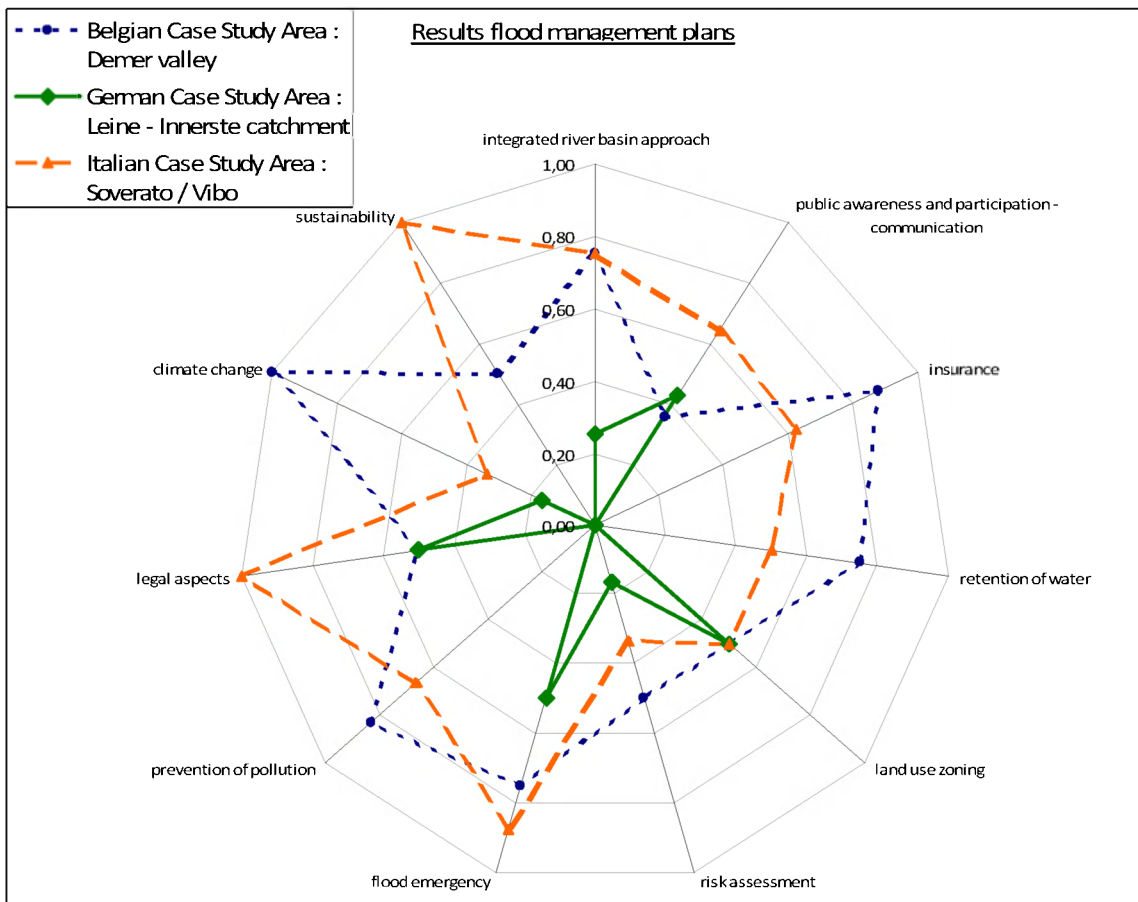


Figure 39: Results flood management plans: comparing the three case study areas

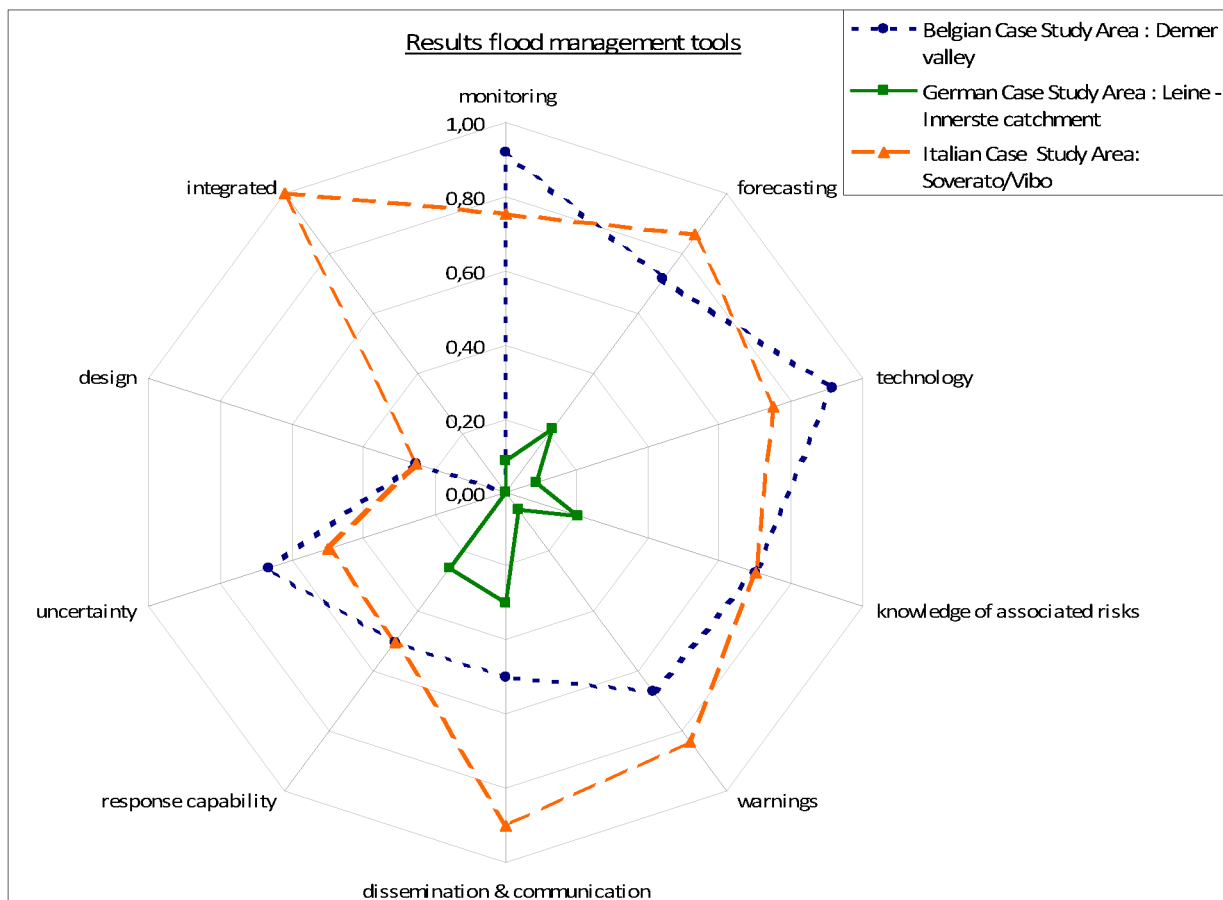


Figure 40: Results flood management tools: comparing the three case study areas

The interpretation of one variable will not necessarily be the same for all stakeholders. Examining the methods followed in each of the case studies as described in sections 5.3.2 to 5.3.4 indicates indeed differences in application of the evaluation scheme and hence also in possible differences in interpretation. Although all respondents have specific expertise in flood management issues, some are professionally leaning more towards technical and design issues of the flood management tools where others may rather be leaning towards public awareness or risk communication issues.

As a consequence not all variables have been scored with the same level of expertise. To make a careful comparison of the resulting indicator values for the three case studies, the scores of each individual variables should be compared, taking into account the background of the respective respondents and their motivation. Because of the limited number of respondents and fully completed questionnaires, a systematic in-depth analysis of each individual variable is not included in this report. However within the scope of this assignment we do conclude that the proposed methodology is sufficiently suitable to make an overall assessment of the plans and tools available in each study site and allows the identification of measures for improvement.

5.3.5.2 Proposing measures and strategies

For a generic list with potential measures and strategies to improve the utilisation of available tools as a step towards more resilience, the reader is referred to Table 21. This list is based on the partners joint expertise, existing literature and findings from case study evaluations presented in this report.

5.4 Flood policy framework (WP 4)

5.4.1 Setting the scene

Introduction

The WP4 (Flood policy framework) set to analyse flood risk institutions and governance regimes in the three case study areas. In doing so it complements the assessment of risk perception and communication, addressed in WP2; and risk management tool and planning instruments, explored in WP3.

There are multiple and at least partly inconsistent definitions of both, institutions and governance (regimes). Extensive discussion of both can be found in (IRGC 2008; Walker *et al.* 2010) and elsewhere. Here we limit ourselves to a short introduction into the concepts, and the assumptions and methodology applied. The various definitions enumerate different qualities of both concepts, or make different assertion about the relationship among these qualities (Kaplan 1960). We realise that these differences only apparently obstruct a common understanding of the underlying concepts. As (Marris *et al.* 2008) notes, 'scientists are competent, if unconscious wielders of definition, just as one can walk quite happily without having a complete account of walking'.

“Governance is the exercise of economic, political and administrative authority. It comprises the mechanisms, processes and institutions, through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences (UNDP 2004).”

Good governance is conform with normative principles such as openness, transparency, accountability, coherence and effectiveness (EC 2001), respected by democratic societies and applied in act in course govern. Risk governance applies the principles of good governance to the identification, assessment, management and communication of risks.

“Institutions are the formal rules and informal norms that define and modify the choice sets of individuals and their interactions (Saleth and Dinar 2004); hierarchically nested rules that can be analysed at several interconnected levels: culture, basic rules, governance and resources (Williamson 2000).”

In plain words, institutions we analysed include legislation, regulation and organisation engaged in the flood risk management, whereas governance addresses the process of decision-making and the process by which decisions are implemented. Governance and institutions are interwoven and intersect, according to many, but both are important determinants of adaptive capacity and resilience. Paraphrasing Renn (2008), risk governance encompasses a web of actors and institutions (rules, conventions, processes), 'concerned with how relevant risk information is collected, analysed and communicated, and how management decisions are taken'.

In the WP4 we analysed the interplay of the flood risk institutions, both horizontal and vertical, and the performance of flood governance regimes. With respect to both, the breath and depth of the analysis was decided individually in the different case studies, based on the specific characteristics of the case studies and the available skills. Analysing risk governance means paying attention to 'legal, institutional, social and economic contexts in which a risk is evaluated, and involvement of the actors and stakeholders who represent them' (Renn, 2008).

European flood and disaster risk legislation

The 2007 marks two important milestones in European risk governance. First, the 2007/60/EC Directive on the Assessment and Management of Flood Risks (hereafter Floods Directive) was adopted on 18 September and entered into force on 26 November 2007. The adoption of the Directive concludes the legislative efforts not at least triggered by devastating floods along the Danube and Elbe rivers in summer 2002. Second, the European Council adopted a Decision 2007/779/EC, Euratom on 8 November 2007 that substantially changed the Community Civil Protection Mechanism (hereafter **CCPM**), introduced initially by the Council Decision 2001/792/EC, Euratom back in 2001.

The legislative efforts leading to the Floods Directive started back in 2004 with the EC Communication 2004/4723 (hereafter referred to as **COM04**) which recognised the importance of concerted Community action and highlighted the paucity of existing EU regulations on flood risk. The COM04 acknowledged the ever increasing flood-inflicted damage as well as health risk posed by floods, and identified climate change as one among several drivers of flood risk in the years to come. Most importantly, the COM04 tightly embeds the flood risk management in an 'integrated and comprehensive approach to river basin management' (EC, 2004) the framework for which has been laid down by the Directive 2000/60 (Water Framework Directive, WFD). The WFD however was not meant for addressing flood risk. Therefore, the COM04 proposed a 'co-ordinated flood prevention, protection and mitigation action programme' jointly implemented by the Commission and Member States.

Followed a positive review by Environmental Council, the EU Council invited the Commission to develop a proposal for a European Action Programme on flood risk management (APFRM), informed by regular meetings of the EU Water Directors and in co-operation with other stakeholders. Over 2005 the EC conducted a public consultation of the proposed APFRM which included, among other, the proposal of introducing a legal instrument. In January 2006 the EC finally adopted a proposal of the Directive. It took two years to negotiate the final text of the Directive (2007/60/EC) with the European Council and European Parliament.

In the disaster response domain, the early mark in the field of Community Civil Protection Mechanism was set by the Council Decision of 23 October 2001 establishing the Civil Protection Mechanism (CCPM). The Commission Decision of 29 December 2003 laid down the rules for the implementation of the CCPM, defining its duties and the functioning of the various tools made use of. More recently, the European Union's efforts in disaster risk reduction intensified with the EC Communication on Disaster Response Capacity (EC 2008). This Communication highlighted the need for stepping up the Community capacity and effectiveness to respond to disasters, within and outside the EU. To do so, the EC proposed several tangible means for a better coordination of various EU/Community policies, instruments, services and players (at national, European and international levels). While the Communication focuses on the response to disasters, it acknowledges that a comprehensive approach to disaster management is needed comprising risk assessment, forecast, prevention, preparedness and mitigation. The Communication also laid out the plan to create a European Disaster Response Training Network, drawing on the past experiences and scientific knowledge acquired at national and European level through the Framework Programme research projects dealing with natural hazards and disasters issues.

As a follow-up, the EC released two additional Communications in 2009. The first, COM(2009)84 (EC 2009a), sets to scale up the support for disaster preparedness capacities in third countries facing high levels of risk. In this Communication, among others, the EU commits itself to help to expand research (including on social science) capacity and training in developing countries. The second, COM(2009)82 (EC 2009b) stresses the need to make research results easily and systematically available for DRR practitioners, and to develop a database for experts with specialist knowledge.

³ From the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: Flood risk management; Flood prevention, protection and mitigation, COM(2004)472 final

5.4.2 Synthesis of the results for the Innerste case study, Germany

5.4.2.1 Institutional framework for flood and risk management

The main characteristic of governance in Germany is the federal system which was established after the second world war. Responsibility for a number of sectors such as education, transport and infrastructure as well as environmental resources is largely in the hands of the federal states. Generally, laws and regulations are developed and issued at the federation (Bund) and federal state (Länder) levels, and the implementation of these laws and regulations occurs at the district (Kreis) and municipal (Städte und Gemeinden) levels. One of the central characteristics of federalism is a bottom-up decision making process, and decentralised implementation of federal and state level legislation, regulations and policies that apply to the local and regional level. Flood and risk management in Germany is shaped by all three levels: federal, state and district/municipal. Each is described below with respect to flood and risk management.

The federation (Bund) level

The German Federation is responsible for legislation. They establish the legislative framework and require that the federal states including lower administrative levels to implement the the federal laws and regulations. Some of the most relevant laws for flood protection are:

- Improvement of Preventive flood Protection Act (Gesetz zur Verbesserung des vorbeugenden Hochwasserschutzes), 3rd of May 2005. This relatively new law commits the German Federal States to support the implementation of flood protection measures, in particular by providing rivers with more space. The main elements of this law are:
 - 1) Definition of floodplains with high potential for damage by 10 May 2010;
 - 2) Identification and documentation of flood-prone areas through mapping (flood hazard maps);
 - 3) Stringent conditions for development of infrastructure and buildings in floodplains;
 - 4) Responsibility for informing the public bodies and general public lies with the state;
 - 5) Establishment of flood protection plans by 10 May 2009, (for medium probability 1:100);
 - 6) Co-operation with neighbour states and countries.
 Most of these elements are derived from the implementations of the Floods Directive (FD, 2007/60/EC).
- Federal Water Management Act (Wasserhaushaltsgesetz, 19th of August 2002). This law defines notions and terms such as watersheds, sub-watersheds and river basin units including responsibilities and usage. This law is fundamental for the implementation of flood protection policies.
- Spatial Planning Act (Raumordnungsgesetz, ROG, 18th of August 1997). This law regulates urban and rural development. It protects vulnerable landscape such as floodplains and natural areas.
- Building and Development Act (Baugesetzbuch, 2004). Refers to building regulations that apply to flood-prone areas and the determination of retention areas. The implications of development activities on nature and water balance must be examined through environmental impact assessment.
- Federal Soil Protection Act (Bundes-Bodenschutzgesetz, BbodSchG, 17th of March 1998) regulates the protection of soils, as well as the management of toxic waste and pollutants in soils.
- Federal Waterways Act (Bundeswasserstraßengesetz, WaStrG, 23rd of May 2007) regulates flood warning and protection, as well as the protection of navigation and related facilities.

The Federal state level

In general, the federal states must implement the laws listed above and are hence responsible for flood prevention, flood defence and flood protection. The federal state has the right and the duty to execute the legal guidelines of flood protection. They are also the regulation authority, execution authority and financing authority. The instruments for implementing the federal laws are state planning, spatial planning and civil protection. Civil protection is prescribed by the German Constitution. The federal minister of the interior executes civil protection by delegating to the districts and municipalities. It is regulated and implemented by means of the federal state law by the following means:

- Make available information about flood dangers, prevention measures and codes of behaviour to residents and public bodies;
- Define water bodies or parts of water bodies where minor damage caused by flood or is expected;
- Designate floodplains as well as areas where floods (statistically once in 100 years = design flood) are expected by 10 May 2012 => Floodplains must be set and integrated in the Regional Planning Act (ROG 1997);
- Provide information to the population about floodplains;
- Compilation of flood protection plans.

Article 70 the German Constitution determines that federal states are responsible for disaster management including natural disasters such as floods. Furthermore, financial resources for disaster management have to be allocated by the federal states.

In collaboration with the federal states, Bremen, Hessen, Nordrhein-Westfalen and Thüringen the state government of Lower Saxony developed the "Action Plan for preventive flood protection in the Weser basin (ARGE, 2001). This planning document provides guidelines for the planning of effective flood prevention in the Weser river basin.

The districts and municipalities (Kreise und Gemeinden) level

Districts and municipalities are responsible for the planning and implementation of flood protection and flood prevention on a regional and local level. Whereas the districts act at the sub-watershed level, the communities may only take measures on a local level. Plans such as building dykes or designating a new floodplain have to be approved by higher-level institutions: 1) on the district level (integrating local measures into river (sub) basin management plans); and 2) by the federal state (i.e. Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency, NLWKN). Furthermore, all plans have to be approved by departments of the relevant sectors, nature protection, agriculture and Infrastructure.

The districts are responsible for developing the "Regional Spatial Planning Programme" (Regionale Raumordnungsprogramme, RROP) which has an integrative function for the urban planning and development in the municipalities. However, the federal structure of the administration has a high degree of sectoral fragmentation which occasionally results in long-lasting planning processes. As a consequence of an administrative reform in Lower Saxony, which was effective on January 1, 2005, fragmentation of specialised departments was increased.

5.4.2.2 Institutional actors, organisations and their interplay

In this section the relevant actors and organisations (from high to low institutional level) who are actively involved in flood prevention and protection as well as in disaster management are described briefly. A flow chart of organisations that play a role in disaster management is provided in Figure 13 and chapter 5.2.2.2.

LAWA, German working group of the federal states on water issues

LAWA is an association among representatives of all federal states and the federation of Germany created in order to discuss water related issues, and release guidelines and recommendations for water and flood management. Examples of flood-related publications are LAWA 2010a, 2010b, which describe the implementation of flood hazard maps as well as flood risk maps according to the Floods Directive.

State police

The police service at the state level does not have responsibility for disaster management. However, during a calamity such as a flood the police may support the organisations designated for this task. Moreover, disaster management is co-ordinated between the responsible administrations and the federal police. The regional police department will convene disaster management staff in case of a calamity, and co-ordinates management of and collaboration with all involved organisations.

Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency (NLWKN)

The responsibility for nature protection and water management in Lower Saxony are merged under one roof - the NLWKN, which is directly associated with the Department of the Environment. This organisation manages the integration of nature protection and water management of which flood risk management is part of. The NLWKN is also responsible for the operational implementation of flood protection.

An important function for flood control is the urban land use planning at the municipal levels and the designation of flood plains for the rural areas which is conducted by the NLWKN. An intermediary level between the federal state and the municipal urban land use planning is the regional development plan (RROP) at the district level such as the Region Hannover. Among others, these plans designate priority areas for drinking water protection and flood control, and they are as legally binding as the urban land use plans developed by local authorities at the lowest level of territorial management in German. Further tasks of the NLWKN are:

- Implementation of flood control in all districts and municipalities of the federal state;
- Planning of flood protection facilities and infrastructure;
- Implementing flood control projects for the (coastal) dyke associations;
- Flood control plans for rivers or river sections that are subject to particular flood hazards;
- Establishment of flood risk management plans according to the Floods Directive;
- Determining the limits of the flood areas which is consistent with the development of flood hazard maps according to the Floods Directive;
- Development of flood risk maps according to the Floods Directive.

The NLWKN has initiated the development of a flood management plans. Several plans are finalised within the Weser catchment. An important basis for the flood management protection is the water law of the Federal state of Lower Saxony (NWG, 2007). The aim of the all flood management protection in Lower Saxony is be to minimise the impact of floods with a 1:100 probability. (NLWKN, 2009).

Weser river basin authority

The river basin association Weser developed the flood management plan for the entire river basin of the Weser. Plans for the sub catchments are developed by the NLWKN. This plan comprises a detailed description of the river basin as well as recommendations for the implementation of flood protection measures. Furthermore, the river basin association is actively involved in disaster management.

Flood forecasting centre

Since the 1st of October 2009 a flood forecasting centre has been established, for example, in Hildesheim for the Leine catchment. The centre is still in a testing phase. One of the main tasks is to provide flood warning data to the municipalities in time.

Water associations

Many associations in Lower Saxony, Bremen and Saxony-Anhalt are a member of the umbrella association the Wasserverbandstag e.V. (<http://www.wasserverbandstag.de/>), which was founded in 1949 to bring together various interest groups and associations in one forum. Nowadays, the umbrella association has approximately 1000 members, which are supported in the fields of: surface water maintenance and development, drinking water supply and waste water disposal, flood protection (inland and coastal), landscape and nature conservation, Regulation of soil moisture budget.

Lower water authority

At the District Level the lower water authority (Untere Wasserbehörde) has the responsibility for the implementation of measures for flood protection. This is laid down in the Building Development Act (BauGB), because the communities are responsible for an adequate flood protection in the residential areas.

The lower water authority is a permit authority, execution- and supervisory authority. They are accountable for approval of measures affecting floodplains or for river training. Their instrument of implementation is the General Development Plan.

The district administration also administer disaster response in co-ordination with the administration of the federal state. The responsible person for disaster management is the district administrator (Hauptverwaltungsbeamter) of the disaster administration.

Dyke associations

Not only the municipalities are responsible for flood protection. In the federal state of Lower Saxony, the dyke associations (Deichverbände) are also responsible for flood protection. They maintain about 800 kilometres of coastal dykes.

Locally-based organisations

Local organisations involved in disaster management are: the fire brigade (Feuerwehr), several aid organisations (Deutsches Rotes Kreuz, Johanniter-Unfall-Hilfe, Arbeiter-Samariter-Bund, Malteser Hilfsdienst, Technisches Hilfswerk (THW) and Deutsche Lebensrettungsgesellschaft).

5.4.2.3 Conclusions

The organisations who are involved in flood management in Lower Saxony are organised to the German federal structure. The main advantage of this structure is the dependence and freedom for decision making throughout all administrative layers from the German government to the municipalities. Thus there is no centralised administrative entity (on the governmental level) that can entirely determine decision processes down to the municipality level. Especially, the federal states strive to maintain independence from the German government. However, a hierarchical structure is obvious, and this way boundary conditions and regulations are imposed in a top-down way.

As a consequence local requirements must comply with federal state as well as governmental regulations. In practise this may entail delays or even rejections of decision processes, since these are matter of review and balancing out with higher-level interests. For local authorities the implementation of flood protection measures may be cumbersome and lengthy.

For crisis management a sharp and clear structure of responsibilities has been established based upon experiences from previous years. Crisis management, however, is not specified for floods, but for all kinds of natural and technical hazards. The advantage is much experience in managing the consequences of hazards as to reduce or avoid damages or to avoid casualties and rescue lives. On the other hand standards such as the 1: 100 probability for floods possible appear mechanistic, and can result in misunderstandings such as observed in the municipality of Holle at the 29th of September 2007.

Whereas crisis management is organised in a 'multi-disciplinary' way, flood management and preparation must coexist with other sectors and the related preferences and decision. During the interviews the representatives of responsible organisations repeatedly regretted the elimination of the administrative middle-layer 'Bezirksregierung', where experts from several sectors where clustered in one institution.

Furthermore, the strict top-down management of floods does not permit much feedback from local-scale administrations and stakeholders. After the flood of 2007 all interviewed representatives of responsible organisations reported from lessons learnt. However, there is no evidence for an interactive and vital exchange of perspectives, and hence there is no social learning process that results in a systematic review and improvement of the existing flood management system.

5.4.3 Synthesis of the results for the Demer case study, Belgium

5.4.3.1 Interplay of flood institutions

A. Actors and pieces of legislation

Introduction and governance levels in Belgium

Belgium is a Federal State composed of three Regions for territorial matters (Figure 42) and three Communities for cultural/linguistic matters (Figure 41). The country is further divided into 10 provinces and 589 municipal councils.



Figure 41: Communities in Belgium (www.belgium.be, 2011)



Figure 42: Regions in Belgium (www.belgium.be, 2011)

Broadly speaking, the powers of the *Federal State* cover everything connected with the public interest. Police and civil security as well as crisis management are the area of the Federal Minister of Home Affairs. Water policy is (almost) entirely a *Regional* competence. There is no coordinating federal water administration, only a national consultative body, the Coordination Committee on International Environmental Policy (CCIEP). Within this framework, the CCIEP Steering Group Water is the consultative body that is in charge of the necessary coordination of the implementation of the international water policy between the different competent authorities in Belgium (Raymaekers, 2010).

The regions (Walloon Region, Brussels Capital Region and Flemish Region) are on their entire territory competent for the implementation of the water policy (Raymaekers, 2010). *The provinces* are responsible for water management matters in its territory that are of provincial interest and which do not come under the general interest of the Federal State, the Communities and the Regions, or under the municipal interest (Raymaekers, 2010).

Municipalities also have local competences in the field of water management like urban drainage and sewer systems.

Disaster management is rather a federal matter while water management is a regional matter. For water management only the Flemish regional level will be set out in detail further on since the Belgian case study (Demer basin) is part of the Flemish Region.

Overview of legislation related to water (and flood) policy

Water Framework Directive (including Floods Directive)

The juridical and organizational framework for integrated water policy in Flanders is described in the Decree on Integrated Water Policy of 18 July 2003. The Decree was the transposition of the EU Water Framework Directive (2000) in Flemish legislation. Flood risk management and other water related items were from the beginning incorporated in this Decree, although not required by the Water Framework Directive. The Decree on Integrated Water Policy establishes the principles for the policy. Orders implementing this decree make it more specific.

Geographical division of the territory in Flanders

The Integrated Policy Water Decree describes the geographical division of the water systems into:

- Two international river basin districts (*stroomgebiedsdistricten*): part of the Scheldt and the Meuse (Figure 43)
- Four river basins (*stroomgebieden*): Meuse, Scheldt, IJzer and Brugse Polders
- Eleven basins (*deelstroomgebieden* or *bekkens*): IJzer, Brugse Polders, Leie, Gentse Kanalen, Bovenschelde, Benedenschelde, Dender, Dijle & Zenne, Nete, **Demer** and Meuse (Figure 43)
- 103 sub-basins (*deelbekkens*)

An implementing order regarding the geographical division of the water systems was made in 2005⁴.



Figure 43: Delineation of the two international river basin districts and the eleven basins in Flanders (CIW, 2007)

Organizational structures to ensure water policy coordination at all levels

The implementing order of 2005⁴ also stipulates how the consultative structures described in the Decree should look like: The Coordination Commission for Integrated Water Policy (=CIW) on the Regional (Flemish) level = River Basin level; Boards, councils and secretariats on Basin level and Water Regulatory Authorities (Waterschappen) on Sub-basin level.

The CIW, established in 2004, is the competent authority at the Flemish level. It is a multi-disciplinary commission uniting different levels of water management and governance responsible for preparing, planning and monitoring of integrated water policy and for the implementation of the decisions taken by the Flemish government. The Flemish government describes her vision and the main principles on integrated water management in a Vision Document on Water Policy (*Waterbeleidsnota*). It also determines the River Basin Management Plans for the Flemish parts of the International River Basin Districts of Scheldt and Meuse. One of the five themes in this document is the combined approach of floods and water shortage (Raymaekers, 2010). The document, prepared by the CIW, was approved the 8th of April 2005. The Vision Document on Water Policy and the three planning processes (RBMP, BMP, LWMP⁵) are reviewed every 6 years. Yearly state of play is monitored through basin progress reports. For

⁴ Order of the Flemish Government of 9th September 2005 on geographical divisions of the water system and organisation of integrated water management in implementation of title I of the Decree on Integrated Water Policy of 18 July 2003

⁵ RBMP = River Basin Management Plan; BMP = Basin Management Plan; LWMP = Local Water Management Plan

the moment, this government is not having an accepted *Waterbeleidsnota*. RBMPs cover mainly the larger navigable rivers and canals and groundwater bodies, BMPs mainly the larger unnavigable rivers, and the LWMPs mainly the smaller tributaries with urban runoff aspects. The RBMPs (and BMPs) contain among other things measures for the management of flood risks (Raymaekers, 2010)⁶:

At the Basin level (11 basins), Basin Boards and councils are established. Responsibilities of the boards are to elaborate Basin Management Plans (under the supervision of the Region) and to advise authorities on action programs affecting the water system. The Basin Management Plans contain measures to prevent flooding (infrastructure, dredging...). The information of these Basin Management Plans (BMPs) is used in the River Basin Management Plans (RBMPs).

The basin board consists of delegates of the Flemish Government of all involved policy domains and representatives of the provinces and sub-basins (CIW, 2007). The Basin Management Plan of the Demer was approved 30 January 2009 (VMM, 2009).

At Sub-basin level (103 sub-basins) one or more sub-basins can make cooperation agreements for the establishment of a Water Regulatory Authority (*Waterschap*), responsible for drawing up the Local Water Management Plans. The information of these LWMPs has to be in line with the Basin Management Plans. A Water Regulatory Authority is a cooperation between the Flemish Government, the provinces, the municipalities and the Marshes and Wetlands (*Polders en wateringen*). There are 53 Water Regulatory Authorities (Figure 44).

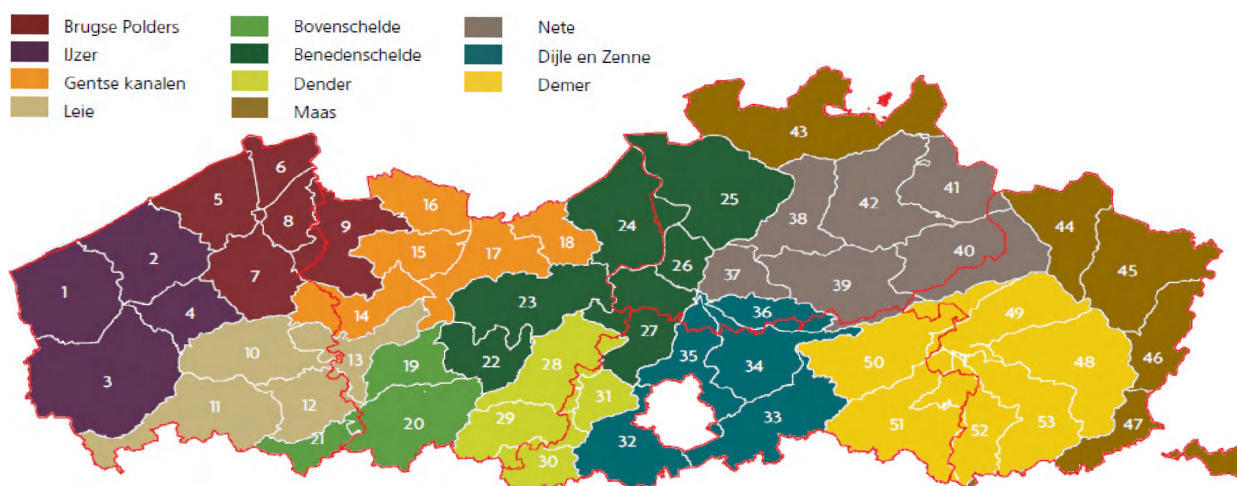


Figure 44: Delineation of fifty three water regulatory authorities, they manage the hundred and three subbasins (red line = province border) (CIW, 2007)

An overview of the three levels discussed above is given in Figure 45. Table 15 shows the organizational structures in the Demer basin. Figure 46 shows the 14 sub-basins and the 6 Water Regulatory Authorities in the Demer basin.

⁶ Order of the Flemish Government of 30th January 2009.

Level	Plan	Preparation	Advisory	Decision
Flemish Government	River basin management plan – end of 2009	CIW	SERV MINA- council	Flemish Government
	Water policy document – April 2005			
Basin	Basin management plan – end of 2007	Basin Secretary	Basin council	Basin board
Sub basin	Sub basin management plan – end of 2007	Secretary Water Regulatory Authority	Local environmental councils	Water Regulatory Authority
		Official pillar	Civil pillar	Political pillar

Figure 45: Schematic overview of the water policy in Flanders (CIW, 2007)

Table 15: Demer basin in the integrated water policy in Flanders

Level	Structure	Planning
International Scheldt River basin district (ISRBD)	International Scheldt Commission (Parties: France, Belgium, Walloon Region, Flemish Region, Brussels Capital Region, The Netherlands)	International Scheldt Basin Management plan
Scheldt Basin	Flemish Government – CIW	River Basin Management Plan: Scheldt
Demer Basin	Demer Basin board and council (assisted by a secretariat)	Basin Management Plan: Demer (2008-2013)
14 sub-basins: Velpe, Winterbeek, Ossebeek, Kleine Gete, Grote Gete, Winge, Motte en Begijn(n)beek, Boven-Demer, Midden-Demer, Herk, Beneden-Gete, Melsterbeek, Zwarte Beek, Mangelbeek en Mombeek.	These sub-basins are coordinated by two provinces and six Water regulatory authorities; (Provinces: Vlaams-Brabant & Limburg) (Water regulatory authorities: Zwarte Beek & Mangelbeek, Bovenstroom Demer, Herk en Mombeek, Demer Noord, Demer Zuid, Melsterbeek)	Sub-basin Management Plans: Velpe, Winterbeek, Ossebeek, Kleine Gete, Grote Gete, Winge, Motte en Begijn(n)beek, Boven-Demer, Midden-Demer, Herk, Beneden-Gete, Melsterbeek, Zwarte Beek, Mangelbeek en Mombeek

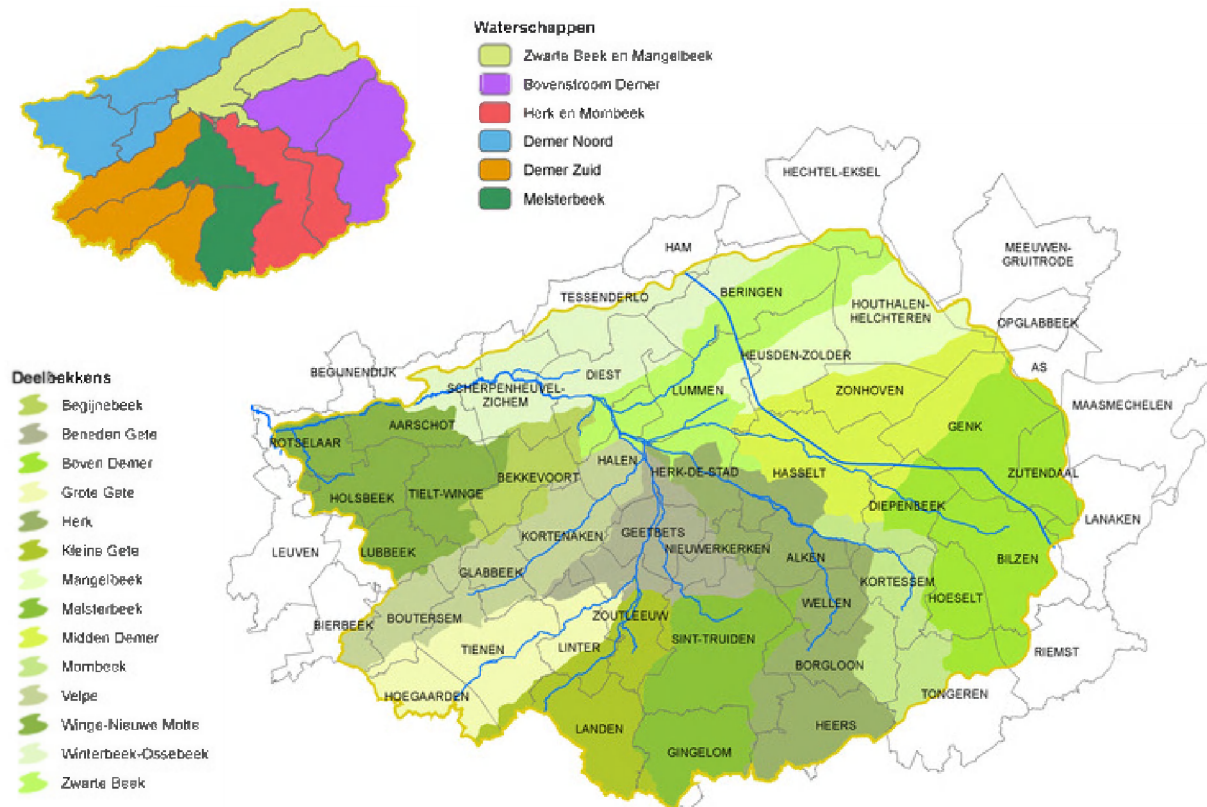


Figure 46: Sub-basins (deelbekkens) and water regulatory authorities (waterschappen) in the Demer basin (VMM, 2009)

The Decree also translates the special obligations for river districts from the EU Water Framework Directive. These obligations have been implemented in an order during 2010⁷.

Instruments

Instruments for an integrated water policy are also described in the Decree. Related to flooding, the 'Water test' (Watertoets) is one of the key instruments. In 2006 criteria were approved for the application of the 'Water test'.

It is a tool used to assess possible negative impact of proposed initiatives on surface water, groundwater and the aquatic ecosystem. This includes the assessment of possible increased flood risk. The implementing order⁸ gives guidelines for the application of the 'Water test' to local, provincial and regional governments involved in suspending permits for new projects.

⁷ Order of the Flemish Government of 21st May 2010 on special obligations for the International River Basin Districts in implementation of title I of the Decree on Integrated Water Policy of 18 July 2003

⁸ Order of the Flemish Government of 20th July 2006 (Besluit van de Vlaamse Regering van 20 juli 2006 tot vaststelling van nadere regels voor de toepassing van de watertoets, tot aanwijzing van de adviesinstantie en tot vaststelling van nadere regels voor de adviesprocedure bij de watertoets, vermeld in artikel 8 van het decreet van 18 juli 2003 betreffende het integraal waterbeleid)

Public and stakeholders' participation

The decree also describes how the population should have participation in the water policy. At the three coordination levels, stakeholders and the public are involved (Raymaekers, 2010).

Floods Directive (2007)

The European Floods Directive (FD) has been transposed to Flemish legislation more recently although some measures and instruments had already been integrated in the Flemish water policy over the last couple of years. The Flemish Government has chosen to integrate the Floods Directive into the existing Integrated Water Decree. The amended decree has been approved on July 16th, 2010. Flood risk management plans will be integrated into the river basin management plans.

Legislation disaster management

Crisis management: in phases

Emergencies are coordinated at the communal, provincial and federal governments, according to the Royal Decree of 16 February 2006⁹.

The level of crisis management (and planning) is delimited on the basis of criteria such as (www.crisis.ibz.be): facts, geographical extent, number of (potential) casualties, effects on the environment, economic impact, social impact, necessary means, the nature of the emergency (Seveso, nuclear terrorism, ...) and evolution of the event.

Since 2006, emergency planning, as well as managing an emergency, is divided into different levels marking the administrative authority responsible for crisis management (Table 16). In federal phase, three instruments are convened: an information cell, a policy cell and an evaluation cell.

Table 16: Disaster management levels

Level	Area	Coordination
Municipal	Municipalities / cities / villages	Mayor
	> 2 municipalities	
Provincial	Or	Governor
	Not enough means to cope with the risk	
Federal	Multiple provinces	Minister of Home Affairs
	National / Belgian territory	

⁹ Royal Decree of 16th February 2006 on emergency planning

Emergency and intervention planning and structure

In recent years, several changes were made in the organization of emergency planning. The implementation of the new Royal Decree of 16 February 2006, replaced old plans. These are the three types of new plans (Figure 26):

- General (ANIP) and specific (BNIP) Emergency and Intervention Plans
- Mono-disciplinary intervention plans
- Internal emergency plans

The highest level or the development of *NIPs (Emergency Intervention plans)* contains guidelines and necessary information to ensure proper management of every emergency situation. Procedures and methods within these plans are in principle the same as within mono-disciplinary intervention plans. A specific emergency intervention plan (BNIP) contains in addition to an ANIP (General emergency intervention plan) specific instructions and guidelines about a single subject (e.g. floods). For a good coordination, NIPs for the three different levels (Mayor, Governor and the Minister) have been drawn up:

- The governors of the provinces are responsible for approving the various municipal Emergency and Intervention Plans.
- The General Directorate of Civil Security is charged with the provincial plans in consultation with the Directorate General of the Crisis Centre.
- The Crisis Centre works - in consultation with the Civil Security - on the federal Emergency and Intervention Plans.

The next level or the *Mono-disciplinary intervention plans* regulates the intervention modalities of each of the disciplines in consistency with the NIP (Emergency Intervention Plan). The tasks of the different services are clearly delimited and classified within five functional disciplines (indicated within Figure 26).

The lowest level or *Internal emergency plans* are developed and set up at the level of specific firms or institutions. The plan contains e.g. organisational emergency measures in order to limit the possible harmful consequences of specific emergency situations within the firm or institution.

The coordination of the disaster management on the operational and policy level is given in Table 17.

Table 17: Coordination of the disaster management on the operational and policy level

Operational coordination	Operational command post (CP – OPS) Who: Director CP-OPS (lead) and Responsible person of each discipline
Policy coordination	Coordination committee (CC) Who: <ul style="list-style-type: none"> Mayor/Governor / Minister Emergency planning official Representatives of the disciplines involved Experts Representatives of services / organizations involved

Town and country planning

Since 1980, the competence of planning has gone to the regions. In 1997 the first Flemish Spatial Structure Plan (SSP) was produced. In Flanders, there are three planning levels: the regions, the provinces and the municipalities. The Decree on Town and Country Planning¹⁰ is based on the principle of subsidiarity. 'Areas prone to flooding are described in the decree as vulnerable spatial areas. Since 2003, the Flemish government can issue a bye-law prescribing urban development instructions for the protection against flooding because new projects in reserve areas for living (*woonuitbreidingsgebieden*) need to pass the 'Water test'. As from 1 November 2006, all permits need to pass the 'Water test'. There are 7 schemes to assess the decision-making (Table 18) in the 'Water test'. A tool on www.watertoets.be is set up for that. If the water test is positive according this tool, a permit can be given on condition that the decision is recorded in a 'water paragraph'. When the result of the tool is negative, advice must be obtained at the instances mentioned in Table 19. However, the advice is not binding.

Table 18: Seven assessment schemes 'water test' (RWO, 2007)

Nr	Situation	Assessment schemes
1	Dividing land into lots, establishing a building, with or without subterranean Construction, or laying surfacing.	<ul style="list-style-type: none"> • Change of flooding regime • Change of the amount of runoff • Change of infiltration to groundwater • Change of groundwater flow pattern
2	Storage of, dumping of unusual soil material or the change of vegetation	<ul style="list-style-type: none"> • Storage and dumping of unusual soil material • Change of vegetation
3	Change of relief	<ul style="list-style-type: none"> • Change of relief
4	The construction of buffering and infiltration systems to catch surface water or precipitation.	<ul style="list-style-type: none"> • Buffering and infiltration of surface water and precipitation
5	A discharge point on the sewer system, the surface water or groundwater	<ul style="list-style-type: none"> • Change of the amount of discharge points
6	An extraction of groundwater	<ul style="list-style-type: none"> • Change of the extraction of groundwater.
7	A change of the bed and structural quality of the water course	<ul style="list-style-type: none"> • Increase and renewal of bottlenecks of fish migration in the water course • Impediment to migration of fauna on the bank • Change of runoff in the water course

¹⁰ Decree of 16th July 2010 adjusting the Flemish codex on spatial planning of the 15th May 2009 and Decree of 10th March 2006 concerning decree amendments related to spatial planning and real estate

Table 19: Authorities for advice in the water test (RWO, 2011)

Advice from authority	Advice in case of:
VMM Department Water	<ul style="list-style-type: none"> • Harmful consequence for the condition of the groundwater; • In or in proximity of an unnavigable waterway of the 1st category; or the surface water in question is gathered in this waterway; • If the request of permit is originated with the province;
Province (service water management)	<ul style="list-style-type: none"> • In or in proximity of an unnavigable waterway of the 2nd category; or the surface water in question is gathered in this waterway; • If the request of permit is originated with the municipality or Marsh or Wetland;
Municipality (service water management)	<ul style="list-style-type: none"> • In or in proximity of an unnavigable waterway of the 3rd category; or the surface water in question is gathered in this waterway;
Marsh or Wetland	<ul style="list-style-type: none"> • In or in proximity of an unnavigable waterway of the 3rd category; or the surface water in question is gathered in this waterway in their working field;
Policy domain Mobility and Public Works (MOW or W&Z or Shipping Agency or Agency for Maritime Services and Coast)	<ul style="list-style-type: none"> • In or in proximity of a navigable waterway in their respective management areas; or the surface water in question is gathered in this waterway;
Coordination Commission for Integrated Water Policy (CIW)	<ul style="list-style-type: none"> • If the request for permit is originated from a commission on land consolidation described by article 25, § 2 in the law of 22 July 1970; • If the request for permit is originated from the VMM, MOW, W&Z, Shipping Agency, Agency for Maritime Services and Coast);

Insurances

Damage caused by floods is since 2005¹¹ covered by the fire insurance. The damage reimbursed by the insurance company depends on the arrangement between the insurance company and the insured person. However, there is also a 'Disaster Fund' which can be consulted in specific cases. The 'Disaster Fund', established in 1976, is a federal fund that covers material damage due to natural disasters.

Overview of agencies related to floods

The Flemish government is since 2006 organised in 13 policy domains. Each policy domain comprises a department and a number of (semi-) independent government agencies. The role of the department is the preparation of policy decisions while implementation is more the role of the agencies. The policy domains 'Mobility and Public Works', 'Environment, Nature and Energy' and 'Town and Country Planning, Housing Policy and Immovable Heritage' are the main ones related to floods. These are briefly discussed below. However, the policy domains 'Agriculture and Fisheries' and 'Economy, Science and Innovation' are also partly involved in the water policy, although not considered below.

¹¹ Royal Decree of 7th September 2005

As mentioned earlier, disaster management is a federal matter. The federal government is since 2000 organised in 14 Federal Public Services (formerly Ministries). The Federal Public Service 'Home Affairs' is related to floods and will also be discussed below.

Policy domain 'Mobility and Public Works'

In Flanders, waterways are classified into navigable and unnavigable waterways. This regional (Flemish) policy domain manages the navigable waterways. The organization chart of this policy domain is given in Figure 47. The department 'Mobility and Public Works' as well as the agency 'Waterways and Sea Canal' are mainly involved in flooding matters and are discussed below. The Agency for Maritime Services and Coast and the Shipping Agency are also partly involved.

Technical and management support services (Figure 47) in the Department is given by 'Flanders Hydraulics Research' (Figure 48). The group 'Water Management' examines the water levels of navigable rivers. The Hydrological Information Centre (HIC) carries out the operational activities of the group 'Water Management'.

The Agency 'Waterways and Sea Canal' (W&Z) consists of three coordinating divisions (grey in Figure 49) and three territorial divisions (yellow in Figure 49). The overall direction of the partnership is held by the delegated administrator.

Figure 50 gives an overview of the geographical division of the responsible water authorities for navigable waterways. In the Demer basin, the agency 'Waterways and Sea Canal' (W&Z) manages the Demer downstream of Diest till the mouth in the Dijle in Werchter. The Shipping Agency manages the 'Albertkanaal'.

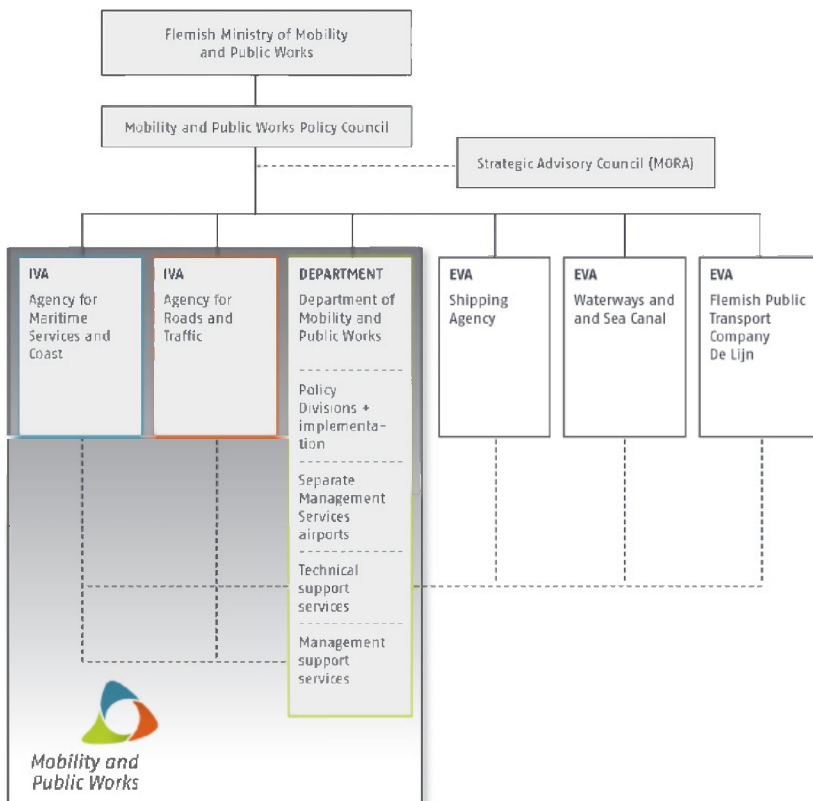
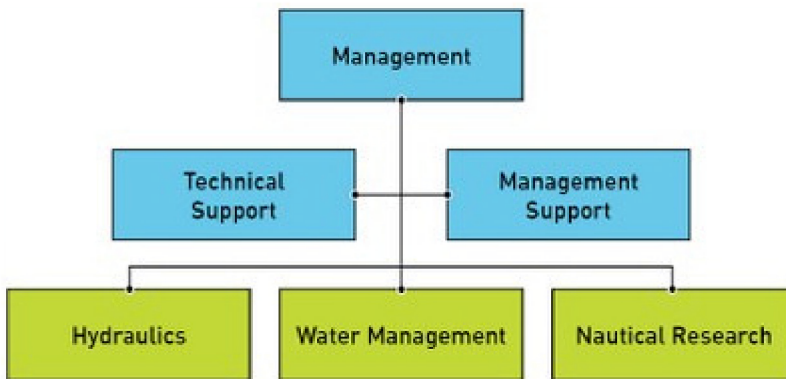


Figure 47: Organization chart of the policy domain 'Mobility and Public Works' (Source: www.wegenenverkeer.be, 2011)



HIC = Hydrological Information Centre

Figure 48: Organization chart of the Flanders Hydraulics Research (Source: translation of www.watlab.be, 2011)

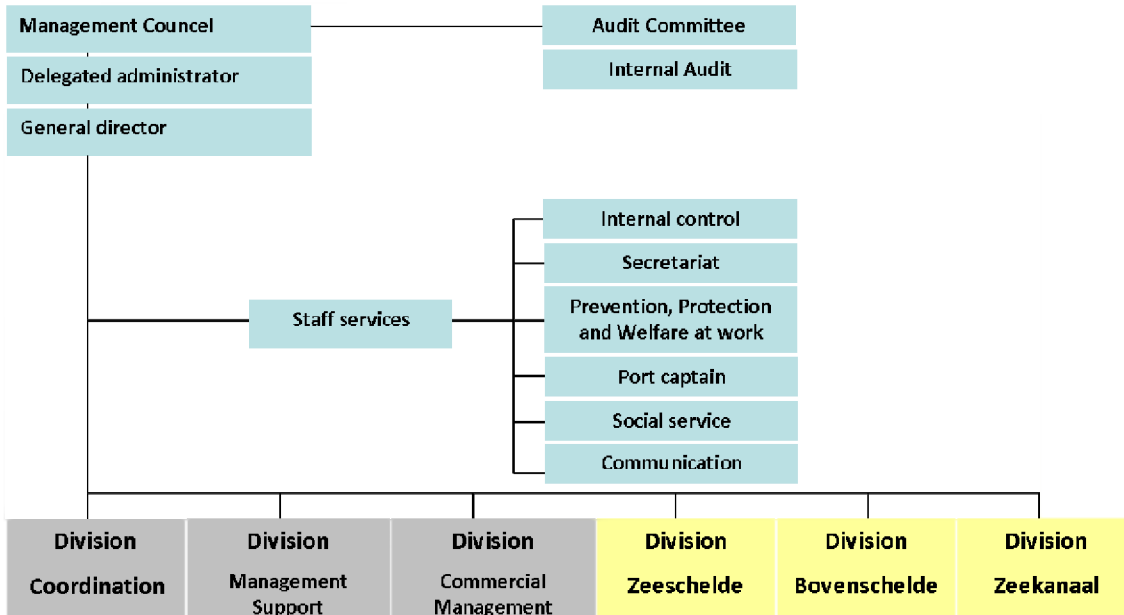


Figure 49: Organization chart of Waterways and Sea Canal (Source: www.wenz.be, 2011)

Waterways and Sea Channel

- Division Zeeschelde
- Division Bovenschelde
- Division Zeekanaal

Shipping Agency

- Shipping Agency

Agency for Maritime Services and Coast

- Division Maritime Services
- Division Coast



Figure 50: Geographical division of water authorities in the policy domain 'Mobility and Public Works' (Source: www.wenz.be, 2011)

Policy domain 'Environment, Nature and Energy'

The policy domain 'Mobility and Public Works' manages the navigable waterways. Within the unnavigable waterways, there are three categories of waterways. This regional policy domain 'Environment, Nature and Energy' manages the unnavigable waterways of first category. The unnavigable waterways of second category are managed by the provinces and the municipalities manage the waterways of third category. The department and (semi-) independent agencies of the policy domain 'Environment, Nature and Energy' are shown in Figure 51.

The "Flemish Environment Agency" (*VMM – Vlaamse Milieumaatschappij*), is the independent agency with power of jurisdiction under the responsibility of the Flemish Minister of Environment, Nature and Energy. The organization chart is given in Figure 52.

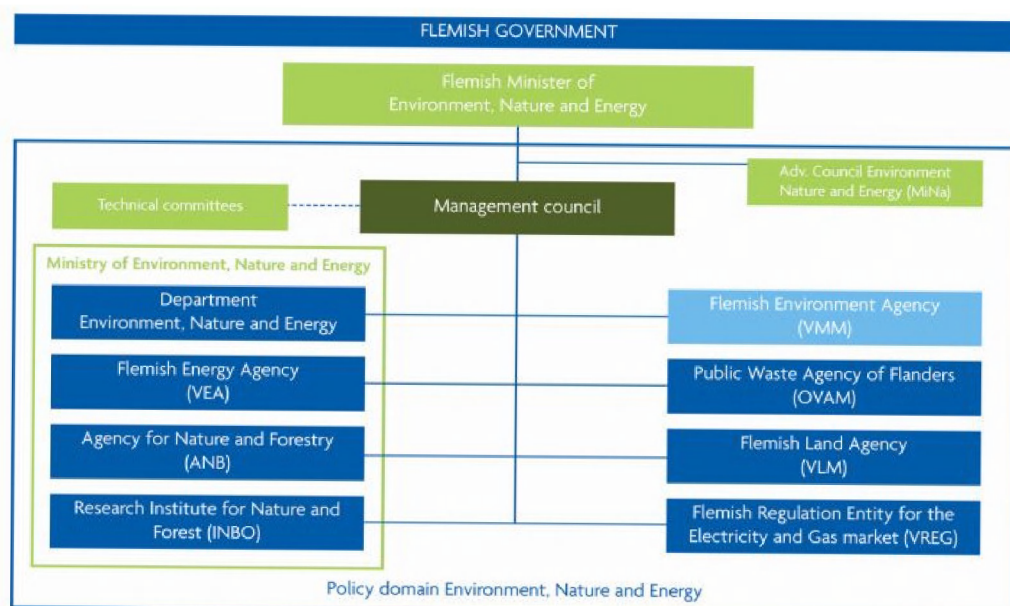


Figure 51: Organization chart of the policy domain 'Environment, Nature and Energy' (VMM, 2010)



Figure 52: Organization chart of the 'Flemish Environment Agency' (VMM, 2010)

Policy domain 'Town and Country Planning, Housing Policy and Immovable Heritage'

The organization chart of the (regional, Flemish) policy domain 'Town and Country Planning, Housing Policy and Immovable Heritage' is given in Figure 53.

The Department 'Town and Country Planning, Housing Policy and Immovable Heritage' (=RWO-department) (Figure 54); the Agency for the Inspection of Town and Country Planning and the Agency for 'Town and Country Planning and Immovable Heritage' are involved in flood management.

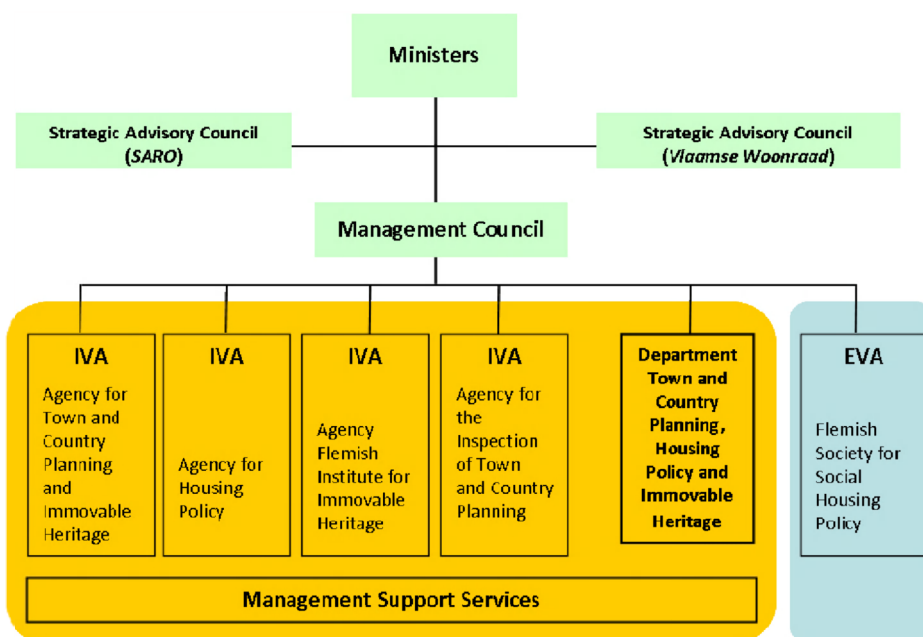


Figure 53: Organization chart policy domain ‘Town and Country Planning, Housing Policy and Immovable Heritage’ (Source: www.rwo.be, 2011)

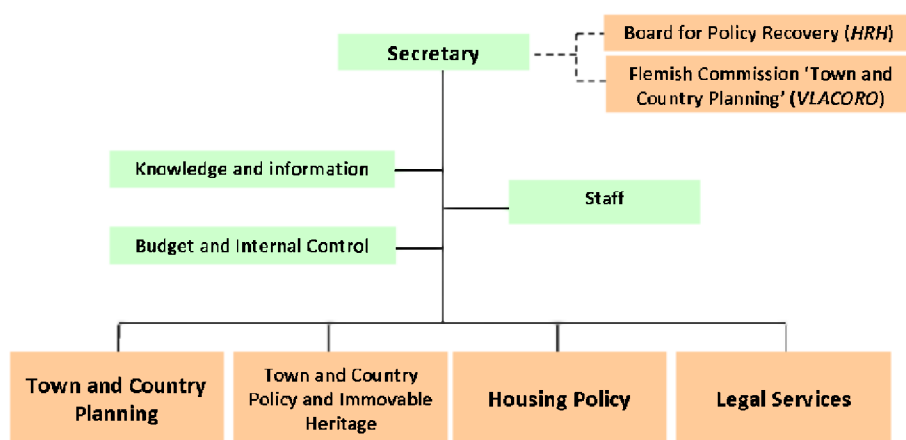


Figure 54: Organization chart department ‘Town and Country Planning, Housing Policy and Immovable Heritage’ (HRH = Hoge Raad voor Herstelbeleid, VLACORO = Vlaamse Commissie Ruimtelijke Ordening) (Source www.rwo.be, 2011)

Federal public service ‘Home Affairs’

The aim of the Home Affairs Federal Public Service (FPS) is, among other things, to prepare and implement the policies of the Federal Home Affairs Minister in the areas police & civil security and crisis management. The management of emergency planning and interventions is a responsibility shared by the General Directorate of Civil Security and the General Directorate of the Crisis Centre.

General directorate of civil security¹²

The General Directorate of Civil Security is responsible for the emergency services:

- directly for the Civil Protection
- indirectly for the fire brigade (Demer basin, Figure 55). The letters C, X, Y and Z indicate different types of fire brigades

The Directorate centralizes the following activities: purchase of equipment, telecommunication, regulations, advice and disputes, prevention, operational training, interventions and crisis management, inspection, international activities, recovery of damage and communication.

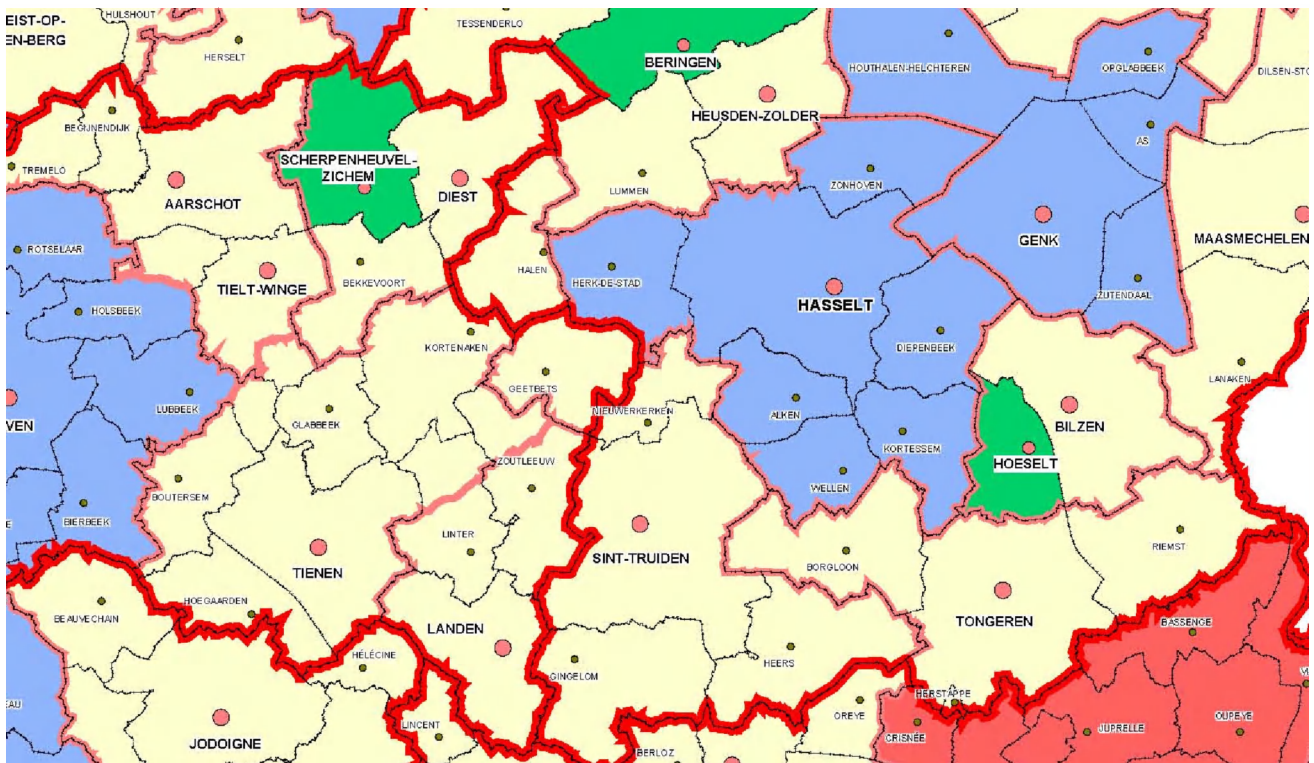
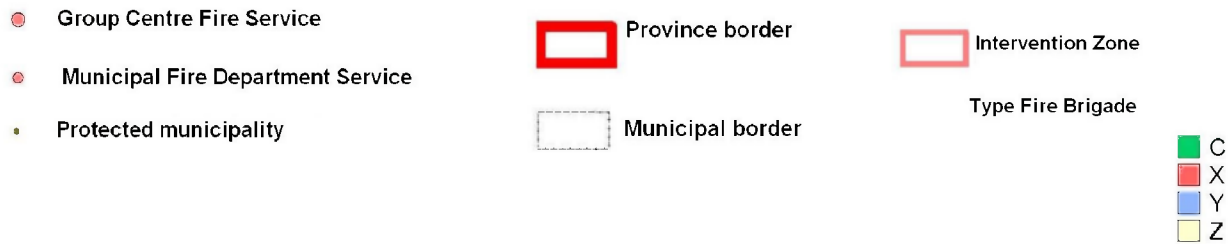


Figure 55: Fire Department Services and intervention zones in the Demer basin in Flanders (Source: www.civieleveiligheid.be, 2011)

¹² Based on www.civieleveiligheid.be, 2011

General directorate of the crisis centre¹³

Essential tasks of the Crisis Centre somehow related to flooding are:

- Active standby
- Organization of emergency planning
- Infrastructure for Crisis Management

The Crisis centre guarantees the coordination between the hydrological regional services (like HIC see Figure 48), responsible for monitoring the water levels, the meteorological services (Royal Meteorological Institute, Meteowing) and the emergency services to inform them in time (www.crisis.ibz.be).

B. Legal amendments

See chapter 5.4.3.2.

5.4.3.2 Policy responses

Between 11 and 14 November 2010, Belgium struggled with heavy rainfall but the rainfall amounts weren't that large (60-80 mm) that a flood was straightforward. However, water levels in many rivers and canals increased quickly above the alarm level. Many basins ran over and some embankments collapsed. Following the event, an investigation was done by the Flemish Parliament, consisting of a series of hearings. Quotes, questions, reactions and conclusions stated during these hearings are listed below.

5.4.3.2.1 Coordination Commission for Integrated Water policy (CIW)

Future improvements:

- The focus should be on retention of water, increasing the buffer capacity and water infiltration. Therefore extra storage capacity should be provided.
- There is a necessity for emergency measures due to the recent (November 2010) floods.
- A more efficient control of the infrastructure by automation and emergency pumps to pump flood water to the sea is required.
- It is not possible to protect against all floods, therefore prevention and preparedness is very important.
- Crisis communication should be done through one portal site and further research in flood prediction tools is required. The measuring systems should become more robust.
- There is a need for special flood emergency plans.
- Procedures should be shortened and simplified in order to allow a quick execution of investment and management programs.
- Inhabitants, interested in buying property in flood prone areas, should be informed properly.

The CIW concludes its contribution with a list of bottlenecks and opportunities:

- The water managers do not have the adequate amount of people to work on all the different actions.
- The existing law on unnavigable waterways is outdated and should be actualised.
- The implementation of the CIW - vision is hampered by a lack of money.
- The procedures to be followed are too complicated and too long (e.g. some procedures are ongoing for more than 8 years).
- The information flow should be optimised.
- The communication between the different actors needs to be improved (e.g. the Dender basin, the cooperation with Wallonia can be optimised).
- The integrated water policy can be improved by an increased cooperation among the involved parties.

¹³ Based on www.crisis.ibz.be, 2011

- A protocol should be set up and further optimised for mapping the most important flood areas (helicopter flights).
- The important partners off the integrated water policy are growing towards each other, but this work is still in progress.

5.4.3.2.2 Scientists (Flemish universities)

Catholic University of Leuven (KU Leuven): Prof. Dr. ir. J. Berlamont

Professor Berlamont mentions the following issues:

- An integrated policy is still missing in Belgium.
- Every municipality should have its own rainwater drainage plan.
- Different basins in one hydrographical system should ideally be coordinated by one institution.
- There should be less fragmentation of the authorities. Nowadays, local decisions (upstream) can result in a negative impact in other areas (downstream). Measures should be taken to prevent this in the future.
- Even small floods sometimes cause major damage due to ignoring the Water test (Watertoets).
- People/companies still settle in flood prone areas.

University of Ghent/Hasselt and Flanders Hydraulics Research: Prof. Dr. F. Mostaert

In contrast to Prof. Dr. ir. J. Berlamont, Professor Mostaert pointed out that fragmentation is inevitable because it is impossible to govern this complex situation by one entity. However, fragmentation only works when different authorities cooperate properly.

The way the (broad) public is informed should be optimized. Therefore, a general protocol could be created. Now, every institution uses its own specific way of communication. Therefore a portal website will be constructed.

University of Antwerp (UA): Prof. Dr. Patrick Meire

Professor Meire listed the following problems and opportunities:

- Considering water management, Flanders is not resilient.
- Spatial planning in Flanders disturbs the interaction between the river and the river valley. This results in flooding.
- An integrated approach is lacking.
- There is too much fragmentation. Due to this fragmentation contradictions and ambiguities exist within the legislation. Keeping only one authority, responsible for everything is also impossible.
- There is a need for a better cooperation.
- There are too many water authorities and sanitation might be necessary.
- The classification and management of the waterways is illogical. The UA suggests keeping three different levels: the provinces, the Flemish entity responsible for unnavigable waterways and the Flemish entity responsible for the navigable waterways.
- Data management is also very fragmented. Studies by the government are fractioned and professors do their research without coordination (there is cooperation) with the different laboratories. A consistent research program for water, including the effects of climate change, would be very important because there is not enough scientific substantiation.
- There is a decent legislation and good instruments, but there is room for improvement. There is also a lot of knowledge. Unifying this knowledge could create an economical importance for Flanders.
- Multidisciplinary thinking is not considered as important in the Flemish education. Water managers should be involved when a research program is set up.

- The Water test (Watertoets) should be binding, in order to prevent future construction in flood prone areas. According to UA, the best scenario would be the prohibition to build in flood prone areas.

5.4.3.2.3 Water managers

Waterways and Sea Canal and Shipping Agency

There is a quite good cooperation and communication between the water policy makers and water managers. However, this could be further optimised:

- A more effective water management is possible by introducing a new classification system for the unnavigable waterways. It should become possible to categorize waterways of the third category as second category when the municipalities ask for it. The basins of general interest should be categorized and maintained.
- There is a need for intelligent control, remote monitoring and automation.

There were some remarks after the presentation. Listed here are the two most important ones:

- It is argued that research is being carried out, but no further action is taken. Waterways and Sea Canal replies that these studies are required and that this institution takes a long term approach.
- It is mentioned that the basin management is under discussion. Waterways and Sea Canal responds that the two agencies work well together and exchange a lot of information. De Shipping Agency adds that there is a difference between unnavigable and navigable waterways. Separating the management responsibilities should not delimit the good cooperation and coordination.

The Flemish Environment Agency (VMM)

- Introduce a new classification system for the non-navigable waterways to ensure a more effective water management (e.g. a number of waterways of the first category should not be governed on a regional level). The basins of general interest should be categorized and also maintained.
- There is a need for intelligent control, remote monitoring and automation to ensure the optimal use of infrastructure
- Re-categorization would result in an effective water policy (avoid fragmentation).

Union of Flemish Provinces

They listed the following bottlenecks:

- The fragmentation of the Flemish water policy. It is of utmost importance to evolve towards an efficient water policy. The existing legislation divides the responsibilities (navigable and unnavigable waterways) over the Flemish Government with different services, 5 provincial administrations, 308 municipalities and 86 marshes and wetlands. Especially on local level it is very chaotic and complex. The water regulatory authorities (waterschappen) serve as a forum for local water policy but they do not rationalise the daily management. The same applies to the basin management level.
- The population also demands a very high, sometimes even unrealistic level of protection. There should be a discussion about the norm we want to achieve.
- The long administrative procedures, especially for the construction of flooding areas. This can take up to 10 years.
- The Water test (Watertoets) is a good instrument but the fragmentation of the authorities result in various interpretations that undermine its credibility and strength.

Therefore the union of Flemish provinces wants to give a more important task to the provinces. They propose to govern the waterways. The Flemish government would -in this case- manage the watercourses and the bigger waterways that are of structural importance for the supply and of those waterways that require complex water technical constructions. The Flemish government should also be responsible for

the centrally managed services such as the flood forecasting system. The provinces would then work together with the marshes and wetlands (public body in charge of protection against flooding), the latter often in need of money. The marshes and wetlands should get a function as implementing agent because of their terrain knowledge. Water discharge would then fall under the responsibility of the municipalities because they have the municipal water companies and inter communal organisations. This new approach will result in an increase of efficiency and will make the provinces politically responsible. This approach will also allow a more integrated vision on the management. The Flemish Environment Agency suggests to offer the municipalities the free choice of turning over the responsibilities to the provinces, but to achieve an integrated water policy it should be kept as transparent as possible. It is further advised to govern the water system (category two and three, as well as the major part of category one) by one authority.

Union of Flemish cities and municipalities

According to the union of Flemish cities and municipalities:

- The flood forecasting system from the Flemish Environment Agency works but can be optimised. There should be a separate data connection for those services that need to access it.
- Different forecast websites should be integrated.
- Flood contours should be listed in a more automatic way.
- Communication between the safety cells and the waterway, sewer and watercourse management can still be improved.
- Evaluation should take place by means of an area/territory based approach so that solutions can be translated into investment plans directly.
- Water retention is important.
- Local authorities should (also) be able to carry out investment projects in a faster way, without having to deal with new and more complicated procedures.
- The existing management procedures should be evaluated and the capacity of the advisory and licensing authorities expanded.
- Inhabitants, interested in buying property in flood prone areas, should be informed properly.
- Municipalities, with the agreement of another watercourse management, could do works on the latter's infrastructure.

Workgroup Water test (CIW)

In 2010 an evaluation took place and based on this, further improvements were made:

- The Water test (Watertoets) is useful but the advice is not always asked for. Therefore, in some cases, the advice will be mandatory.
- The quality of the advice provided can be improved as well.
- Embankments should be avoided so that the surface and volume available for water is maintained.
- Potential buyers should be informed about the flood risk.
- Property owners think that they have no responsibility concerning flood damage. This attitude should ideally change. Today, there already exist waterproof doors.
- Spatial implementation plans showing flood prone areas should be compiled. This implementation will happen in different steps but should preferably start on regional level.
- Some marshes and wetlands are too small to govern in a good way. They do not have the required men force at their disposal in order to make the right decisions.

5.4.3.2.4 Water cycle management

Flemish Environment Agency

The following issues are of importance:

- They ask for more buffering capacity and this should depend on the characteristics of the waterways.
- There should be a better enforce ability preservation of ditches and infiltration and the reuse of rainwater should further on be promoted.
- There is a growing awareness related to the importance of the quality of the sewer system and taking care/solving bottlenecks, but it is still too low.
- There is not enough money; the additional costs for projects carried out in 2010 are now paid for with the budget for 2011. Due to additional requirements such as the environmental impact analysis and buffering, projects cost more. Costs have almost doubled by prohibiting work from the waterside, so work can only be done from the street side.
- Managers sometimes oversize buffer areas. This results in too large investments.
- Water problems solved at local scale displace the problem further downstream. The awareness is insufficient.
- There is a long waiting list for the construction of separated sewer systems, but it should also be checked if the municipalities still want to implement their projects since improved understanding might have changed these original projects.
- There is not enough money, but the municipalities have forgotten that there is also a municipality fund that has funds for sewer system construction. It is also difficult to estimate the required funds because municipalities have the freedom to start the works when suits them best. Setting a due date could be a possible solution.

5.4.3.2.5 Risk management and insurance companies

Aon Belgium, COT Instituut voor Veiligheid- en crisismanagement (The Netherlands) and CEMAC (Belgium)

The key problems are:

- There is a need for better coordination and leadership when major floods take place. At the moment there are too many different authorities. E.g. in Civil Protection there is always a struggle for pumps due to shortage.
- There is a need to cooperate with public companies during emergencies. They also have a lot of equipment (e.g. pumps, cranes) that can be used.
- There is no experience with mass evacuation.
- Compared to neighbouring countries, Belgium has few experience considering emergency plans (e.g. floods, evacuation plans) Belgium. The same is true for education and training of the actors and citizens.
- It is a misconception that public services can solve everything. A good cooperation with the government is of utmost importance. Belgians often rely on insurance companies. However, damage could already be limited when citizens take precautionary measures themselves.
- New settlements influence and change the hydrology. Due to changing the original spatial planning more damage could be caused. The government should therefore make strategic choices to protect its citizens, companies and society. These strategic choices should be taken transboundary (between different regions etc.). Cooperation is therefore a necessity.

Flemish province governors

It is of utmost importance that there exists a good participation and solidarity among the different actors.

After the November 2010 floods an analysis was made:

- There is a necessity for a thorough emergency and evacuation plan.
- The emergency services should have a better insight in the watercourses, the fire department in specific.
- Maps should be improved.
- Good agreements for using the helicopter should be made.
- Consultation between emergency services, water managers and the water companies should be improved.
- There should be more awareness and self-help from the citizens. And the participation of volunteers should be better organised.
- Risk maps should be made.
- Overall management should be linked to basin management.
- Fragmentation of the management should be stopped and the management simplified.

When crises occur it is of major importance that crisis communication is well supported, preferably by one Flemish water knowledge centre. Besides they list the following:

- There is need for one single good flood forecasting system.
- There should be one Flemish representative between the flood forecasting system and the crisis committee and one contact point per water manager.
- An integrated approach is very important as it is more efficient, this can be realised by the use of strong basin managements. These basin management plans should be area based and should take into account spatial planning.
- The hydrographical borders should be followed instead of the administrative borders. Basin management and structures should therefore be strengthened. This management should take place on two levels: catchment area plans with specific basin management plans that are area based.
- Today there are multiple public inquiries. It would be good to reduce this to one public inquiry per catchment area.
- A strong involvement of the local authorities and actors is necessary.
- The basin and sub basin levels should be integrated.
- The decree integrated water policy should, step by step, be simplified, because a lot of the procedures reach too far.
- A clear distinction between the unnavigable and navigable waterways is advisable with one Flemish Agency for the navigable waterways.
- There is a synergy between the role of the governor in case of emergency and that of the president of the basin management.
- Management on a local scale is not efficient and therefore a provincial management would be better. There is also a significant relation between spatial planning and waterway management.

5.4.3.2.6 Conclusions hearing Flemish Parliament

The Flemish Parliament approved on the 8th of July, 2011 almost unanimously recommendations proposed in a resolution to prevent flooding.

In the resolution, a suggestion made is to avoid further hardening of the soil and therefore to allow maximum infiltration of water (principle of holding, storing and slowing down the runoff).

The resolution also called for additional requirements for building in flood prone areas (flood-resistant constructions) and pleads to tighten the Water test (Watertoets).

The resolution also states explicitly that Flanders needs to strengthen the legal instruments for water management. For instance, "the potential buyer of a property should be informed properly if the property is located in a flood-prone area, estate agents and real estate companies should be obliged to inform the buyers by adding a 'water paragraph' in the act of the real estate.

Amongst other things, it should be possible to exchange areas (from the planning point of view) that are not, or less suitable for building.

The CIW compiled a program of measures, including 6 themes. The list is added to this document (see Annex 2 and Annex 3).

5.4.4 Synthesis of the results for the Soverato/Vibo case study, Italy

5.4.4.1 Methodology applied

The flood risk institutional analysis conducted in the Italian case study consists of 1) analysis of the flood legislative framework, both national and regional, starting from 1989 (the Law 183/1989) which many consider the most comprehensive flood risk management framework in Italy, albeit not fully implemented in Calabria until after 2000 Soverato flood; 2) the transposition of the EU Floods Directive in Italy in 2010; 3) criminal trial and investigation into alleged manslaughter, environmental disaster, personal injury and other wrongdoing, triggered by the analysed flood events. The synthesis presented here is based on the analysis of the legislations and regulations; review of the testimonies, reports and the transcribed discussions of parliamentary commissions; review of the legal proceedings of the Soverato 2000 flood; and expert interviews.

Compared to the previous section (5.3.4) where we described the evolution and the current normative framework of the flood management plan, here we focus on the short description of the normative framework, and the roles and interactions between the various organisations foreseen by the law.

The section 5.4.4.2 discusses the transposition of the Floods Directive into Italian legislative framework. The next section, 5.4.4.3 sheds light on the current state and the evolution of flood risk institutions (legislations, regulations and organisations involved) and their interplay. The section 5.4.4.5 introduces the National Civil Protection Service (NCPS) in Italy. The section 5.4.4.5 provides a short synthesis of the trials triggered by the analysed floods and lessons learned from the cases. Finally, the section 5.4.4.6 offers the key conclusions for the flood risk governance in the Italian case study.

5.4.4.2 Transposition of the Floods Directive

The Floods Directive (2007/60/EC) on the assessment and management of flood risks was transposed through Legislative Decree 49/2010 of 23 February 2010 (Gazzetta Ufficiale No. 77, 2 April 2010).

The Decree adopts the definitions given in the Floods Directive, but includes the transported sediments and debris in the definition of flood and flood risk. The definition of the flood hazard, not given in the Floods Directive, is the "probability of occurrence of a flood within a specified time span and in a specific area".

The central tenet of this legislation is the preliminary flood risk assessment, which assesses potential risks, mainly based on available or readily derivable information, such as records and studies on long term developments, in particular impacts of climate change on the occurrence of floods, with special emphasis on flood hazard. On the basis of a preliminary flood risk assessment, RBD Authorities shall, for each River Basin District (RBD), or portion of an international RBD lying within their territory, identify those areas for which they conclude that potential significant flood risks exist or might be considered likely to occur in the future. In the case of international RBD, the Ministry for the Protection of the Environment, Land and Sea, in agreement with the relevant RBD Authorities, shall coordinate efforts with other Member States to identify the shared international areas for which potential flood risks exist.

By 22 June 2013 RBD Authorities have to prepare flood hazard maps and flood risk maps at the level of RBD and establish flood risk management plans coordinated at the level of RBD. Flood hazard maps shall cover the geographical areas which could be flooded with an indication of the areas where floods with a high content of transported sediments and debris can occur. On the basis of flood hazard maps and flood risk maps, each region coordinates with the other regions and with the *National Civil Protection Department* to establish *national, state and regional warning systems for flood hazard*, as part of the management plans for the relevant river basin and of civil protection operations especially aimed at flood control.

Flood-related administrative powers are exercised by RBD Authorities referred to in Art. 63 of Legislative Decree 152/2006, aka Environmental Act, without prejudice to the powers of the Ministry for the Protection of the Environment, Land and Sea. RBD Authorities shall carry out the preliminary flood risk assessment for their district by 22 September 2011. On the basis of a preliminary flood risk assessment, RBD Authorities shall, for each RBD, or portion of an international RBD lying within their territory, identify those areas for which they conclude that potential significant flood risks exist or might be considered likely to occur in the future.

For the RBD falling entirely within national territory, each administrative authority – according to its responsibilities – sets up either a unified management plan or a number of management plans coordinated at the level of RBD. For the RBD falling entirely within EU territory, each administrative authority – according to its responsibilities – shall set up either a unified international management plan or a number of management plans coordinated at the level of international RBD. In terms of engagement, RBD Authorities and the regions included in the river basin shall liaise among themselves and with the National Civil Protection Department – each one according to their responsibilities – to make available to the public the preliminary flood risk assessment, flood hazard maps, flood risk maps and flood risk management plans. The provisions in the third part of Legislative Decree 152/2006 (Environmental Act, Testo Unico) and the relevant legislation on civil protection, including the national warning system, shall remain in force.

5.4.4.3 Evolution of flood risk institutions

In Italy, prior to the entry into force of the Legislative Decree 49/2010, soil protection was regulated by Law 183/1989 and Decree 180/1989 which became Law 267/1998.

The Law 183/1989 had been the first attempt to codify the flood risk management, within an integrated river basin management approach. Following the advice of the De Marchi Commission, established in the aftermath of the Florence flood 1966, the Italian territory was split into river basins (RB) of national, inter-regional and regional importance; and RB authorities were established for each of them. Calabria RBA was instituted by Regional Law 35 of 29th Novembre 1996. The law 183/1989 compelled the production of a river basin (management) plans, a part of which was the flood risk management plan, the so called Piano Stralcio per Assetto Idrogeologico (PAI) (we have discussed the evolution of normative framework of these plans in the section 5.3.4.4). The successive reform through the law 152/1999 anticipated the provisions of the EU Water Framework Directive (WFD, Directive 2000/60).

The full transposition of the WFD had been done by the Legislative Decree 152/06 (TU Ambiente) which replaced previous existing water and soil laws. Article 67 of the aforementioned law makes provisions for the transitional plans for the protection against hydrogeological hazard and for protection measures in high-risk areas. The regulations aim to “guarantee soil and subsoil protection and remediation, hydrogeological remediation through deterioration prevention, safety measures in high-risk areas and actions against desertification”.

Said activities are carried out by the State, the Regioni, the autonomous Province of Trento and Bolzano, the Province, Town Councils, Comunità Montane (groupings of municipalities in mountain areas), and land reclamation and irrigation consortia. Art. 55 establishes the obligation for State administrative bodies, public bodies and institutions, to collect relevant data for soil protection and to make it available to the Regione with territorial responsibility for the area and to the Italian Geological Service – Department for Soil Protection of the Higher Institute for Environmental Protection and Research (ISPRA).

Town Councils, the Province, their consortia or associations, the Comunità Montane, land reclamation and irrigation consortia, mountain catchment area consortia and other public bodies headquartered in the RBD contribute to regional actions for soil protection in the ways and forms established by the Regioni, individually or in agreement with the other Regioni, according to the powers assigned to local autonomies. (Art. 62, Legislative Decree 152/2006)

In each RBD as defined in Art. 64, a RBD Authority is established. Basin Authority of Law 183/89 was abrogated by Legislative Decree 152/06 and then extended by Legislative Decree 284/06 till the institution of District Basin District Authority. RBD Authorities are to be established as non-budgetary public bodies acting in agreement with the objectives defined in this Section and following the principles of efficiency, efficacy, cost-effectiveness and transparency. At the moment, the RBDA have not yet been instituted.

RBD Authorities shall: a) design the District RBP; b) give an opinion on the compatibility of the objectives of the RBP with other EU, national, regional and local plans for soil and water protection, water resources management and against desertification; c) carry out an analysis of the characteristics of the district, a survey of the impact of human activities on the state of surface water and groundwater, as well as an economic assessment of water use. These data gathering activities shall be carried out following the technical specifications included in Part 3 of this Decree.

5.4.4.4 Civil protection

A legislative sector bearing close relevance to flood risk is that of civil protection activities. The legislation on civil protection is vast and particularly complex since it regards a variety of administrative sectors, that have different powers and functions in the forecasting, prevention, planning and management of emergencies.

The term 'civil protection' refers to all the organisations and activities set up by the State to safeguard the integrity of human lives, goods, settlements and the environment against the damage and hazards deriving from natural disasters and catastrophes. The first law introduced on these matters was Law 996/1970 providing "Norms on relief and assistance to calamity-stricken people". It contained general provisions for a single integrated body for civil protection, with no reference made to forecasting and prevention activities. Law 225/1992 regulates the National Civil Protection Service by drawing the following distinctions among events of different nature:

a) natural events or events associated with human activities, which can be dealt with by single relevant bodies or authorities following ordinary provisions; b) natural events or events associated with human activities which, by their very nature and extent, require coordinated action by multiple relevant bodies and authorities following ordinary provisions; c) natural disasters, catastrophes or other events which, by their very nature and extent, require the use of extraordinary means and powers.

Civil protection activities are defined as those activities aimed at forecasting and preventing different kinds of risk and rescuing disaster-stricken populations, as well as any other activity deemed necessary and undelayable to overcome the emergency resulting from the above events. The Civil Protection Department is a department of the Presidency of the Council of Ministers. It manages the National Civil Protection Service and, in the event of a disaster of national relevance, coordinates the response from the whole system. It advises on legislation on the prevention of risks and works on the drafting of exceptional and derogatory regulatory measures and orders needed to cope with disasters and minimise damage to people and property. It manages monitoring activities for the forecasting, prevention, assessment and mitigation of risks and defines system-level intervention procedures and actions. It supports national training activities. Finally, it promotes projects and activities that contribute to spreading the culture of civil protection by raising awareness among the public opinion and fostering the creation of associations working on these issues. The Department is divided into 9 offices and 42 services. The latest change to the internal organisation of the Department of Civil Protection was made with Prime Ministerial Decree of 31 July 2008, followed by Secretary General's Decree of 12 December 2008.

Further civil protection functions are performed by the Network of Functional Centres established by the 2004 Prime Ministerial Directive. The Network of Functional Centres was created to deal with hydrogeological and hydraulic risk as it emerges and evolves in emergency situations. The initiative arose in the aftermath of very serious disasters such as those occurred in Sarno in May 1998 and in Soverato in November 2000. It was funded as part of the financial provisions made for Law 267/1998 (Sarno Law) and

Law 365/2000 (Soverato Law), as well as from money collected from the 0.8% donations from personal income tax (IRPEF). The Network of Functional Centres is composed of the Regional Functional Centres, a Central Functional Centre managed by the National Civil Protection Department and by a number of Competent Centres for technical-scientific support. The network provides an ongoing monitoring service which is active every day of the year and, where needed, 24 hours a day, to assist civil protection operations and support decision-making processes by the authorities responsible for warning systems and emergency management.

Law 59/1997 of 15 March 1997 delegated important administrative functions and responsibilities about civil protection, previously held by the State, to the Regioni and local authorities. The Regioni shall contribute to the organisation and implementation of civil protection activities within the limits imposed by this law and the powers assigned to them or delegated to them by the State. Furthermore, they shall set up and implement regional forecast and prevention programmes in agreement with the provisions of national programmes. The Province shall contribute to the organisation and implementation of the activities of the National Civil Protection Service by guaranteeing the collection, gathering and processing of data that is relevant for civil protection activities, as well as setting up and implementing province-level forecast and prevention programmes in agreement with national and regional programmes. Further civil protection responsibilities are assigned to Prefects: on the basis of (among other things) the provincial forecast and prevention programme, Prefects shall set up and guide the implementation of an emergency management plan for the whole territory of the province. Each Town Council can establish its own civil protection body. The Mayor is the municipal authority for civil protection. When an emergency occurs within municipal territory, the Mayor shall direct and coordinate relief and assistance services in aid of disaster-stricken people and adopt the necessary measures, promptly informing the Prefect and the President of the Regional Council thereof. Where municipal means are not sufficient to adequately deal with a natural disaster or event, the Mayor shall request the intervention of other forces and bodies to the Prefect. The latter shall adopt the measures to which he is entitled in coordination with municipal civil protection bodies.

In accordance with Art. 12 of Law 225/1992 of 24 February 1992, the Regione Calabria shall set up and guarantee the implementation of civil protection activities, within the limits of their powers and those delegated to them, and in accordance with State legislation. Civil protection activities are set up in a way to safeguard the integrity of human lives, goods, settlements and the environment against the damage deriving from natural disasters and catastrophes.

The Regione shall carry out the coordinating functions of civil protection activities falling within their responsibility through the Regional Civil Protection Committee, the Technical and Scientific Civil Protection Committee, the Regional Emergency Operations Committee and the Regional and Provincial Operations Rooms. The regional civil protection premises shall host the "Regional Operations Room" where technical coordination and supervision activities are carried out as part of the Regione's civil protection responsibilities. The Operations Room is under the direction of the official responsible for Civil Protection and is active 24 hours a day. The regional civil protection premises shall host the "Provincial Operations Room" where news gathering, ordering, coordination, communication, supervision and monitoring activities are carried out as part of the Province's civil protection responsibilities. These Operations Rooms are decentralised in the areas of each Provincia and are hosted in the regional civil protection premises.

In accordance with national programmes, the Regione's civil protection functions regard the creation of forecast and prevention programmes and emergency plans (for the sectors lying under its responsibility), to allow prompt and efficient disaster response and contribute to Government-led rescuing operations. Regional forecast and prevention programmes and emergency plans are implemented through annual plans on a proposal from the regional civil protection bodies.

In terms of organisation of regional operations, the President of the Regional Council, or a delegate, is responsible for directing regional civil protection activities and for their coordination with the activities carried out by State, Province, and municipal authorities, as well as by the other civil protection bodies that are operative in the region.

5.4.4.5 Judicial review of the criminal liability

The trial in the aftermath of the Soverato 2000 flood provides important lessons learned. The events on which the legal case focused were described in the judgement of the Court of First Instance as follows: on the night of 9 September 2000 rain of unusual intensity and magnitude fell over Calabria's Ionian coast, causing flooding and very serious damage within the river Beltrame basin. A massive volume of overflowing water from the river flooded the "Le Giare" campsite, located on the bed of the stream and on public land, in the Turrati village of the Soverato municipality. As a result, 13 guests lost their lives.

Initially, eight people faced charges for their responsibility in the events and were prosecuted for multiple manslaughter and negligent disaster. Four were acquitted and four were found guilty in all three stages of appeal. The appeal courts reduced the sentences. Following probationary suspension of the sentences and pardon, none of the verdicts were executed.

The most important lessons learned from the case are 1) how the court of law interpreted uncertainty and (un)predictability of the extreme meteorological and hydrological events; and 2) how it was possible that the camping site was built with the consent of the responsible authorities in the most unlikely place, prone to high flood risk.

In the section 5.3.4 we have discussed the divergence of expert opinions with respect to the return period of the intense precipitation that triggered the flood and of the maximum discharge. Eventually, the court of law did not pay attention to the scientific uncertainty. The principle of precaution is applied in its most stringent interpretation by the law, which states that NO construction can take place on a river-bed since it is a HIGH-RISK AREA. "In legal terms an unforeseeable event is one that is not expected to ever occur". This was not the case in Soverato, where the high-risk nature of the area was clearly indicated in expert surveys carried out by the Court's advisors and would have been apparent even to the non-expert. In this specific case, prevention and precaution principles arise with the same strength with which the river reclaimed its natural space. They emerge clearly in the judgements of the Courts that assessed the responsibilities for the case, as well as in the legislation introduced following the events. They emerge strongly, but unfortunately only after the tragedy.

The legal proceeding shed light on the practice that has led to issuing the licence for public land use in flood prone area. Since the late 1980s when the licence was first requested and initially denied, the public authorities issued the permits to use the riverbed and certified the safety of the place during the summer months five times. Interesting to note is also the nature of the hydraulic permit approval (a sort of place safety certificate, HPA) and, in particular, its role for deciding whether or not to grant the public land use licence. The judges defined the HPA as "a technical opinion on the compatibility of land use with good water regime, which provides an assessment to safeguard specific public interests". It is therefore a proceeding aimed at authorising specific activities based on a discretionary (technical) assessment "of the damage that such activities could cause to public interest". The judgement of the Court of First Instance stated that HPA, if negative, have to be taken into account. Otherwise, a positive HPA does not imply that a public land use licence has to be released, and thus it is the discretion of the respective public authority whether or not to grant license.

The Vibo Valentia 2006 flood is equally interesting, albeit a full analysis of the legal proceeding has not been yet possible. Two criminal enquiries have investigated the Vibo Valentia events with a view to assess criminal responsibility. Following inquiries by the prosecution office (Procura), officials in the regional branch of the National Roads Authority (ANAS) and the Public Works Department of Calabria's Regional Government were officially declared under investigation at the beginning of 2008. In March 2008, Head of the Civil Protection Department (Protezione Civile, CP henceforth) Guido Bertolaso and director of the CP Emergency Management Office Marcello Fiori received a formal notification of investigation. In November 2008, notifying the conclusion of preliminary investigations, public prosecutor Francesco Rotondo requested and obtained the filing of the indictment for both Bertolaso and Fiori. A group of citizens – admitted as civil party by the Judge of the Preliminary Hearing – appealed against Bertolaso's acquittal to the Court of Cassation, but the acquittal became definitive in June 2009. The accusation against Bertolaso refers to the failure to issue the notification of adverse weather conditions on the day before the floods. A notification of investigation was later issued to Bernardo De Bernardinis, CP official in charge of the coordination of rescue operations in the initial stages of the emergency at Bivona, the coastal resort which was most seriously damaged by the mud and water that affected the Vibo Valentia district on 3 July 2006. On 4 May 2009, the Vibo Valentia Prosecution Office indicted 11 people for

charges connected to the floods that took the lives of 3 people and devastated the Vibo Valentia coasts on 3 July 2006. Charges included personal injury, manslaughter, flood and environmental disaster. All defendants were cleared on 6 July 2009. The first inquiry concluded at the preliminary hearing with the acquittal of all the defendants. On 6 July 2009, Judge of the Preliminary Hearing Giancarlo Bianchi ruled the discontinuance of proceedings for all 11 indicted people, for “not having participated in the criminal acts”, although the Prosecution Office had ordered their indictment for environmental disaster, personal injury, and multiple manslaughter. The “criminal act” had been committed but not by the CP, Calabria’s Regional Government and ANAS officials. The Judge of the Preliminary Hearing deliberated that the evidence against the defendants was not sufficient to proceed to the adversarial stage and, thus, closed the controversial enquiry which had been initiated by Chief Prosecutor Alfredo Laudonio and continued, after his removal from office, under Deputy Prosecutor Francesco Rotondo.

At the same time that the first enquiry was closed, a second line of enquiry was initiated, named “Alluvione bis” (“Flood II”). The enquiry aims to ascertain the conditions – and individuals – that produced or exacerbated the disastrous effects of the flood, which persist to this day. The main factor identified is the extensive residential use of agricultural land, carried out outside public control, without preliminary urban planning and appropriate urban development works, such as (in particular) a public sewage collection system and storm water canals.

On 20 July 2010 the Vibo Valentia Prosecution Office has notified the conclusion of preliminary investigations to 30 people, who face charges of manslaughter, negligent disaster and crime of omission in connection with the consequences of the floods. The notification, signed by Chief Prosecutor Mario Spagnuolo, regarded – among others – two former Mayors of Vibo Valentia, the former President of the Province and former Presidents of the Consortium for Industrial Development (Consorzio Industriale). The judicial proceedings are linked to the “Golden House” enquiry, which led to the seizure of a remarkable number of houses and buildings in the flooded area in February 2009. Aim of the enquiry is to establish the responsibility for the deaths caused by the floods and for the overflows that devastated the area.

5.4.4.6 Conclusions from the Italian case study

The flood risk management legislation in Italy is dominated by legislative acts adopted in the aftermaths of the major flood disaster events, including the Soverato 2000 flood. On the one side this is helpful because it demonstrates that lessons learned from past events are taken up in the legislative review. On the other hand, and as a result, the normative framework is punctuated with ad-hoc and insufficiently coordinated pieces of legislations.

Systematic resorting to the application of the ‘ordinance’ of the Civil Protection as a normative response to disasters creates a situation of a protracted ‘state of emergency’ as follows: in the aftermath of a natural disaster the declaration of emergency clears the way for emergency decrees and ad-hoc legislative activities. A subsequent disaster event stretches out the existing state of emergency or prompts a declaration of a new one, further legitimising the excessive use of emergency decrees.

The above escalation is produced by the lack of comprehensive and consistent policy of disaster risk prevention and thus over-reliance on response interventions to ongoing emergencies. This comes into view also from the chronological review of the flood risk and civil protection legislative frameworks: whereas the disaster response legislation is copious and internally consistent, the normative frameworks of risk prevention and protection in the field of integrated water resource management and territorial development are fragmented and of limited scope. In other words, there is a tendency to respond to disasters only after these occurred, rather than putting major efforts into stopping them from happening.

The Law-Decree that transposes the Floods Directive literally translates the key concepts, without adapting them to the specific context in which these are to operate.

5.4.5 Summary and conclusions

The 2007/60/EC Directive on the Assessment and Management of Flood Risks (Floods Directive) and the European Council's Decision 2007/779/EC, Euratom on 8 November 2007 are two complementary pieces of legislation lay down a framework for flood risk management in Europe. Considering the disaster risk management cycle introduced in EC (2004), the Floods Directive focuses primarily on *prevention*, *protection* and *preparedness*, whereas the CCPM addresses issues relevant for *preparedness*, *response* and to some *extent* recovery. Prevention includes non-structural activities reducing the flood impacts such as restricting the development of flood plains; risk-proofing of buildings and infrastructure; and flood-sensitive land use, agricultural and forestry management practices. Protection addresses both structural and non-structural measures reducing the likelihood and/or impacts of flood such as flood defenses work, temporary flood storage areas etc. Preparedness includes recognition of the imminent danger (i.e. early warning system) and communication of risk. Response entails all emergency activities aimed at protecting human life, property, environment, and cultural heritage. Recovery and review (lessons learned) address activities in the aftermath of the emergency helping to restore normal/ordinary conditions and to help to bear the inflicted hardship.

Floods Directive and civil protection organisation in Germany

In Germany, the federal institutions establish the legislative framework for the implementation of the Floods Directive and the Water Framework Directive. The Floods Directive was implemented the 1st of March 2010 by the amended water law, the Federal Water Act of 1st July 2009.

The states (Laender) are responsible for flood prevention, flood defence and flood protection. The Laender are the legislative and regulation authority, execution authority and financing authority. The instruments for implementing the federal laws are state planning, spatial planning and civil protection. Civil protection is prescribed by the German Constitution¹⁴. The federal minister of the interior executes civil protection by delegating to the districts and municipalities.

Districts and municipalities are responsible for the planning and implementation of flood protection and flood prevention on a regional and local level. Other relevant authorities are: the Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency (NLWKN), the Weser River Basin Authority, the Lower Water Authority and the Flood Forecasting Centre.

Civil protection in Germany is carried out at each administrative level according to the tasks laid down in the respective laws. Germany has different authorities according to their legally stipulated competences: the Federal Ministry of the Interior (Bundesministerium des Innern). The Federal Ministry of the Interior is assisted by the following authorities according to their legal basis: the Federal Office of Civil Protection and Disaster Assistance (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe), The Federal Agency for Technical Relief (Bundesanstalt Technisches Hilfswerk) sixteen Ministries of the Interior of the states, Administrative districts (where applicable), Counties and county boroughs and Municipalities. All civil protection authorities contribute in the form of planning, administration and material resources to the prevention of disaster management during the emergencies. An inter-ministerial coordination group may be set up within the federal Ministry of the Interior when the catastrophe exceeds the ability of a "Land" to cope with it or has spread beyond its territorial boundaries. Without changing the laws concerning the traditional allocation of competency, the federal government increased its coordination of services with the states by setting up a new Federal Office of Civil Protection and Disaster Assistance (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe) in May 2004. The competences and tasks at federal level have thus been revised and laid down in the 2009 German Civil Protection and Disaster Assistance Act.

¹⁴ From Germany's 1949 Constitution (Grundgesetz) follows that protection of the population in peacetime is the responsibility of the 16 constituent states.

Floods Directive and civil protection organisation in Belgium

The Flemish Government has chosen to integrate the Floods Directive into the existing Integrated Water Decree. The amended decree has been approved on July 16th, 2010. Making use of the given discretion, preliminary flood risk assessment has been skipped. The Flemish Government decided the existing tools and knowledge is sufficient to move on to the next step that refers to the development of flood hazard and risk maps, and later on to the development of flood risk management plans. The latter will be fully integrated into the river basin management plans compelled by the Water Framework Directive.

Disaster emergencies are coordinated at the communal, provincial and federal governments, according to the Royal Decree of 16 February 2006. The level of crisis management (and planning) is delimited on the basis of geographical extent; population exposed; environmental, economic and social impacts; available resources; type of emergency and its evolution.

The vertical disaggregation of the crisis management includes at municipal level the mayor; at provincial level the provincial governor, and at federal state level the Minister of Home Affairs. All levels are responsible for emergency planning in their respective territories. At the federal level three instruments are convened: an information cell, a policy cell and an evaluation cell. The competent authority for national coordination is the General Directorate of the Crisis Centre and the General Directorate of Civil Security.

The fire brigade is the first one at the spot in case of accident, fire or disaster. It is organized at the municipal level and is also concerned with prevention. Belgium currently has 251 fire departments of which 165 are located in the Flemish Region. The tasks of the fire brigade are set in the Royal Decree of April 7, 2003. Their assignments are very diverse; beyond fire fight they include a wide range of emergency interventions. In case of flooding, the fire brigade pumps away water. The fire brigade is also responsible for the construction of dikes and disaster assistance to the population.

The Civil Protection only intervenes at the request of the fire brigade and the government (when interventions need heavy equipment and/or specialized skills). Civil protection services are also a federal service and consist of six operational units. Their main task is to strengthen the fire brigade, provide technical assistance, pollution control, flood assistance, telecommunication and coordination, preventive tasks, alerting the population, logistical support, international assignments and water distribution. During major floods, the Civil Protection is equipped to pump away quickly large amounts of water. They also build dikes, distribute food and evacuate the population if necessary.

The Permanency and the Public Order are the major structures in the Crisis Centre. Essential tasks of the Crisis Centre somehow related to flooding (are): i) active standby; ii) organization of emergency planning; iii) infrastructure for Crisis Management. The crisis centre guarantees the coordination between the hydrological regional services (like HIC), responsible for monitoring the water levels, the meteorological services (Royal Meteorological Institute, Meteowing) and the emergency services to inform them in time.

Floods Directive and civil protection organisation in Italy

Directive 2007/60/EC on the assessment and management of flood risks was implemented in Italy through Legislative Decree 49/2010 of 23 February, that is a different piece of legislation (i.e. TU 152/2006) that transposes the provisions of the EU Water Framework Directive (WFD). The activities compelled by both directives are however closely coordinated. In the case of international RBD, the Ministry for the Protection of the Environment, Land and Sea, in agreement with the relevant RBD Authorities, coordinates efforts with other Member States to identify the shared international areas for which potential flood risks exist. By 22 June 2013 RBD Authorities shall prepare flood hazard maps and flood risk maps at the level of RBD and establish flood risk management plans coordinated at the level of RBD. On the basis of flood hazard maps and flood risk maps, each region coordinates with the other regions and with the National Civil Protection Department to establish national, state and regional warning systems for flood hazard, as part of the management plans for the relevant river basin and of civil protection operations especially aimed at flood control. In terms of engagement, RBD Authorities and the regions included in the river basin shall liaise among themselves and with the National Civil Protection Department – each one according to their responsibilities – to make available to the public the preliminary flood risk assessment, flood hazard maps, flood risk maps and flood risk management plans.

Law 225/1992 regulates the National Civil Protection Service. Civil protection activities are defined as those activities aimed at forecasting and preventing different kinds of risk and rescuing disaster-stricken populations, as well as any other activity deemed necessary and undelayable to overcome the emergency resulting from the above events. The Civil Protection Department is a department of the Presidency of the Council of Ministers. It manages the National Civil Protection Service and, in the event of a disaster of national relevance, coordinates the response from the whole system. It advises on legislation on the prevention of risks and works on the drafting of exceptional and derogatory regulatory measures and orders needed to cope with disasters and minimise damage to people and property. It manages monitoring activities for the forecasting, prevention, assessment and mitigation of risks and defines system-level intervention procedures and actions. It supports national training activities. Finally, it promotes projects and activities that contribute to spreading the culture of civil protection by raising awareness among the public opinion and fostering the creation of associations working on these issues. The Department is divided into 9 offices and 42 services. Further civil protection functions are performed by the Network of Functional Centres established by the 2004 Prime Ministerial Directive¹⁵. The Network of Functional Centres was created to deal with hydrogeological and hydraulic risk as it emerges and evolves in emergency situations. The initiative arose in the aftermath of very serious disasters such as those occurred in Sarno in May 1998 and in Soverato in November 2000. It was funded as part of the financial provisions made for Law 267/1998 (Sarno Law) and Law 365/2000 (Soverato Law), as well as from money collected from the 0.8% donations from personal income tax (IRPEF). The Network of Functional Centres is composed of the Regional Functional Centres, a Central Functional Centre managed by the National Civil Protection Department and by a number of Competent Centres for technical-scientific support.

Final considerations

To be effective, the flood risk management has to ensure that the provisions of Floods Directive (and the legislation which transpose it into Member State's normative framework) and Civil Protection Mechanism are closely integrated, both horizontally - and vertically. In 2011, the European Council recognised 'the need for Member States and the EU to take an integrated approach to flood management, building upon existing Member State and EU legislation and policies, with special attention paid to the Floods Directive, encompassing the entire disaster management cycle (prevention, preparedness, response and recovery) (European Council 2011).

These two complementary pieces of legislation lay down a framework for flood risk management in Europe. Considering the disaster risk management cycle introduced in EC (2004), the Floods Directive focuses primarily on *prevention*, *protection* and *preparedness*, whereas the CCPM addresses issues relevant for *preparedness*, *response* and to some extent *recovery*. Prevention includes non-structural activities reducing the flood impacts such as restricting the development of flood plains; risk-proofing of buildings and infrastructure; and flood-sensitive land use, agricultural and forestry management practices. Protection addresses both structural and non-structural measures reducing the likelihood and/or impacts of flood such as flood defenses work, temporary flood storage areas etc. Preparedness includes recognition of the imminent danger (i.e. early warning system) and communication of risk. Response entails all emergency activities aimed at protecting human life, property, environment, and cultural heritage. Recovery and review (lessons learned) address activities in the aftermath of the emergency helping to restore normal/ordinary conditions and to help to bear the inflicted hardship.

The study of the process of implementation and enforcement of Floods Directive in Italy, Germany and the Flanders reveals how difficult it is to balance the different stages of disaster risk management. First, there are no established best practices which limits the competences of one branch with respect to the other. The various involved subjects are strictly and constantly connected only when a catastrophe occurs, based on procedures defined for the case of emergency. But the analysis can't detect any strong and integrated model of communication which realizes a fusion among ordinary/general and extraordinary/sectoral institutions in a clear and coherent model of partnership. The Floods Directive (art. 3-a) invites Member State to "appoint competent authorities which may be different from those identified pursuant to Article

3(2) of Directive 2000/60/EC” and promotes the collaboration among all the parts but doesn’t specify anything about an integrated and uniform code or procedure to join permanently all the authorities. Second, there is scope for harmonising the criminal and civil liabilities for the flood related consequences. As the Italian case shows, the Civil Protection (CP) might be (often is) held liable for the failure to alert upcoming extreme meteorological or hydrological event. Whereas the extraordinary power vested in the Civil Protection Agencies in times of emergency warrants a close review and public control, a practice of identifying a scapegoat does not help to effectively mitigate the disasters.

5.5 Guidelines and dissemination (WP 5)

5.5.1 What is resilience

Throughout this report the resilience concept is defined as: “the ability to cope and respond before, during and after a hazard occurs. Resilience is about returning to the original state or beyond”. Resilience is thus viewed as an ongoing dynamic process, which will not only return to its original equilibrium state, but will gradually increase and bring its equilibrium to a higher level. More details on the definition and literature review has been provided in 5.1.1.

More than anything else, resilience is knowledge. A proficient understanding of the disaster risk, its driving forces and impacts. Knowing how to prepare, respond and recover from disaster strikes. More than that, resilience is a capacity to deploy that knowledge. To help oneself to get back to their feet after having sustained a blow. To learn how to. Paraphrasing Reinhold Niebuhr’s poignant message, resilience is a wisdom of knowing how to put a stop to natural hazards turning into devastating disasters, and a wisdom of enduring risks that cannot be avoided.

Resilience has many forms and manifestations. People convalescing after having lost what was dear to them. Communities recovering from shattering blows. Economies getting back on track after having sustained major shocks and losses. However, resilience has also negative connotation: the persistent overlooking of the threat and perceived powerlessness of individuals, in front of unacquainted community or nonsensical institutions, to make any difference.

5.5.1.1 Building blocks of resilience from a case study perspective

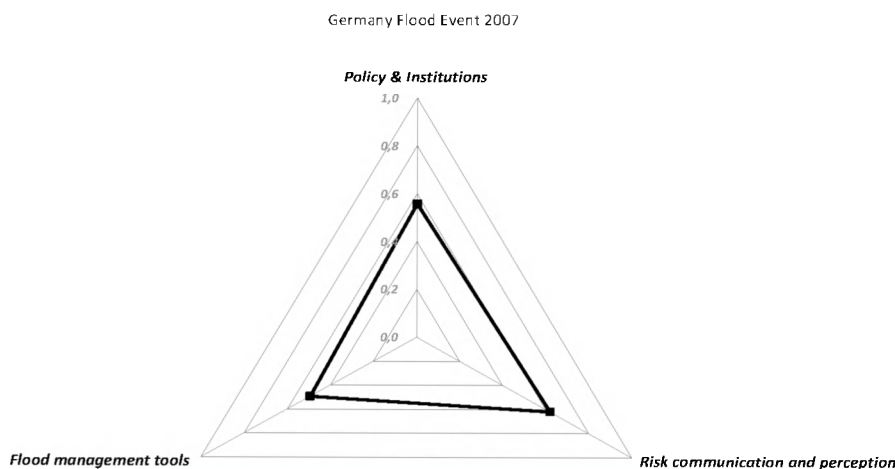
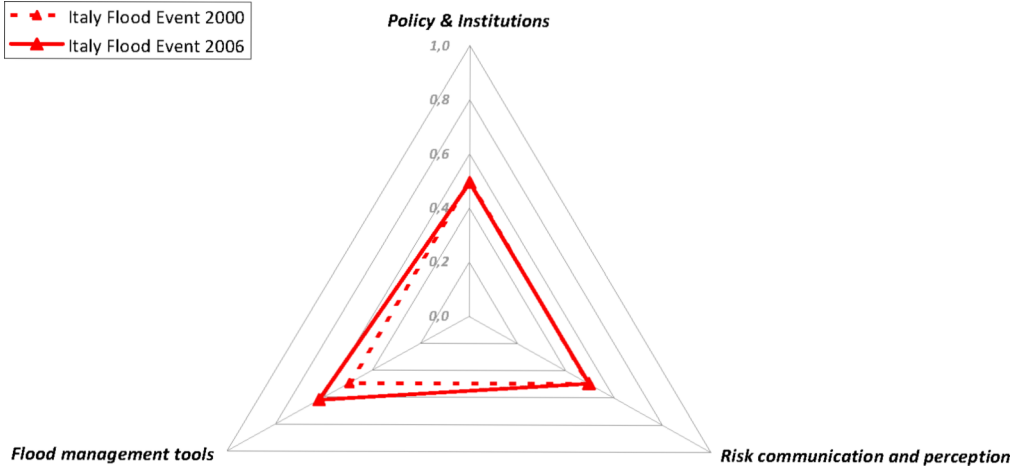
Throughout the project, three dimensions of resilience were addressed. When referring to the various subsystems or sectors (economic, ecological, social) the term resilience receives even more definitions mostly in relationship to the hallmarks, indicators, (normative) values and objectives of these subsystems including its actors. This, however, might be incomplete when examining a system that includes several of these sectors or subsystems. In other words, if a flood-prone community is the research object, just one sector or subsystem can only insufficiently represent all relevant (flood) resilience aspects of the entire system. If a flood-prone community is a system consisting of an agglomeration of social entities: connected in social networks, economically active, reside on physical environment, comply (or not) with rules that is based on a multi- facet institutional structure, than a resilience approach via one of the sectors is most likely insufficient. Moreover, a characterisation of such a system using one of the sectors and proposing measures to strengthen its resilience would remain incomplete.

Table 20: Resilience dimensions & main indicators considered within the project

Resilience Dimensions	Main indicators
Policy & Institutions	Horizontal integration Vertical integration Review and adaptation
Risk communication and perception	Communication of risk Communication during events Awareness of risk amongst residents Preparedness of residents
Flood modelling tools	Flood management plans Flood modelling tools

The selected dimensions are expected to cover the most relevant issues of (flood) resilience from preparation to coping to mitigation. Moreover, these main dimensions are divided in indicators that address aspects from all relevant sectors. In addition, all three dimensions including the indicators may be similarly applied to all three case studies, and based upon empirical evidence, a comparison is possible (see Figure 56).

- - - Italy Flood Event 2000
- - - Italy Flood Event 2006



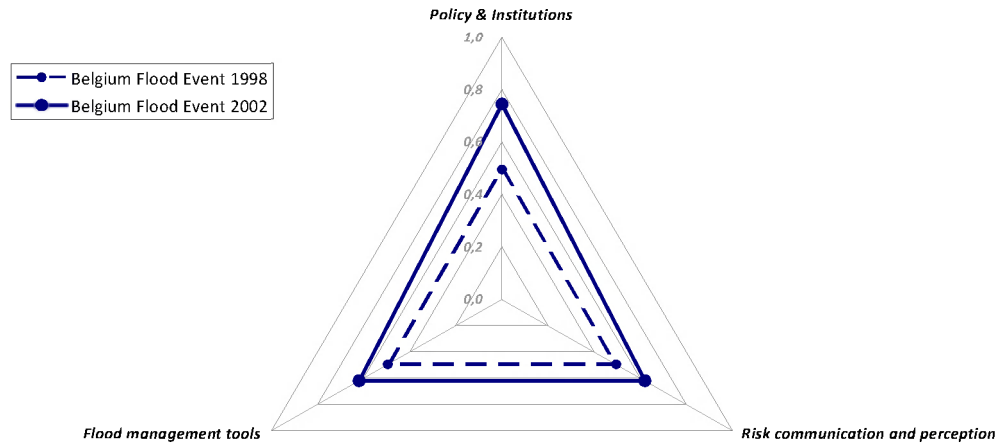


Figure 56: Resilience indicators - comparison of the overall results from the case study areas

Based upon the agreement that both the main dimensions as well as the indicators are employed to all three case studies in order to analyse their performance, it does not matter how much these case studies differ in institutional structure, flood management type or means of communication and participation. Indicators can only be judged to be more or less effective and functioning. The synopsis of indicators in components provides the research team with a general view of resilience as displayed in Figure 56. In Figure 56 we show how a comparison between the different case studies can be presented. For the Belgium and Italian case study the differences and improvements between two moments can be deduced. In case of the Belgium case study, the first Early warning system for the Demer Basin was implemented in 2003 and subsequently improved until 2009.

The ultimate causes for a particular level of performance, however, may then be reasoned by analysing specific indicators. This way the case studies remain comparable, and moreover, transboundary learning processes receive a solid basis with specifications that enable flood managers to improve specific aspects of their system. This approach with its underlying component/indicator analysis gives way for an efficient learning, reviewing and (if necessary) upgrading process. Moreover, experiences from other case studies can efficiently be analysed and transferred from one case study to the other.

Flood modelling tools

A prominent example is one of the Belgian flood monitoring and forecasting systems: "www.overstromingsvoorspeller.be" which is a growing system in terms of its capability and performance. Whereas in 1998 residents had to be warned by means of messages or speaker phones, police and fire men, during the next flood water levels, flow rates and spatial relationships of water levels were displayed, and easily accessible for experts as well as the public. However, at that stage of software development no clear guidelines of what to do in the case of floods were available for users. This feature is currently under development. This monitoring and forecasting online tool was originally developed for water managers and related experts, and has made a transition to an easily accessible tool for both experts and lay people. The web-based approach demonstrates how monitoring for experts as well as for residents can be combined with an EWS in one software package.

The German case study can learn from this example twofold: a precise and instant monitoring system might be available with little effort and relatively low costs. This system can be used as monitoring tool and EWS for both the crisis managers as well as the (potentially) affected people. The easy-to-use interface does not require special capacity building, which is another cost-saving factor. At the long term the foundation of an flood forecasting centre can improve monitoring and early warning. However, an easy to use, and up to date information site is still required. The next flood does not wait for the finalisation of the flood forecasting centre as the high water levels in August 2010 indicated. When comparing the general ratings of both case studies (Figure 56), the Belgian case study scores much better in the flood

management tools component. Zooming down to the specific indicators both case studies score not very high: 0.38 for the Innerste and 0.24 for the Demer on the question whether or not residents know early warning systems. The low score for the Belgian case study is based upon the flood of 1998, when the website 'overstromingsvoorspeller' was not installed (see also 5.2 and 5.3).

Risk communication and perception

Another example is the 'value' of social capital, and thus the performance of informal networks. In the Innerste questionnaire people rated that indicator relatively high (0.73) whereas most respondents in the Demer case study did not answer this question. The relevance of informal networks in a flood-prone community was demonstrated in the case of the 2007 flood in the municipality of Holle: Due to the high connectivity and effectiveness of social networks in Holle significantly higher damage was averted. Residents took own initiative before the official crisis management was activated. In fact for the municipality of Holle the informal networks appeared to be the determinant factor in the limitation of damage. When referring back to the categorisation of resilience the 'informal' institutions together with an effective internal communication (parts of two building blocks) resulted in a high social but also economic resilience. The latter could be easily quantified in a scenario of what would have happened in terms of damage if the residents would not have stacked their sand bags in a self-organised way.

However, not only the high social capital helped the citizens of Holle to prevent higher damage, but also a prevailing scepticism towards the higher scale (district, federal state) institutions. The German respondents give only rates of 0.15 for the performance of the external crisis management. Residents of the Demer valley did not respond to this question. The general view of experts is, however, that there is a general trust to flood managers in Belgian. This example demonstrates how a low score of one indicator can increase the score for another. However, such a synergy should not be desirable. High scores of both indications would, of course, result in an overall better resilience of this community. The learning effect for residents in the Demer valley is the value of social networks and own initiatives even atop of trusted flood managers.

Policy and institutions

To be effective, the flood risk management has to ensure that the provisions of Floods Directive (and the legislation which transpose it into Member State's normative framework) are closely integrated with the territorial development, urban planning and civil protection mechanism. The Floods Directive focuses primarily on prevention, protection and preparedness, whereas the civil protection addresses issues relevant for preparedness, response and to some extent recovery. Prevention includes non-structural activities reducing the flood impacts such as restricting the development of flood plains; risk-proofing of buildings and infrastructure; and flood-sensitive land use, agricultural and forestry management practices. Protection addresses both structural and non-structural measures reducing the likelihood and/or impacts of flood such as flood defenses work, temporary flood storage areas etc. Preparedness includes recognition of the imminent danger (i.e. early warning system) and communication of risk. Response entails all emergency activities aimed at protecting human life, property, environment, and cultural heritage. Recovery and review (lessons learned) address activities in the aftermath of the emergency helping to restore normal/ordinary conditions and to help to bear the inflicted hardship. The Italian legislative framework provides a good example how the integration can be managed. The civil protection agency is closely involved in the implementation of the Floods Directive, in particular through its network flood monitoring and forecasting systems and the emergency plans developed for all territories prone to flood risk.

The aforementioned examples demonstrate how indicators of resilience components can specifically point out strengths and weaknesses of a flood-prone community. Weak points can be easily identified, compared (to other case studies) and analysed. However, indicators must be seen as part of the three main components on the one hand, and linking elements of the entire resilience analysis on the other. Only then, consequences for the existing flood management system should be drawn.

5.5.1.2 Floods Directive and resilience

Concise overview of the Floods Directive

The Floods Directive (2007/60/EC) sets to prevent and limit floods and their damages on human health, the environment, infrastructure, cultural heritage and property. The Directive obliges the Member States to assess risks posed by each Member State's water courses and coast lines, and to produce maps of area subjected to floods of different intensity. The main aim of this assessment is to inform adequate and coordinated management measures to protect assets and humans in these areas. Along with the WFD provisions, the Floods Directive underpins the rights of the public to access this information and take part in the planning process. The time schedule for the implementation of the FD is ambitious: Up to 2011 a preliminary risk assessment has to identify areas with potentially significant flood risk. For these areas flood hazard maps and flood risk maps have to be prepared by 2013. In the areas identified as being at risk the number of inhabitants potentially at risk, the economic activity and the environmental damage potential shall be assessed. Finally, up to 2015 flood risk management plans must be set up for areas identified earlier. The management plans should lay out what measures will be adopted to reduce the probability of floods or their effects.

Floods Directive and resilience

The FD refers to 'resilience' only in the recital 7 in which it recalls the Council Decision 2001/792/EC, Euratom (later revoked by the Council Decision 2007/779/EC, Euratom) establishing the Community Civil Protection Mechanism (CCPM). The recital highlights the ability of civil protection 'to provide adequate response to affected populations and improve preparedness and *resilience* (emphasis added)'. CCPM stands for cooperation in civil protection support and assistance interventions in the event of major emergencies.

Back in 2004, as a reaction to the Commission's Communication (COM(2004) 472 final of 12.7.2004) laying out plans for Flood Actions Plan, the Environmental Council (held on 18/7/2004) concluded that 'a common European approach would increase our resilience to flooding catastrophes'. These and other EU official documents and statements highlight the importance attributed to resilience.

From the sparse reference to and the lack of an explicit definition of the concept in the Floods Directive we conclude that it was not the intention of legislators to include resilience as an active component of the flood risk assessment and mapping exercise. We restrain from discussing whether it should have been. We note that resilience is used more as a symbol for endurance and staying power, an emblem of sustainable societies. A symbol that many try to turn into guidance for a better disaster risk reduction (DRR) strategies. With some success but still far from convincing.

In principle, and also as conceptualised in the FREEMAN project, resilience enhancement is embedded in all five stages of the disaster risk management, outlined not only in the 2004 Communication on Flood Action Plan: prevention, protection, preparedness, response, and recovery and review (hereafter referred to as PR3). The FD addresses three of them. *Prevention* includes non-structural activities reducing the flood impacts such as restricting the development of flood plains; risk-proofing of buildings and infrastructure; and flood-sensitive land use, agricultural and forestry management practices. *Protection* addresses both structural and non-structural measures reducing the likelihood and/or impacts of flood such as flood defences work, temporary flood storage areas etc. *Preparedness* includes recognition of the imminent danger (i.e. early warning system) and communication of risk.

As stressed earlier in this document, the implementation of FD should be closely coordinated with the emergency organisation and recovery, thus the activities of civil protection mechanism and institutions assisting during the recovery phase. *Response* entails all emergency activities aimed at protecting human life, property, environment, and cultural heritage. *Recovery* and *review* (lessons learned) address activities in the aftermath of the emergency helping to restore normal/ordinary conditions and to help to bear the inflicted hardship. (Especially the recovery and review stage is pertinent within the academic community that tries to turn the resilience concept into a practical tool). The 2001 Council statement on integrated flood management within the European Union (Brussels, 12 May 2011) seems to recognise what has been omitted in the Floods Directive – the close coordination of the civil protection and water management

agencies: 'The Council of the European Union ... *underlines the need for Member States and the EU to take an integrated approach to flood management, building upon existing Member State and EU legislation and policies, with special attention paid to the Floods Directive, encompassing the entire disaster management cycle (prevention, preparedness, response and recovery)*'. We believe that the climate adaptation policies of the European Union, and especially the efforts to boost 'adapting capacity', are closely interconnected with the research on resilience. In this respect we note a notable lack of integration between the disaster risk reduction policies and efforts on the one hand, and the climate adaptation challenges on the other. We believe that it is of uttermost importance to bridge these two policy challenges and academic fields, particularly in the social sciences.

Application of the Floods Directive to the case studies

Considering the building blocks described earlier in the document we recognise that the persistent culture of risk negligence in Calabria and Italy, in terms of risk-prevention and partly -protection, cannot be resolved through a single legislative act. The Legislative Decree 49/2010 of 23 February 2010 which transposes the Floods Directive assigns the responsibility arisen from the FD to the regions and river basin authorities established under previous legislation (183/1989) which operate under provisional regime until after the river basin districts are constituted. Furthermore, it has been chosen to transpose FD through a new piece of legislation instead of integrating it into recently consolidated environmental act 152/2006. On the other hand the LD 49/2010 make explicit link to the normative provisions referring to the Civil Protection Mechanism in Italy, helping so the integrate the prevention/protection stages of the disaster risk management with the response/recovery. To conclude, from the normative point of view the integration of water/flood management, civil protection, territorial and land use planning appears to be solid. However, the past experience of non-compliance makes it hard to believe that the FD and LD 49/2010 are likely to achieve short term improvements.

Similarly, vertical integration is well managed in terms of tasks distributions and accountability. The recent trend of making Civil Protection liable in criminal trials for the consequences of natural disasters, however, requires attention. Whereas the liability for negligence, if ascertained, is legitimate, the Civil Protection Department should be shielded from the attribution of guilty by 'default' whenever the natural disasters claim victims or large economic disasters. In small river basins with rapid hydrological response the observation data is scarce and model results too coarse to allow accurate predictions. In such situations, overexposure of Civil Protection to criminal trial and liability make in fact have as a consequence that alerts are issued more frequently than warranted, undermining so the credibility of emergency operations. Finally, the critical point is the mismatch of tasks and accountability on the one hand, and the resources available at the various levels of risk governance for preventing disasters and protecting human life and property.

In terms of **review and adaptation**, we found that the past significant events have been analysed in depth, and properly reported, in terms of meteorological causes and hydrological/hydraulic propagation. The Functional Center and/or the Regional Environmental Agencies analyse all events for which alerts have been issued and report about the evolution of the events. The event bulleting have all features representing of best practice. What is missing is a subsequent economic and social impact assessment of the significant events, a task which goes beyond the competence of the civil protection. We believe that the potential for realisation of our own vulnerabilities at the community level and the regional/national economy is not fully exploited.

5.5.1.3 Strategies and measures

There are many ways in how to distinguish between indicators and their characteristics (measures). For means of feasibility we chose to organise it according to WP and organisational level. One could also like to make distinctions based on short term/long term, soft/hard measures, technical/social and so on. In the table below we incorporated examples of all types of measures covering the different work packages. The development of a strategy is meant for the long term, implementation can have effects on the short term.

Based on the analyses done in the different work packages, a list of strategies and measures has been compiled. This is illustrated in the table below (Table 21). The left column gives an overview of the proposed indicators, used to evaluate the different building blocks of resilience. The proposed measures in Table 21 are grouped in two categories per indicator. Those measures which can initially be introduced were scores are very weak to weak and those which would typically apply to cases scoring moderate to good. It needs to be noted that the implementation of measures will always be context dependent. The table does give clear indications but nevertheless an context analysis should be performed as well in order to gain a better understanding of bottlenecks and opportunities.

Depending on the score of the investigated area, different actions can be proposed. If indicators score weak to very weak, relatively less effort has been put in measures to enhance resilience. This is based on the assumption that it is easier to enhance a level of resilience than to create the basis for resilience. However, this does not mean that the focus should only be on enhancing what already exists. The measures displayed in the table below cover both measures on both the medium and long term.

Table 21: List of proposed measures and strategies to enhance resilience

Indicator	Proposed measures for indicators score 'very weak to weak' & time frame for implementation ()	Proposed measures for indicators score 'moderate to good' & time frame for implementation ()
Awareness	<ul style="list-style-type: none"> ▪ Easy access of flood hazard and flood-risk maps (e.g. as a website) (MT) ▪ better access to guidelines for the proper behaviour at hazard situations (MT) ▪ publishing most recent insights of climate change impact on flood-prone areas (MT) 	<ul style="list-style-type: none"> ▪ Easy access of flood hazard and flood-risk maps (e.g. as a website) (MT)
Worry		<ul style="list-style-type: none"> ▪ Enlighten residents about potential damage and threat in their neighbourhood. A realistic estimation of the threat is presumption for an appropriate preparation. (e.g. website, brochures) (MT)
Preparedness	<ul style="list-style-type: none"> ▪ Simple and easy to access (website, flyer in city hall) check lists for how to be prepared and how to behave in case of a flood (LT) ▪ in flood-prone areas: simple signboards where to escape to in the case of a flood (ST) ▪ no more building permits in flood-prone areas (ST) 	<ul style="list-style-type: none"> ▪ Public-private partnership with local businesses, esp. those who are located in a flood-prone area, and who have the means for crisis acting (LT)

Indicator	Proposed measures for indicators score 'very weak to weak' & time frame for implementation ()	Proposed measures for indicators score 'moderate to good' & time frame for implementation ()
Social capital		<ul style="list-style-type: none"> Support neighbourhood activities, local heroes, and existing social networks. They can close missing links in crisis communication and management (names, phone numbers, associations should be known) (ST)
Early warning systems		<ul style="list-style-type: none"> Make early warning systems better known and publicly available (website, local media) , and easy to understand (MT) mind weak signals and observation of lay people. They should be able to report to authorities in an early stage of a flood (phone, website) (LT)
Insurance/subsidy		<ul style="list-style-type: none"> public-private partnerships (e.g. municipalities and insurance companies) for a better access to insurance, esp. for residents in flood-prone areas (LT) allocate financial resources to support flood victims to recover in a public-private partnership with banks. (e.g. Interest-free loans)(LT)
Internal Institutions	<ul style="list-style-type: none"> See social capital 	
External Institutions		<ul style="list-style-type: none"> Review the performance of crisis communication of a regular basis. Frequently, evaluate response from lay people and municipalities (MT) review communication tools including open source software (e.g. visualisation of flood development) (LT)
Integrated river basin approach	<ul style="list-style-type: none"> Implementation of Water Framework Directive (LT) development of integrated river management plans (LT) development of integrated flood risk management plans (LT) check the presence of soft, preventive measures in the flood management plans (MT) set up international and national coordinating bodies (LT) 	<ul style="list-style-type: none"> Enhance institutional interaction (MT – LT) improve convergence platforms (MT – LT) promote basin based solutions (MT – LT) enhance decision support instrumentation (MT – LT) strengthen assessment frameworks (MT – LT) Evaluate, identify reboot (ST)

Indicator	Proposed measures for indicators score 'very weak to weak' & time frame for implementation ()	Proposed measures for indicators score 'moderate to good' & time frame for implementation ()
Public awareness and participation - communication	<ul style="list-style-type: none"> ▪ Communication of measures to public (ST) ▪ participation of public on FMP (LT) ▪ awareness-raising campaigns (at school, flyers, ...) (ST) 	<ul style="list-style-type: none"> ▪ Enhance participative management (ST) ▪ assess efficiency of participative strategies (ST) ▪ Evaluate, identify reboot (ST)
Insurance	<ul style="list-style-type: none"> ▪ Clear legal principles on compensation and insurance (MT) ▪ provide clear mechanisms for compensation (MT) ▪ financial incentives for flood protection measures (LT) 	<ul style="list-style-type: none"> ▪ Strength legislative framework (MT – LT) ▪ define threshold frameworks (MT – LT)
Retention of water	<ul style="list-style-type: none"> ▪ Restoration of natural flood plain (MT – LT) ▪ creation of flood retention (MT – LT) ▪ measures to prevent rapid run-off (agricultural, wetlands, vegetation, hill slopes) (MT – LT) ▪ room for water (MT – LT) 	<ul style="list-style-type: none"> ▪ Strengthen legislative framework (MT – LT) ▪ stimulate applied research (MT - LT) ▪ enhance appropriate design handbooks (ST-MT)
Land use zoning	<ul style="list-style-type: none"> ▪ Incorporate flood dimension in land use zoning (MT – LT) ▪ training for staff in permitting instances on flood aspects (MT – LT) 	<ul style="list-style-type: none"> ▪ Strengthen legislative framework (LT) ▪ stimulate rezoning (MT – LT)
Risk assessment	<ul style="list-style-type: none"> ▪ Sufficient study of flood risks (MT) ▪ including land use zoning in risk assessment (MT) ▪ provide a information system for land-use planning emergencies and rescue (MT) 	<ul style="list-style-type: none"> ▪ stimulate applied research (MT-LT) ▪ enhance decision support (MT) ▪ capacity building; organize workshops (ST)
Flood emergency	<ul style="list-style-type: none"> ▪ Draft specific emergency plans for flooding (MT – LT) ▪ regular training and revision of plans (MT – LT) ▪ clear escalation over levels and scales (LT) ▪ check plans on actions for immediate aftermath (ST) ▪ feedback and evaluation (ST) 	<ul style="list-style-type: none"> ▪ Evaluate, identify reboot (ST) ▪ Setup warning protocols (ST) ▪ enhance community based approach (MT – LT)

Indicator	Proposed measures for indicators score 'very weak to weak' & time frame for implementation ()	Proposed measures for indicators score 'moderate to good' & time frame for implementation ()
Prevention of pollution	<ul style="list-style-type: none"> ▪ Check for alternatives for water supply and sewage (MT – LT) ▪ Emergency plans include locations of potential contamination (MT – LT) ▪ monitoring-based warning system for trans-boundary pollution (MT – LT) 	<ul style="list-style-type: none"> ▪ Strength legislative framework (LT) ▪ stimulate applied research (MT-LT) ▪ enhance decision support instrumentation (MT) ▪ define threshold frameworks (MT – LT)
Legal aspects	<ul style="list-style-type: none"> ▪ Legal requirement for flood management plans (LT) 	<ul style="list-style-type: none"> ▪ Strengthen legislative framework (LT)
Climate change	<ul style="list-style-type: none"> ▪ Integrated approach (MT – LT) ▪ incorporate effect of climate change on discharges in models (MT – LT) 	<ul style="list-style-type: none"> ▪ stimulate applied research (MT-LT) ▪ enhance decision support instrumentation (MT) ▪ define threshold frameworks (MT – LT)
Sustainability	<ul style="list-style-type: none"> ▪ Set-up of monitoring of basin condition (MT) ▪ include vision of future conditions (MT) ▪ create a legislative framework (MT) ▪ promote financial capacity (MT) ▪ create applied research (ST) 	<ul style="list-style-type: none"> ▪ Strength legislative framework (LT) ▪ Stimulate financial capacity (MT) ▪ stimulate applied research (ST) ▪ capacity building; organize workshops (ST)
Monitoring	<ul style="list-style-type: none"> ▪ Development of a mature, automated observation network (MT-LT) ▪ establish exchange protocols for foreign data (MT-LT) ▪ involve local people (MT-LT) ▪ publish actual situation online (ST) 	<ul style="list-style-type: none"> ▪ Strengthen institutional capacities (LT) ▪ Capacity building (ST) ▪ Promote applied research (MT-LT) ▪ Promote inter regional and international networking (ST)
Forecasting	<ul style="list-style-type: none"> ▪ Improve lead-time, temporal and spatial accuracy (MT-LT) ▪ improve data input (MT-LT) ▪ filter forecast errors by approval of operator (ST) 	<ul style="list-style-type: none"> ▪ Strengthen institutional capacities (LT) ▪ Capacity building (ST) ▪ Promote applied research (MT-LT) ▪ Promote inter regional and international networking/ cooperation (ST)

Indicator	Proposed measures for indicators score 'very weak to weak' & time frame for implementation ()	Proposed measures for indicators score 'moderate to good' & time frame for implementation ()
Technology	<ul style="list-style-type: none"> ▪ Use a pre-warning system (MT) ▪ use of ensemble prediction system (MT-LT) ▪ limit downtime of the system (MT-LT) ▪ implement standard ICT-practices (MT) ▪ test for rare situations and full-chain testing (MT) ▪ provide enough resources for heavy calculations (MT) 	<ul style="list-style-type: none"> ▪ Strength institutional capacities (LT) ▪ Capacity building (ST) ▪ Promote applied research (MT-LT) ▪ Promote interregional and international networking/cooperation (ST)
Knowledge of associated risks	<ul style="list-style-type: none"> ▪ model impact of urbanisation, land use, ecosystem degradation, climate change (MT-LT) ▪ provide sufficient research capacity (MT) 	<ul style="list-style-type: none"> ▪ Promote applied research (ST) ▪ Strength institutional capacities (ST-MT) ▪ Promote inter-institutional cooperation (ST)
Warnings	<ul style="list-style-type: none"> ▪ Provide detailed information on time and space (ST-MT) ▪ limit false alerts (ST) ▪ assure timeliness of warning (MT) ▪ double-check whether it is understandable and legible (ST) ▪ train staff in reading and using warnings (ST) ▪ ask feedback (ST) 	<ul style="list-style-type: none"> ▪ Evaluate, identify reboot (ST) ▪ Capacity building (ST) ▪ Promote applied research (MT-LT) ▪ Setup warning protocols (MT) ▪ Enhance community based approach (MT)
Dissemination and communication	<ul style="list-style-type: none"> ▪ active communication (push) via multiple channels (ST) ▪ provide escalation procedures (ST-MT) ▪ connect with general and specific hazard management plans and emergency services (MT) ▪ establish trusted partnerships (ST-MT) 	<ul style="list-style-type: none"> ▪ Evaluate, identify reboot (ST) ▪ Promote applied research (MT-LT) ▪ Enhance community based approach (ST)
Response capability	<ul style="list-style-type: none"> ▪ Brief residents on options and risks (ST) ▪ increase responsibility of citizen (MT) ▪ design and test disaster plans (both general and specific) (MT) 	<ul style="list-style-type: none"> ▪ Evaluate, identify reboot (ST) ▪ Strengthen institutional capacities (MT-LT) ▪ Capacity building (ST)
Uncertainty	<ul style="list-style-type: none"> ▪ Provide means to quantify uncertainty (MT) ▪ include uncertainty in warning (MT) ▪ train end-users for probabilistic information (ST-MT) 	<ul style="list-style-type: none"> ▪ Promote applied research (MT-LT) ▪ Strength research capacities (ST) ▪ Enhance monitoring (ST) ▪ Improve model (ST – MT)

Indicator	Proposed measures for indicators score 'very weak to weak' & time frame for implementation ()	Proposed measures for indicators score 'moderate to good' & time frame for implementation ()
Design	<ul style="list-style-type: none"> ▪ Involve stakeholders in design (ST) ▪ report on stakeholder's requirements (ST) ▪ know limiting factors (ST) ▪ interface with parallel systems (MT-LT) 	<ul style="list-style-type: none"> ▪ Promote applied research (MT-LT) ▪ Introduce design handbooks (ST)
Integrated at all levels	<ul style="list-style-type: none"> ▪ Integrate EWS in national and international policies (MT-LT) ▪ involve local resources (MT –LT) 	<ul style="list-style-type: none"> ▪ Evaluate, identify reboot (ST)
Horizontal integration of flood institutions	<ul style="list-style-type: none"> ▪ Integrate flood risk maps in territorial and urban development plans (MT) 	<ul style="list-style-type: none"> ▪ Assess the exposure of critical infrastructure to flood risk ▪ Ensure compliance with the flood risk regulation in other sectors
Vertical integration	<ul style="list-style-type: none"> ▪ Ensure a balanced distribution of the tasks across sthe vertical levels of governance (MT) 	<ul style="list-style-type: none"> ▪ Develop emergency plans across the various levels of governance (MT)
Review and adaptation	<ul style="list-style-type: none"> ▪ Review of the past significant disaster events (ST) ▪ Conduct independent assessments of the disaster risk governance (ST) ▪ Include climate change expected impacts into risk assessment (ST) ▪ Ensure full transparency of risk assessment and management operation (ST) ▪ Conduct capacity building on risk governance (ST) 	<ul style="list-style-type: none"> ▪ Initiate public discussion and consultation on risk scenarios to be considered (ST)

5.5.2 Quick wins

The strength of quick wins lies in their short term implementation. These measures or strategies can be implemented with minimum effort, and can have a major impact. The list of quick wins can be extracted from Table 21 (ST).

5.5.2.1 Examples of “quick wins” to enhance resilience

In flood-prone areas, simple signboards where to escape to in the case of a flood should be installed. They can be colour coded, and installed in conjunction with indications of potential water levels, for example, on buildings. In some cases the terrain does not have obvious characteristics, and a simple sign can support orientation in stress situations. Usually, these boards only need to be located at strategic positions, which means that in most cases the effort to produce and install these signboards is rather low.

Many municipalities have already stopped to release planning permissions for buildings in flood-prone areas. Once this priority is realised, a simple stop on planning permissions is easy to accomplish, but might have significant impact for future records of flood damage. This activity can be underpinned with a risk-benefit calculation.

Quick decisions and mutual help among affected individuals can be vital factors in crisis communication and management. In many cases neighbourhoods build up informal networks that may be effective in reducing damage and saving lives. These informal networks should not and often cannot be made formal, but some connections could be identified and registered. Names of residents who have professional functions in crisis management and live in flood-prone areas are examples as well as connections to associations such as sport clubs or other communities of interest. Basically, no costs are associated with this activity, but the effect of informal networks can make a difference in crisis management. If businesses are located in flood-prone areas, more formal agreements such as public-private partnerships may support informal networks.

Many local residents know their surroundings very well and observe changes in the environment on a daily basis. Most flood management authorities do not have the means and resources for permanent on-site observation. The knowledge of local people should be included in a monitoring and early warning system. A phone number and a website are simple but effective interfaces for monitoring activities of people. This reporting may be supervised and evaluated by professionals. Monitoring and reporting may include: the state of gauging stations, have high water levels and associated high flow velocities resulted in changes such as erosion or damages on infrastructure such as dykes and bridges? On the long term capacity building and occasional meetings can support an increased monitoring quality for a (greater) flood-prone area.

The review of past significant events provides a good opportunity for learning about ones own vulnerabilities. The even analysis should include the economic and social effects of the disaster, the meteorological and hydrological evolution of the event, the potential drivers of the risk (that is factors that amplified the experienced effects), performance of the emergency operations, the policy responses in the aftermath of the event etc.

It is beneficial to collect all available data about recent and future flood events and store them in a public database, including the spatial data describing the flooded areas. The open access to a flood impact database, fully georeferenced, can boost development of applications based on that data that translate into market incentives to stop or curb development of flood prone areas.

The flood risk institutions might initiate external review of their performance, in order to identify strengths and weaknesses.

5.5.2.2 Policy briefs

Policy brief - The Development of the Resilience Checker

Resilience focuses on finding ways to minimize the possible impact of a flood in the preparation phase by taking non-structural measures. Potential damage can be minimized pro-actively by decreasing the level of vulnerability and increasing the resilience level. This policy brief describes the FREEMAN approach to resilience, and the development of its resilience checker.

What is flood resilience?
Within the FREEMAN project resilience is defined as the capacity to absorb disturbance and re-organize into a fully functioning system. It includes not only a system's capacity to return to the state (or multiple states) that existed before the disturbance, but also to advance the state through learning and adaptation. So, resilience is considered to be dynamic, during time and at different scales.

The relationship between resilience, adaptive capacity and vulnerability is heavily debated and ongoing. Based on extensive literature review, resilience and adaptive capacity have a similar goal, being to better cope with existing or future perturbations and diminish inconveniences. Due to this similar goal, both concepts (adaptive capacity and resilience) are equated. Using this equation constitutes a simplification. Nonetheless, it is expected that this simplification ensures the comprehensibility of the resilience concept. Thus, the comprehensibility will be raised amongst residents, policy makers and flood risk managers. Resilience consist of several dimensions. Widespread and commonly used dimensions are: physical, social, economic, institutional and natural. The

main focus within the FREEMAN project lays upon the social and institutional dimension. Within both dimensions, flood modeling tools are considered to be the third dimension. FREEMAN operates using three distinct work packages, each with their own focus.

Why should flood resilience be measured?
There is an increasing interest within the concept of resilience as such. Authorities and institutions see resilience a mechanism for mitigating the impacts of floods to local communities. Resilience contains a dynamic component, indicating change over scales and timeframes. This change enhances difficulty to design a tangible and

practical tool. Moreover, research and literature reviews come up with very long lists of possible variables and indicators, measuring resilience. However, to date, no concise set of indicators is ready to be used in practice. Yet another difficulty to cope with. However, measuring resilience can contribute to encouraging residents, policy makers and flood managers to better anticipate, cope and deal with the adverse effects of floods. Within FREEMAN, indicators are selected that can increase the level of flood resilience. Indicators can be identified and selected within several fields of expertise and across several scales. In order to be able to measure resilience in a valid and objective manner, a thorough research of known variables and indicators is needed.

How is flood resilience measured?
To measure resilience, it is of utmost importance to delineate important variables or indicators. Within the resilience checker, three essential resilience dimensions are considered: flood modelling tools, flood institutions and flood risk perception and communication. These dimensions are interlinked and directly influence each other. In order to effectively assess each of the dimensions, a set of indicators and variables have been defined. These variables and indicators are gathered and validated through extensive literature review, expert judgement and practical know-how. In practice the level of resilience can be assessed through a stepwise approach.

The first step consists of a detailed investigation of the target area:

- Overview of the institutional organization of the area
- Overview of flood risk, available tools and maps
- Overview of effected population.

This creates the qualitative basis defining the gaps, strengths and weaknesses. The next step is to go more in depth. This step allow further quantification of the variable set, which results in a separate, unique score per variable. The scores are automatically standardized and produce values between 0 and 2. Very weak is represented by score 0 and 2 stands for very strong/outstanding. During the final step the variables are being grouped into their original dimensions, by means of a validated methodology. A unique score is thus retrieved, giving a powerful and useful indication of the overall flood resilience within the target area. Within FREEMAN this has been tested in the three case study areas. The diagram below gives an example of the outcome of the resilience checker.

Acknowledgements
The project would like to thank the 2nd CRUE ERA-NET funding Initiative. The following project partners would like to thank the funding organization: Flanders Hydraulic Research (Belgian case study, Antea Group); Bundesministerium für Bildung und Forschung (BMBWF), through PTKA (Project Management Agency Research Centre Karlsruhe) (German case study, Seconest); Istituto Superiore per a Protezione e la Ricerca Ambientale (ISPRA) (Italy) (Italian case study, FEEM).

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Visit our project website at: <http://www.fcem-project.net/FREEMAN/index.php>

Figure 57: First policy brief – The Development of the Resilience Checker (<http://www.fcem-project.net/FREEMAN/>).

freeman

Flood Resilience Enhancement and Management

Policy brief – Resilience of flood-prone communities – concepts, analysis, results and implications

Resilience of flood-prone communities is the central motive of the FREEMAN project. The research team intended to investigate whether or not the concept of resilience can help to analyse the performance of a flood management system from the point of view of a community. Hence the affected people including their assets, common pool resources, formal and informal institutions received the focus of attention.

Flood prone communities

On the one hand a community is a coherent system with a number of exclusive economic, social and physical (infrastructure, technical networks, morphology) functions. However, the smaller such a community is, the more it depends on external services and functions both from the input as well as output side. When examining the resilience of such a community, a number of external functions must be included.



Figure 1: The Safety Chain

The resilience of a flood-prone community is characterised by its three main dimensions:

- policy and institutions;
- risk communication and perception;
- flood modelling tools.

This is a structural approach to resilience of a flood-prone community.

The procedural approach includes all aspects of the safety chain: preparedness, response, recovery and mitigation. The application of such a holistic approach enables researchers to view measures and activities beyond a simple list of technical and so-called soft measures.

Throughout the project, three dimensions (building blocks) of resilience were addressed (see table 1 on the next page). If a flood-prone community is the research

object, just one sector or subsystem can only insufficiently represent all relevant (flood) resilience aspects of the entire system. A flood-prone community is a system consisting of an agglomeration of social entities: connected in social networks, economically active, reside on physical environment, comply (or not) with rules, etc.

Methodology

Three dimensions of resilience have been selected to measure resilience. These dimensions are expected to cover the most relevant issues of (flood) resilience from preparation to coping to mitigation. In addition, all three components including the indicators may be similarly applied to all three case studies, and based upon empirical evidence, a comparison is possible.

Resilience Dimensions	Main indicators
Policy & Institutions	Horizontal integration Vertical integration
Risk communication and perception	Review and adaptation Communication during events Awareness of risk amongst residents
Flood modelling tools	Preparedness of residents Flood management plans Flood modelling tools

Table 1: Dimensions and Indicators

Furthermore, these building blocks provide connectivity to other (higher) scale levels both spatially and institutionally. The results of the resilience checker as introduced in the previous policy brief are displayed in a radial diagram where each axis represents a dimension.

Examples for results and implications

In general, on the municipal level of flood management including representatives of the municipalities and residents there is a high level of awareness and willingness to prepare for floods. However, those groups identify bureaucratic obstructions as the main hindrance of an appropriate preparation for floods. Some quotations from citizens

Quotes:

"The inundations around the municipality of Helle in the year 1926 were more serious. However, intense development and use of housing increases the vulnerability." This respondent recognises the increase of vulnerability depending on land use and development.

"We are still waiting for the fulfilment of politicians' promises to design and implement a flood management plan for the district of Hildebeheim." Indeed the website of the NLWKN confirms that the flood management plan for the Leine catchment (is in preparation but not finished (Hochwasserschutzplan Leine, 2011).

"Since this was for me the first time to experience such a flood, I observe the river Innereife during every intense rainfall event." This respondent clearly describes a learning process and the increase of his/her own awareness.

"What will be the result of the next flood? Nothing will be changing. Only the frequency of extreme meteorological events will increase." This person utters his frustration about the lack of activity after the Innereife flood of 2007, and is afraid, that the impact of heavy rainfall events will be more severe in the future.

who answered the online questionnaire can be found in the box below.

An example of perception is the knowledge of structural (EWS) with gauging stations, communication network and interface for observing the development over water levels) and non-structural elements of flood management: if residents do not know about the existence of an EWS, the effectiveness of such a system is diminished. Even if people know how to find a website or other means of information, it does not mean that these people are able to interpret this information, and draw conclusions for an appropriate behaviour in a hazard situation.

Another example is the value of social capital including informal networks and neighbourhood activities. During the flood event of 2007 the residents of Helle in the Innereife valley were able to protect most of their homes in a self-organised manner. This way communication problems of the district-level crisis management were compensated. This so-called soft-measure communication and participation can this way be recalculated in tangible economic values. The number of damaged homes would be much higher without this self-organisation. On the other hand, both strong formal and informal networks are, of course, the best option in terms of the resilience of a flood-prone community.



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Recommendations for quick wins

From the FREEMAN research activities a number of recommendations for flood managers emerged, of which some are long-term measures. However, some measures can be implemented without much effort and resources in a relative short-term period of time. Some examples are:

- In flood-prone areas: simple signboards where to escape to in the case of a flood should be installed. They can be colour coded, and installed in conjunction with indications of potential water levels, for example, on buildings. In some cases the terrain does not have obvious characteristics, and a simple sign can support orientation in stress situations. Usually, these boards only need to be located at strategic positions, which means that in most cases the effort to produce and install these signboards is rather low.
- Many municipalities have already stopped to release planning permissions for buildings in flood-prone areas. Once this priority is realised, a simple stop on planning permissions is easy to accomplish, but might have significant impact for future records of flood damage. This activity can be underpinned with a simple risk-benefit calculation.
- Quick decisions and mutual help among affected individuals can be vital factors in crisis communication and management. In many cases neighbourhoods build up informal networks that may be effective in reducing damage and saving lives. These informal networks should not and often cannot be made formal, but some connections could be identified and registered. Names of residents who have professional functions in crisis management and live in flood-prone areas are examples as well as connections to associations such as sport clubs or other communities of interest. Basically, no costs are associated with this activity, but the effect of informal networks can make a difference in crisis management. The example of the municipality of Helle during the 2007 flood may be seen as a role model.
- If businesses are located in flood-prone areas, more formal agreements such as public-private partnerships may support informal networks.
- Many local residents know their surroundings very well and observe changes in the environment on a daily basis. Most flood management authorities do not have the means and resources for permanent on-site observation. The knowledge of local people should be included in a monitoring and early warning system.

• A phone number and a web site are simple but effective interfaces for monitoring activities of lay people. This reporting may be supervised and evaluated by professionals. Monitoring and reporting may include: the state of gauging stations, have high water levels and associated high flow velocities resulted in changes such as erosion or damages on infrastructure such as dykes and bridges? On the long term capacity building and occasional meetings can support an increased monitoring quality for a (greater) flood-prone area.

The final report of the FREEMAN project presents these aspects in detail, and provides a multi-faceted knowledge base for discussing and applying the concept of resilience to flood-prone communities. This report does not contain a perfect solution, but with its attempt to move away from pure and straggled academic research, and intersperse consulting methods such as recommendations, the FREEMAN team hopes to provide ideas and help to close the gap between science and practice a little bit more.

Outlook

The resilience approach for flood-prone communities revealed a number of surprising results. The structural concept with dimensions and indicators in conjunction with empirical work resulted in a systematic analysis of technical and non-structural aspects of flood management. Yet, non-structural measures may receive a higher significance especially when the conjunction with structural measures



Acknowledgements

The project would like to thank the 2nd CRUE ERA-NET funding Initiative. The following project partners would like to thank the funding organisations: Flanders Hydraulics Research (Belgian case study), Antea Group, Bundesministerium für Bildung und Forschung (BMBF), through IPKA (Project Management Agency, Research Centre Karlsruhe) (German case study), Seveso2010; Istituto Superiore per la Protezione e la Ricerca Ambientale ISPRA (Italy) (Italian case study, IREI).

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Figure 58: Second policy brief – Resilience of flood prone communities – concepts, analysis, results and implications (<http://www.feem-project.net/FREEMAN/>).ksc

6 Contribution of the project to the overarching topics of the call

6.1 FREEMAN case studies – overarching questions

6.1.1 What do we understand under a resilient community/how do we define resilience

More than anything else, resilience is knowledge. A proficient understanding of the disaster risk, its driving forces and impacts. Knowing how to prepare, respond and recover from disaster strikes. More than that, resilience is a capacity to deploy that knowledge. To help oneself to get back to the feet after having sustained a blow. To learn how to. Paraphrasing Reinhold Niebuhr's poignant message, resilience is a wisdom of knowing how to put a stop to natural hazards turning into devastating disasters, and a wisdom of enduring risks that cannot be avoided.

Resilience has many forms and manifestations. People convalescing after having lost what was dear to them. Communities recovering from shattering blows. Economies getting back on track after having sustained major shocks and losses. However, resilience has also negative connotation: the persistent overlooking of the threat and perceived powerlessness of individuals, in front of unacquainted community or nonsensical institutions, to make any difference.

6.1.2 What is the role of resilience during floods?

During the flood emergency situations, the community resilience is determined at *individual* level by the willpower and readiness of community members to help others in need ('we don't step away') and themselves, and the degree to which they know how to. In this sense, the preparedness comprises capability and experience that can be acquired or trained, and commitment which is transmitted by moral obligation and community membership. In the most cases it is not the professional staff trained for emergency situation which arrives as first at the place of disaster, however well the emergency response is organised. Before the professional rescue teams, the ordinary people intervene, or can do so, with positive or negative outcomes. In the FREEMAN project we have not pursued research on how individuals contribute the individual level of resilience, with the exception of the collective perceptions of threats posed by flood. Recalling the four level of analysis of existing institutions (see section 5.4.4), we observe that changing the community mindset and culture towards risk is a slow and most difficult process.

At the institutional level, the preparedness is measured with the actual or expected performance of early warning systems (EWS) and emergency plans/operations. The reliability and technical sophistication of the EWS is an important aspect of resilience, one which allows 'buying' time to prepare for an imminent strike. However, the 'lead time' gained from the deployment of advanced EWS must not get lost to insufficient alert communication or to 'not knowing' what to do in the wake of the disaster. Once again we note that resilience is about knowledge, in this case not only what to do but what to do first.

In system dynamics terms, resilience is a stock that can be accumulated or depleted. A series of blows may be a final push over the edge. Resilience in the response and recovery phases is most tangible concept to everyone, measured in terms of 1) human capacity of the emergency agencies during the response, and 2) financial resources available to steer reconstruction and alleviate the hardship from the shoulders of those who suffered most.

Most importantly however, resilience is about knowing, or continuous learning, about one's own vulnerability. At best, this knowledge should be collected and used long time before the disaster strikes. In this respect, the most value-added of resilience is in the disaster management stages related to prevention and preparedness.

6.1.3 Drivers of insufficient resilience at case study level

Leine-Innerste

The Innerste river basin has divergent levels of exposure and sensitivity towards flood risk: landscape and morphology are determining factors. The municipality of Holle is located at the confluence of the Innerste with its tributary Nette. This results in an increase of exposure to flood.

Both exposure and sensitivity can be increased when building in flood-prone areas. In the post-war period, especially in the 1960s and 1970s Germany saw an increased development of building land, especially housing and business areas. Terrains in flood-prone areas were usually the cheapest land to develop. From the institutional point of view the consistency of flood management on the district/federal level with the municipality including the stakeholders is missing. Individual flood protection measures are permitted. However, as soon as residents endeavour a joint effort of protection and preparation, the interests of the entire river basin must be safeguarded by higher authorities. There is no joint effort on both scale levels of water management, only rule compliance. However, the representatives of the municipality of Holle demonstrated that this can result in long delays or complete rejections of local flood protection plans with no results.

Demer-valley

Most of the residents living in the Demer basin are exposed to flood risks. Throughout this project it has been illustrated that residents in the Demer valley are less aware of the existing flood risk.

A discrepancy exists on the self protective behaviour of residents on the one hand and being protected by the different authorities on the other hand. However, in Flanders spatial planning is subject to a so-called water check (watertoets). The water check is only consultative and evaluates whether an initiative causes a detrimental impact on surface water, the ground-water or nature. The result of the water check is non binding. Due to this, still development of housing and recreation areas in flood prone areas continues.

Calabria

The high vulnerability of Calabrian communities is only in part caused by disproportionate exposure to almost any kind of hazards. Throughout this report and the case study related documents (deliverables) we have demonstrated that the bulk of the vulnerability is caused by the persistent culture of non-compliance (lack of enforcement), the negligence of the prevention and protection, and the messy normative framework. Most importantly, we have observed a mismatch between the task and accountability of the flood risk management organisation on the one hand, and the available financial resources (and capacity) on the other hand.

6.1.4 FREEMAN case studies - factsheets

 <p>Innerste Basin, Germany</p> <p>Main Characteristics</p> <p>Level of stakeholder involvement</p> <p>CRUE Activities</p> <p>CRUE Project</p> <p>Partners</p> <p>Activities</p>	 <p>Damen basin, Belgium</p> <p>Main Characteristics</p> <p>Level of stakeholder involvement</p> <p>CRUE Project</p> <p>Partners</p> <p>Activities</p>	 <p>Soverato/Vibo catchment, Italy</p> <p>Main Characteristics</p> <p>Level of stakeholder involvement</p> <p>CRUE Project</p> <p>Partners</p> <p>Activities</p> <p>Specific outcomes & lessons learned</p>
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6.2 Connection to the Floods Directive

The implementation of the Floods Directive (FD, 2007/60/EC) is in an initial stage in all three countries. An in-depth analysis of the methodologies for risk assessment and mapping, let alone the design and content of the flood risk management plans, has not been doable. Notwithstanding, in this section we summarize how the FREEMAN project and its results can inform the implementation process.

First, the FD calls for a **description of the past events** that caused significant adverse impacts, in course of the preliminary risk assessment exercise (Article 4). In this context, the event analyses conducted in the context of the FREEMAN project provide useful information and insights about the effects of significant flood disasters, their impacts and implication on risk governance in a broader sense. The efforts of the European Environmental Agency (EEA) to establish an European Database of Flood Impacts are laudable in this respect, and can be informed by the results of the FREEMAN project. Moreover, the analysis of the perception of flood risk and the recommendations for the improved risk communication are valuable contributions worth to be taken up by the authorities in charge of the implementation of the Floods Directive in the three project's countries. To strengthen the benefits provided by the FREEMAN project to the above initiative, we are committed to produce a policy brief summarising the key information and lessons learned from all analysed flood events and submit a concise report to the EEA and the DG Environment.

Second, the analysis of the **flood management tools** (early warning systems and flood management plans) identified several ways of improving the flood management tools (management plans and early warning systems). The guidance for assessing the tools allows for a 'health check' of the key strength and weaknesses of the existing systems, and recognition of 'quick wins' that provide, in short term, the highest added value with modest resources. We realise that there is a scope for strengthening the cooperation of the national (and regional) early warning systems across Europe, under coordination of the Joint Research Centre's European Flood Alert System (EFAS). The FREEMAN consortium members have attended the EFAS meeting in 2011 and conduct research meant to explore the legislative and judicial basis for a larger uptake of the EFAS forecast within Europe. Furthermore, the Italian network of early warning systems, embedded within the activities of the National Civil Protection Service provides a good

example. Not only the up-to-date scientific standards of the network, but the detailed elaboration of the procedures and protocols, forged over the past 10 or so years, represent valuable lessons learned. Third, the analysis of the risk governance regimes in the three case studies identified many pitfalls that should be avoided in course of the Floods Directive's implementation. The key lesson learned from the FREEMAN case studies are summarised in the recommendations (section 8). In short, we have proposed a vision for the modern flood risk management, one which closely integrate all activities along the disaster risk management cycle: prevention and preparedness on the one hand, and the response, recovery and review on the other hand. Our recommendations for the horizontal and vertical integration of the flood risk institutions are valuable steps

6.3 Participation

6.3.1 Introduction

Although the process of public and stakeholder participation continues to be intensively investigated and discussed in academic circles, the implementation of participatory methods in practice remains problematic. This can be attributed to the lack of knowledge transfer on the one hand, and the general underestimation of participatory approaches in planning and decision processes in flood management on the other.

The impact of stakeholder participation on an entire decision process is frequently mis-interpreted or underestimated. With the release of the European Water Framework Directive (EU, 2000) public and stakeholder participation is prescribed, and the synthesis of expert and lay knowledge is recommended.

Best practice guides on the application of participatory methods have been produced in plenty over the last two decades. Issues of stakeholder analysis, participatory methods, communication, levels of participation, capacity building, social learning have been analysed and described in numerous documents such as Wates (2000); van Asselt et al. (2001); Ridder et al. (2005); Elliott et al. (2005).

However, when addressing complex (planning) problems in a human-environment domain, planners, scientists and flood (water) managers are often confronted with a dilemma: which participatory methods are most suitable for the given situation, and what is an appropriate sequence for participatory planning? Years of research in social science including the development of multi-disciplinary approaches provide managers with a wide variety of methods for addressing a 'multi-perspective' environment. However, 'participatory managers' are often overwhelmed with the multitude of methods from which to choose or simply do not know of their existence. They may also lack knowledge of the implications of employing particular methods within a planning and decision process. As a result, methods are selected based upon the experience of the responsible authority, which is often limited, and does not permit space for experimentation and expansion of available knowledge. In other words, contrary to well-educated engineers, planners or ecologists there are usually no properly-educated 'participatory managers' among responsible authorities for flood management on all administrative levels. The role of the participatory manager (if there is one) is often taken over by communication officers, engineers, planners or ecologists, who may not be explicitly trained to manage a participatory process.

In many cases, interaction with the public and stakeholders is often seen as risk management to prevent individuals or groups from delaying a planning procedure or having other undesired impacts on the process. Moreover, the participatory process does not go beyond legally prescribed routines. In this way opportunities for obtaining domain knowledge from the local public or stakeholders, identify appropriate 'soft measures for flood management, and enrich expert approaches or detect procedural errors are missed.

The response to this dilemma can only be a holistic approach that involves stakeholders and/or the public in the complete planning process throughout its life span. The 'art of participatory management' cannot simply described in a textbook with clear instructions. A successful participative process, however, emerges from deep knowledge of the required methods, strong 'soft skills' such as moderation and communication and the instinct to do the right thing at the right time. In the end participatory managers

have to interact with human beings and not with 'elements of a system'. For this reason science cannot provide managers with a complete cookbook on how to handle participation.

6.3.2 Assumptions, indicators and framework

The design of an appropriate participatory management strategy can be characterised by three distinct indicators: (1) process (2) constraints and (3) objectives. *Process* implies the available methodology as well as the consequences of applying particular methods (Krywkow, 2009). *Constraints* refer to the boundary conditions of a particular case study. These conditions include:

- the physical environment such as land use, size of a river basin, climate and weather, geology, slope and others;
- the stakeholders and lay people who are involved in a particular land-use activity or have particular interest in the management of the region under investigation;
- the available resources: budget, time and staff;
- legal constraints such as planning permissions, the right of the public to comment/object to planning proposals;
- cultural and behavioural differences which distinguish countries or regions.

Objectives are significant indicators of a participatory process. Objectives of the planning process and its participatory process have to be distinguished clearly. The latter may include knowledge elicitation, problem identification (of the overall planning process), conflict resolution, seeking consensus, finding support for maintenance. In other words, the objectives of the participatory process determine to a large extent the combination and application of participatory methods. Project goals may however, include sustainability, improving the infrastructure, increasing safety, improving biodiversity, improving drinking water quality, changing resource management and many more. Within a project it is crucial to distinguish between the overall project goals and the goals of the related participatory process. Commonly, the goals of a participatory process integrate into the overall project goals.

6.3.3 Levels of participation and classes of methods

From a methodological point of view a participatory process may reach four different levels of participation: (1) *information provision*; (2) *consultation*; (3) *active involvement* and (4) *social learning* (Krywkow, 2009). Levels of participation do not indicate a sequence for the application of methods, but the quality of interaction between managers, experts and lay people. For instance, information provision is a one way communication from managers to the public or stakeholders. Whereas consultation already includes a dialogue, and social learning an intensive exchange of opinions, knowledge and views that may result in a change of perspectives among individuals and groups at the end of a process (Arnstein, 1969; Mostert, 2003; Krywkow, 2009).

In addition to the levels of participation Krywkow (2009) summarised the main participatory methods in classes and displayed those in relationship to the levels of participation (Figure 59).

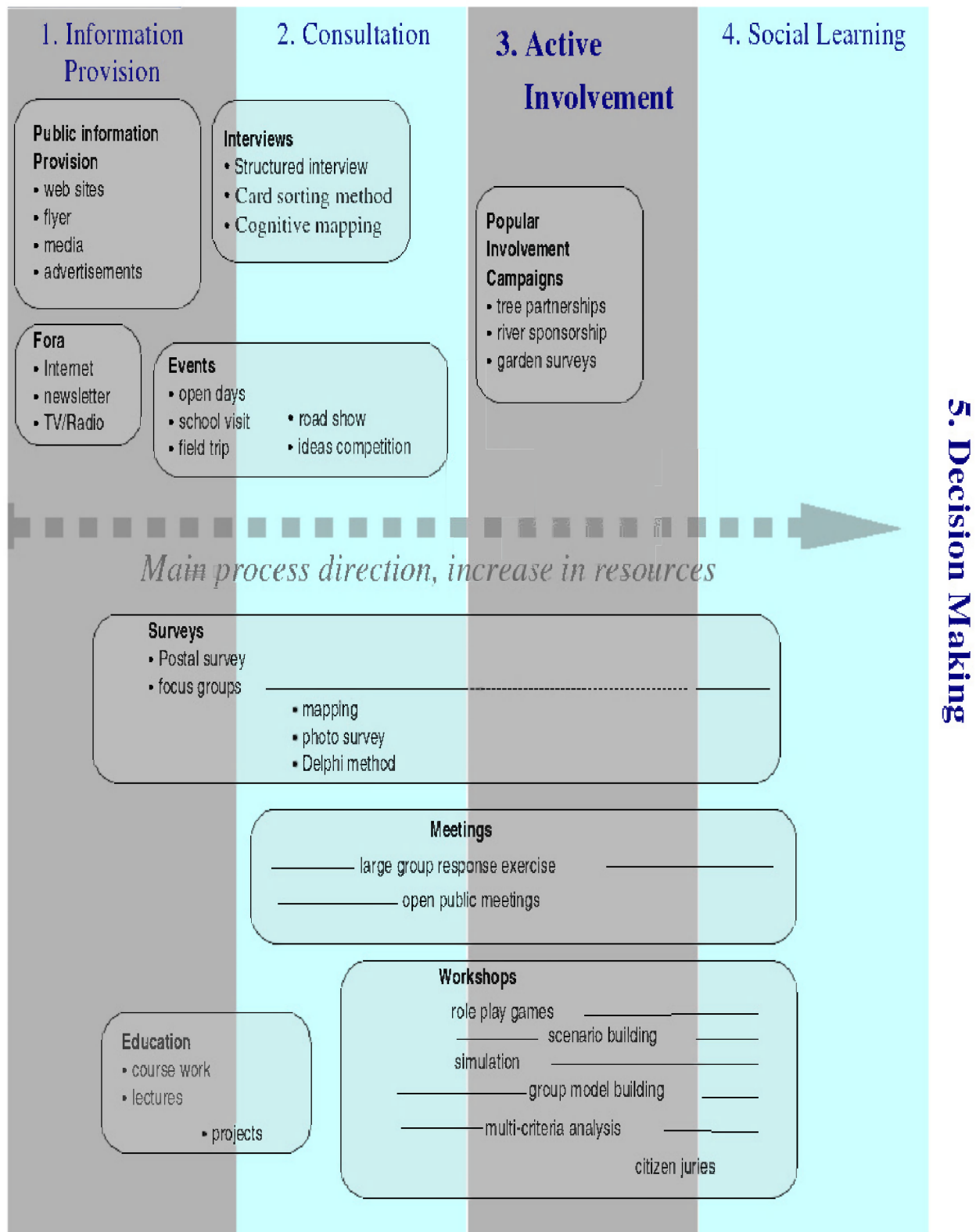


Figure 59: Levels and classes of participatory methods (Hare and Krywkow, 2005, p.19)

Classes and levels of participation are a guideline for participatory managers. However, additionally Krywkow (2009) provides users with an overview of indicators of methods such as: cost/effort share, expertise, moderator skills, user mode and computer application. Moreover, the effort involved in applying various methods in terms of staff resource, time, tools and miscellaneous costs is estimated in terms of in preparation, execution and analysis phase.

6.3.4 Phases of a participatory process

Furthermore, Krywkow (2009) developed a first draft of a universal framework based upon *phases* of participatory processes in water management projects. Independent of its constraints, a participatory process can be partitioned into four phases:

1. *preparation phase*: problem analysis, stakeholder analysis, resources analysis, goals analysis, drafting a participatory plan;
2. *publication phase*: introducing the public and stakeholders to the planning objectives and problems, envisaged solutions and measures including possible impacts on the social and physical environment;
3. *dialogue phase*: additional and deeper information provision, knowledge elicitation, education, detecting planning design errors and yet unknown side effects;
4. *response phase*: education, social learning, recruiting volunteers, scenario building, model validation, finding consensus or compromise, adjusting planning goals.

The list above indicates a number of tasks for the water managers as well as participatory methods that are applicable in one or more specific phases of a water management project.

Before a participative process can be initiated, a sound preparation is required including the analysis of stakeholders, resources and budget as well as setting of the agenda (participatory plan). The course and, at the end, the success of a participatory process both depend on these factors. When preparing the process, managers must be aware of maintaining the balance between a well organised schedule and sufficient flexibility for applying participatory methods.

6.3.4.1 Publication phase - Information provision

The publication phase falls, of course, within the realm of communication. Sufficient information provision requires a well-functioning communication process. Information provision is one-way communication where information about a new project is published. In most cases legally prescribed means of information provision such as an official announcement in the local newspaper or a weekly neighbourhood journal is not sufficient. A comprehensive website is nowadays one of the most suitable ways of providing information, and should be used as a basis for all supplementary information such as brochures and fliers. The website should not be a mere advertisement, but also provide detailed and up-to-date planning documents, maps, calendar of (planned) events and any available information that may be published according to the communication plan. For people without Internet access there must be a well-known location to view and browse the same documents. Depending on the available budget, regular advertisements in conjunction with reference to more detailed information in local media are preferable to fliers and colourful booklets.

Individuals and groups must have a chance to react. These reactions have to be documented. The documentation helps to recognise possible design errors at a very early stage of a planning procedure, identify 'difficult stakeholders' and (potential) conflicts.

In the recent years planners have started to provide the public not with a first and only draft of a plan, but with a number of planning alternatives. This is a step forward towards more flexibility and adaptive water management, but it entails two contradictory problems: 1) a part of the public may be confused, and may have problems in comprehending these alternatives; and 2) the public may only choose between the provided alternatives, which introduces a new inflexibility. One solution might be a very explicit explanation of the options and the public should be repeatedly be asked for their level of awareness. Another approach could be to design just one map indicating the variable elements, and have a precise description

of the variability of these elements in addition to the map. Furthermore, the 'information provision' phase can be used to find yet unknown stakeholders and interest groups. As indicated the section 'communication', there should be a central contact address and person to whom interested new individuals and groups can refer. This is especially important for large projects that involve a consortium of planning organisations.

Additionally, individual and personal contact 'in the field' is always useful. On-side work can be efficiently coupled with publicity. Every project employee should be able to communicate with local stakeholders and the public, and be able to point out at least relevant contacts on specific issues. Besides identifying new stakeholders, this will build up trust and consolidate contacts.

6.3.4.2 Dialogue phase

Surveys and interviews

Planners have to make a decision how knowledge elicitation can be accomplished in the best way. If most stakeholders as well as current public opinion on relevant issues are known, the next step can be a meeting. However, it may be preferable to interrogate the public and/or stakeholders to find out about their perspectives on the relevant issues, before bringing them together. The results may be used in preparing a meeting and other subsequent participatory methods.

Public meetings

After all available electronic and print media have been employed to inform people, a public or stakeholder meetings is recommended as a next step for several reasons:

- awareness raising;
- relevant information can be provided to the public or stakeholders in more depth;
- first questions can be answered, misunderstandings can be cleared up;
- yet, unknown stakeholders can be identified;
- stakeholder perspectives and opinions can be identified and categorised;
- side effects, and previously neglected problems or anticipated problems may be identified;
- opinions on the effectiveness of information provision can be collected (monitoring).

However, project managers and planners have to decide in which phase of the participatory process a meeting is advisable. Significant indicators may be:

- Has all collected information been pre-processed and available?
- Is the staff who performs and supervises the meeting appropriately prepared?
- Are all relevant parties able (and willing) to participate in the meeting?
- Ensuring that all individuals and groups will not be excluded from subsequent participatory activities?
- Can eventual mutations such as the transition from public to stakeholder participation be anticipated and handled?

A public meeting must be well prepared, and methods especially for knowledge elicitation, must be thoughtfully selected. When applying knowledge elicitation it is crucial to distinguish between asking stakeholders for their knowledge, preferences, and interests about the (desired) state of their environment and preferred measures to be implemented.

Small groups can be more easily handled than larger groups, and a variety of methods for this management is available. For larger groups a 'large group response exercise' is advisable. The performance of a (first) meeting can be trend-setting for the course of the subsequent participatory process. For this reason the support of a professional moderator is recommended, if the planning organisation or consortium itself does not have a sufficiently trained or neutral moderator. They should be prepared to collect information about the quality of the meeting and the participatory process thus far (monitoring). The meeting itself must have clear goals and provide every involved person with tangible results. One result must be a programme for the participatory process (a participatory plan).

Analysis of public meetings and related activities

A thorough and well-structured analysis of the meeting and the preceding participatory process is a determining factor for the further participatory process from now on. At this point all relevant stakeholders should be known. All problems, new criteria and new findings must be identified, analysed and categorised. Further steps depend on the results of this analysis. In other words, this analysis helps the water manager decide how to proceed. The combination of the goals of the planning procedure and the participatory process provides the manager with a number of options. Here are some examples:

- Public or stakeholder participation: At this point it should be clear if a participatory process with stakeholders, the public or a combination of both is the dominating process;
- Stakeholder categorisation: After the identification of stakeholders, before or after the initial provision of information a categorisation of stakeholders is highly useful. This provides an overview of relevant stakeholders, and distinguishes them according to their perspectives and interests. Particularly, when a large number of groups and individuals manifest their interest in the participatory process, it is important to have an overview of stakeholders and their representatives;
- Is the involvement of volunteers useful and helpful? If so, this should go into the planning of further participatory activities including course work, workshops, creative activities, etc.;
- Consensus or controversy: this is one of the most sensitive issues in a participatory process. If conflicts are detected, apply 1) social learning methods such as role playing games, scenario building exercises, citizen juries, nominal group technique, group model building or similar methods, and 2) response methods: views and perspectives of particular stakeholders may be tested with models and simulations in order to display the consequences of individual management options on the project;
- Has the meeting revealed (planning) design errors such as missed criteria, side effects, hidden costs, etc.? If so, the original plan or draft should be modified, and introduced to the public and stakeholders in a new meeting or information campaign;
- If stakeholders have a significant knowledge deficit, educational activities or awareness raising activities are recommended.

At this point a definite participatory plan including a planning sheet should be developed.

6.3.4.3 Response phase

The design of the response phase within the participatory process depends on the analysis of a first meeting and related activities. The following methods may be applied:

- *educational activities*, if there are still knowledge gaps among stakeholders, and also professionals;
- *events* can help to increase the public awareness and popularity of the project;
- *popular involvement campaigns* can recruit volunteers, and take advantage of the labour and creativity of lay people. Besides idealistic, artistic and monetary benefit, these activities may increase the sense of ownership significantly;
- for a *follow-up meeting*, collected, analysed and processed records and other information must be available, so that this activity does not repeat the effort of a previous meeting.

Stakeholder analysis and categorisation including the various views of the stakeholders should be completed. In this particular meeting stakeholders may already be confronted with scenarios or planning options that include various perspectives, and indicate the consequences of particular options on the individual stakeholder or groups as well as the variety of possible consequences on the affected community. Appropriate methods are (environmental or economic) models, maps with planning alternatives. Stakeholders should be able to comprehend the methods, and draw conclusions.

Working with models and scenarios

The use of models and scenarios can be part of follow-up meetings. Whereas stakeholders and lay people were asked to provide their domain knowledge to planners, experts have to review their own plans and models. In a way this step within both the planning process as well as the participatory process can be seen as a validation and verification of the plans and the available models respectively. If stakeholder

perspectives have proven that the plans are not viable, the plans should be modified and employed in a new validation round with stakeholders. All perspectives of stakeholders, however, should be processed with the available methods such as models, simulations, thought experiments or scenarios, and displayed as well as discussed with the stakeholders. Participants must be chosen in a way that those individuals are able to comprehend the methods and all groups are sufficiently represented. In particular, interactive model approaches require a great deal of expertise and moderation skills. In many cases it is advisable to employ an external expert.

6.3.5 Planning types

Expert planning is a planning procedure where a planning draft is designed by experts (planners, engineers, ecologists, etc.) and presented to lay people. *Co-planning* is a process where a project idea may emerge among lay people, and is (co) designed by experts and lay people together. If an experienced planning authority can propose a planning draft that is open for discussions with the public and stakeholders, it can be as transparent and adaptive as a planning draft that is developed by a group consisting of both experts and lay people. In the case of a co-planning approach planners, however, must maintain control over the participatory process. Co-planning requires stakeholder identification before a planning draft can be designed. Otherwise, there is a risk that some groups and individuals may be excluded. If the project uses a co-decision approach, the problem analysis must be conducted together with the participating stakeholders. If the project is an expert approach, a problem analysis comes first, and subsequently the relevant stakeholders must be found. In both cases, however, stakeholder as well as problem analyses must be flexible and repetitive, and should reach into the next phases of the participatory process.

6.3.6 A participatory plan

Once problem identification, stakeholder identification, goals, resources and a communication plan, are settled, a first draft of a participatory plan can be designed. Planners are in a dilemma, since stakeholders might expect both a well-organised and efficient agenda as well as sufficient flexibility to incorporate new stakeholder perspectives and eventually new criteria and side effects. In other words water managers need an adaptive management agenda both for the entire planning as well as for the participatory process. However, a number of activities can be planned well ahead:

- *Information provision*: managers have to choose the means of informing the public and stakeholders such as websites, announcements in newspapers, face-to-face contacts, flyers, posters, etc.;
- *Surveys and interviews* can help to understand the perspectives and interests of stakeholders and the public;
- *First meeting with stakeholders or the public*: the main purpose should be providing more information in greater depth and knowledge elicitation. This meeting is important, since it can determine the further course of the project;
- *Miscellaneous activities*, depending on the results of the first meeting: space should be given for additional activities such as site visits, training for volunteers, popular involvement campaigns, survey or events ;
- *Response meeting*: This meeting should be used to display the results of knowledge elicitation and consequences of chosen solutions on the physical and social environment, as well as introducing new solutions and discussing them, if necessary;
- *Further activities* such as workshops, voluntary work, educational activities, etc.;
- *A final event* such as an on-site festivity, a final conference etc..

The participatory plan can be seen as a link between between theory and practice, between objectives, local constraints and the available methodology. With the participatory process the participatory manager is able to adjust available methods and resources to the given circumstances of a specific location.

6.3.7 Goals of planning and participation

Similar to a communication plan goals are a significant guideline for designing and implementing a participatory process. First, there are several types of goals:

1. goals of the overall project such as improving flood safety and preparation, environmental protection, sustainability, better access to and functionality of recreational areas, better infrastructure and many more. Within these main goals there may exist sub goals. Note that goals and sub-goals of stakeholders and the public may significantly differ from the planning objectives of the planning organisation or the consortium involved in a particular project. Therefore, it is crucial to identify the goals of all involved stakeholders throughout a participatory process;
2. goals of the participatory process such as developing consensus or a compromise, satisfying stakeholders, increasing the reputation of the responsible organisation, identifying the appropriate measures, detecting undesired side effects, designing a transparent, democratic participatory process.

Goals of the participatory plan usually depend on the overall project goals. At the end the participatory process is supposed to support the project or planning goals. However, project goals may not be confused with the goals of a participatory process. Goals may be defined with reference to the planning organisation's own goals, the goals of the local, regional, national or European governments and of course the goals of stakeholders and lay people. Limitations that cannot be modified throughout a participatory process may be legal, environmental or budget constraints and limited space. Since budget can be a limitation, it is advantageous to not only include participation as part of a planning process from the beginning, but also to allocate sufficient budget for the participatory process throughout the design phase of the planning process. It is helpful that all involved parties of the participatory process are aware of all the goals and limitations.

As soon as a first planning draft or concrete ideas for a project are available, the main issues as well as potential problems and side effects that are relevant for the planning process from the point of view of the planners should be identified and documented. This helps to avoid surprises at initial stakeholder meetings.

There are two purposes of stakeholder analysis: to identify the possible stakeholders in a project, and to categorise them according to a framework that can allow you to make decisions about how to involve them, or not, as the case may be. Categorisation of stakeholders also helps water managers to make explicit the assumptions about the nature of the stakeholders so that within the planning organisation the involved parties can discuss the basis of these assumptions. Stakeholder analysis is essentially a three stage, iterative process:

1. Identify stakeholders
2. Categorise stakeholders
3. Select stakeholders.

6.3.8 Communication and resources

Sufficient communication is a crucial requirement for a participatory process. However, participation is more than communication. Indeed, a *communication plan* is helpful for projects that include multiple planning organisations and stakeholders. With a communication plan managers can assign responsibilities, identify tasks, provide stakeholders and the public with key contacts, keep track of what was said and written, and more. A communication plan should have a clear objective. Objectives of the communication plan must be compatible with the goals of both the overall project and the participatory process.

Before the actual participatory process starts, resources and tasks have to be allocated. Funding, expertise and man power are limited resources. The participatory process must accompany the planning process. If participation is both a vital part of the entire project, and is initiated at the outset of a planning process, then it should be feasible to allocate resources such as available staff, costs for professional advice, computer capacity, locations for meeting, printing costs etc.

Some methods that involve, for example, the use of complex models and analysis tools are not always easy to apply, and universally understandable. External experts are helpful, and despite primary costs, their recruitment can help to spare financial resources and increase the level of participatory applications. An estimation of costs of and effort required by particular methods is provided in Krywkow (2009, p. 59).

6.3.9 Monitoring and evaluation

Monitoring and evaluation can support a successful participatory process, and may help to avoid process failure. Therefore, it should be prepared and initiated as early as possible. A planning sheet such as described in Krywkow et al. (2007) is an appropriate means for recording a participatory process. This approach serves two purposes: 1) a planning sheet can be seen as a logbook for a project and its participatory process, that helps planners to keep track of all phases of the project; and 2) regular stakeholder feedback can be planned and incorporated in the process from the outset. When setting the agenda of the participatory process (participatory plan), dates for monitoring activities should be incorporated. Stakeholder feedback on the participatory process may not be confused with feedback on planning options. An in-depth description of monitoring and evaluation of participatory processes is provided in Rasche et al. (2006).

6.3.10 Summary and conclusion

This section is an attempt to inform practitioners in the field of water management with tangible advice how to organise a participatory process within decision processes that endeavour to improve the resilience of communities in flood prone areas. These processes may include the development of soft as well as engineering measures in combination. Much effort in research and consultancy work was required to generate this framework for 'participatory process management'. The guidelines such as described here can be seen as sort of 'optimisation' of a participatory process, and is fully consistent with section 14 of the Water Framework Directive (EU, 2000, L327/16). The novelty of the participatory management framework is the process oriented guidelines with the main criteria: (1) the systematic view of projects including the criteria *objectives*, *constraints* and *process*, (2) the close interrelationship between project planning and the participatory process, (3) monitoring and evaluation of the process with the possibility of stakeholder feedback, and (4) a generic process scheme that is applicable to many cases independent of their constraints. This section can only give a brief overview of guidelines for water managers. In summary it can be said that an appropriate participatory management process enables managers to improve the results of a planning process and its maintenance, increase the acceptance of results and prevent or at least minimise unwanted side effects. This all assumes an adaptive and transparent governance style that truly accepts the participation of lay people, and allows engineers or planners to adjust their calculations by incorporating domain knowledge.

6.4 Harmonisation

Under this chapter we focus on questions that aim to view flood risk management on a different scale, where a common terminology is used and intercomparability can be assessed.

6.4.1 How to balance the trade-off between harmonisation of flood risk management within the EU and in-depth analysis of case studies?

The Floods Directive (2007/60/EC) relies on the principle of subsidiarity. Subsidiarity, one of the principles of Good European Governance, stands for making political decisions at the lowest possible administrative and political level, and as close to the citizens as possible. The floods defy a common categorisation. High tide, storm surge, overflow or breaks of embankments, dam failure, and extreme precipitation with impeded outflow have in common that land is temporarily submerged where this normally doesn't or shouldn't happen. Globally, floods of different kinds account for the greatest share of natural disasters, inflicted economic damage and death toll. The different types of floods, and the variety of normative, economic, environmental and cultural do not allow for a close harmonisation of the risk assessment or mapping tools, let alone the risk management measures. The harmonisation striven for and highlighted during the negotiation process leading to the adoption the Floods Directive is not the normalisation of the risk assessment techniques, models, parameters or 'calibration' of what is socially acceptable level of residual risk. Rather, the harmonisation is in line with the Open Method of Coordination, employing soft law mechanisms such as non-mandatory guidance documents, risk indicators, benchmarking and sharing of best practice.

Still, we believe that it is of uttermost importance, given also the mobility of the European citizen, to introduce flood warning and alerting communications that are easily understandable to everyone, including non-residents and foreign visitors. Similar to the calibration exercise conducted under the Water Framework Directive, it is feasible and desirable to harmonise risk classes and categories, the colours and map symbols used to draw hazard and risk maps. Moreover, we believe that that the extreme weather and flood forecast, if based on probabilistic information, should convey the uncertainty in a way that is at least familiar to the European citizens. Furthermore yet, we believe that the flood prone areas at highest risk should be delimited on ground, or at least designated as such in a similar way as this is done for the Natura 2000 sites (the visitors may be warned by entering into the zone prone to significant flood risk, resort visitors should be informed about whether the location of the resort is in a close proximity of a flood risk prone area, etc). Similarly, there may be similar provisions for instructions to be followed during the disaster emergency.

We strongly believe that in all other aspects of the flood risk management, the best practice sharing, dialog and exchange is better than mandatory obligation for the sake of harmonised procedures and protocols.

6.4.2 What structures on a regional / basin scale are needed to improve flood event management on a local scale?

Because flood event management is often very complex and depending on technical and political issues on different levels, management should be based on a combination of (sub)regional and local actions. When defining structures for an efficient flood event management, a distinction can be made in management to prevent the flood (i.e. policy level) and management during the flood (i.e. crisis management).

Policy

On regional scale there has to be an official body uniting the different levels of water management. This official body must be responsible for preparing, planning and monitoring of integrated water policy and for the implementation of the decisions taken by politics over the whole region. Actions programs to prevent flooding and to manage flood risk must be described in regional management plans (e.g. river basin management plans).

Regional management plans must give a framework for more local actions and measures, and subregional and local plans must be in line with these regional management plans. In these plans, issues of nature conservation, spatial planning and water legislation must be harmonised following transparent protocols. To account for flood risk in spatial planning, possible negative impact of proposed initiatives on surface water, groundwater and the aquatic ecosystem have to be assessed (f.i. in building permit procedures). The implementation of a water assessment has to be unambiguous and following clear procedures.

Both regional and local authorities must have competences in the field of water management. Local authorities, which have detailed information often not available on a regional scale, are f.i. best suited to make urban drainage and sewer plans, while the control of retention basins in a larger basin is typically the responsibility of a higher level authority.

A good organisational structure of the official body contains a board (coordination of policy), a secretary (daily activities and design of basin management plan) and a stakeholder committee providing advice. Whether on subregional and local scale similar organisation have to exist, depends on the dimensions of the subregions. If these subregions are full drainage basins of significant rivers, it is advisable to have similar systems for each drainage basin. If necessary, also on sub-basin level organisational structures can be imposed dealing with local water management.

Besides management plans, regional and local authorities must elaborate adequate emergency and evacuation plans for crisis management.

Crisis management

A crisis management team (just before or) during flooding should consist of water managers and disaster planners. On which scale the crisis should be coordinated depends on the magnitude of the disaster. Apart from the local crisis management, there should at least be a regional crisis management that can deal with crisis measures of translocal scale.

Because there are usually of lot of instances involved in flood crisis management, a crisis center should coordinate the actions with clear leadership. This crisis centre guarantees the coordination between the hydrological regional services, responsible for monitoring the water levels, the meteorological services and the emergency services to inform them in time. A local crisis center and a translocal crisis center (e.g. regional) can both work within their competences, but the actions of the local center have to be in line with the regional center.

Frequent and clear communication between the different actors and towards stakeholders and citizens is essential. The communication lines have to be preconcerted:

- crisis communication should be done through one portal site for the crisis zone.
- clear agreements have to be made concerning essential information such as:
 - flood forecasting system
 - flood contours
 - warning report
 - contact points

6.5 Restrictions

Social / political / economic characteristics

The method developed for FREEMAN to assess and check the level of resilience was designed and tested in three different countries with a completely different political and organisational structure. This has the advantage that the methodology can be applied regardless of political or institutional boundaries.

However, social/political and economic aspects do influence the application of the methodology. The results can only be analysed in a meaningful way if the organisational set-up of the area is taken into account. For instance, it can not be plainly stated that basin A scores better than basin B, if you are discussing two entirely different basins (e.g. different type of flood, institutional set up, political developments, economic possibilities). What could be effective for basin A does not necessarily work for basin B. The FREEMAN methodology enables to effectively assess the resilience of a certain basin in its own specific context. The strength lies in applying internationally accepted and proven indicators in all assessments. The underlying principle is that these indicators have an effect on resilience in all situations – and therefore provide a solid basis for comparison. Correctly analysing the results can only be done by looking at the results in their rightful context.

Flood type

Another aspect that could restrict the usage of the methodology is the type of flood. The resilience checker has been designed specifically for river basin areas. For these basins, both pluvial and fluvial floods are taken into account. An important aspect concerning flood types is the lead-time and the uncertainty one has to deal with. The methodology of FREEMAN was specifically designed for hydrological floods. Providing forecasts for river basin suffering from “plain” floods is much more reliable than for instance predicting flash floods or coastal flooding.

In FREEMAN, the methodology was tested for flood areas in Germany and Belgium, and in a flash-flood prone area in Italy (Calabria/Vibo Valentia). Flash floods occur in river catchments, and are especially dangerous due to their quick appearance and possibly devastating results. The results are promising, it was shown that the resilience checker could effectively be applied even in that area, since it takes into account so many different aspects of resilience.

Coastal floods are somewhat different in nature. They are difficult to predict, and they could have a much bigger impact, not only in the coastal zone but also in the hinterland. Despite the total different aspects and impacts of type of flood a thorough analysis can be made, focussing on many aspects like communication, cooperation and organisation of the flood management system (both technical –tools etc-, as from the organisational side). These aspects are the same for all types of flood prone areas. Therefore, the resilience checker is quite flexible and applicable for different flood types.

The resilience checker does not work for multirisk situations. For instance, if a dam breaks (due to terrorism or other unforeseen causes) the effect of the breach for downstream areas can not be predicted. The same goes, for instance, for floods after huge fire events (e.g. forest fires).

Uncertainties

The methodology consists of several main indicators and many underlying variables. Some of those variables aim at measuring sustainability, uncertainty, climate change etc. By including those variables in the final analysis the overall “uncertainty” is already taken into account.

The communication of those uncertainties remains challenging. Communicating those uncertainties requires a thoughtful approach of all involved actors. Models and clear descriptions of those uncertainties can aid communication. Predicting floods and anticipating a level of resilience always requires people and organisations to accept and work with a certain overall level of uncertainty. However, using the resilience checker provides acceptable results and usable analyses within a certain range.

6.6 Enhancement of resilience

The resilience concept has been studied intensively for several decades. The concept has quickly gained on importance under the impulse of the United Nations Hyogo Framework for Action (HFA). The 2009 Global Platform for Disaster Risk Reduction concluded that strengthening community resilience is one of four priority areas for disaster risk reduction worldwide (UN/ISDR, 2010). Many scholars (e.g. Adger et al., 2005; Cutter et al., 2008a,b, 2010) consider resilience a promising instrument for preventing and mitigating the impacts of hazards.

In current flood management policies, little attention is paid to measures increasing the level of resilience. A limited knowledge of the concept of resilience is due to many obstacles regarding the concept itself. For most people it is yet unclear what resilience really is, how it can be measured and what the effects could be. Additionally, this hampers the translation of the resilience concept into management practice.

Resilience is being used in several research domains and has evolved through time. The evolution of the definition is illustrated in the figure below (Figure 60, based on Adger, 2000).

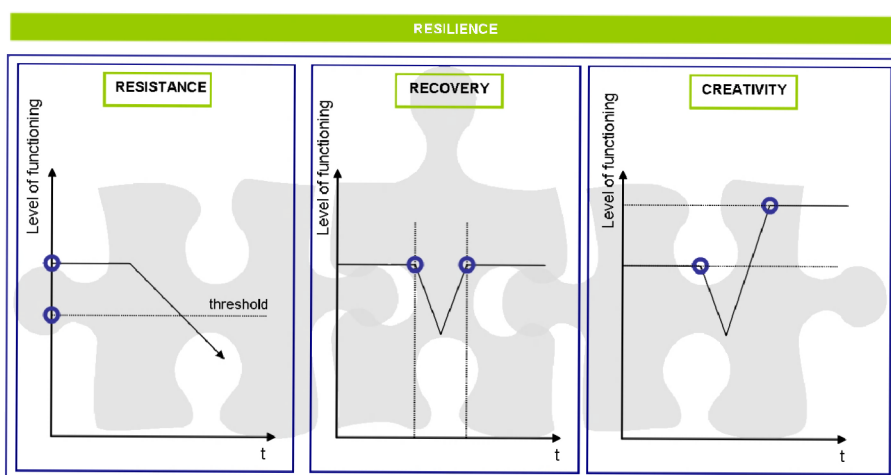


Figure 60: The resilience concept explained (based on Adger, 2000)

In the beginning, resilience was mostly used within ecology and reflected the level of resistance. Resistance describes how a system withstands perturbations and its consequences. It can be understood in terms of the degree of disruption a system can tolerate without undergoing a significant change. Later, also social-ecological interactions were taken into account. These interactions are reflected in the phases 'recovery' and 'creativity' in Figure 60. UN/ ISDR (2009) for example defines resilience as a non-tangible property describing how a community - that is exposed to hazards - resists, absorbs, accommodates to and recovers from the effects of a hazard in a timely and efficient manner. The recovery part refers to the preservation and restoration of the essential basic structures and functions (see 'recovery' in Figure 60).

The most recent development of the term "resilience" is to view resilience as creativity (see 'creativity' in Figure 60). The defining characteristic of resilient communities is the ability to reduce, prevent and cope with the flood risk. Resilient communities have improved their capacity in each phase of the flood management cycle. They are knowledgeable and aware of the risk, are well-prepared and respond better when a flood occurs, and recover more quickly from disasters.

In analogy with changing meaning and interpretation of resilience, the FREEMAN projected decided to view resilience to correspond to adaptive capacity. FREEMAN uses the following definition:

“resilience is the ability to cope and respond before, during and after a hazard occurs. Resilience is about returning to the original state or beyond”.

The FREEMAN project underlines the importance to make the resilience concept understandable for all layers of the society, including residents, as well as policy makers. Taking into account the definitions of the different concepts, it can be stated that resilience and adaptive capacity both have a similar goal: to better cope with existing or future perturbations and diminish inconveniences. Equating both concepts constitutes a simplification. Nonetheless, it is expected that this hypothesis ensures the comprehensibility of the resilience concept, which is an important requirement if the practical use of resilience will be stimulated.

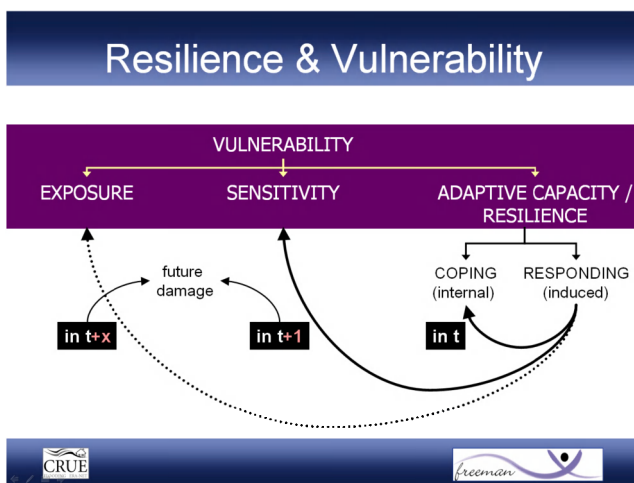


Figure 61: Resilience according to FREEMAN

Resilience is seen as an ongoing dynamic process, which will not only return to its original equilibrium, but preferably will gradually increase and subsequently bring its equilibrium to a higher level (the 'creativity' part in Figure 60). The working definition includes the 'recovery' and 'creativity' components of resilience and takes into account the dynamic social nature of a system and the process of enhancing and fostering resilience, which is one of the goals within the project.

In contrast to technical measures, resilience remains difficult to quantify. Resilience contains a dynamic component, indicating change over scales and timeframes. Resilience may vary from system to system and from one kind of disturbance to another: resilience is place dependent. Despite the lack of consensus about the exact definition and measuring techniques, the concept is applicable (Cutter et al., 2008b; Folke, 2006; Gallopín, 2006; Klein et al., 2003; Manyena, 2006). The importance to study and the necessity to measure resilience and subsequently to develop usable tools is highlighted in Cutter et al. (2008a), Cutter et al. (2008b), Joerin & Shaw (2011) and Klein et al. (2003). Due to many attempts and new insights gained by different scholars, very long lists of possible dimensions, variables and indicators exist. Most common dimensions are 'natural', 'physical', 'infrastructure', 'social', 'economic', 'institutional', 'community competence / capital' (Cutter et al., 2008b, 2010; Joerin & Shaw, 2011, Shaw, 2009). To date, no concise set of indicators is ready to be used in practice.

Still, measuring resilience can contribute to encouraging residents, policy makers and flood managers to better anticipate, cope and deal with the adverse effects of floods. Instead of focussing on new indicators or variables, the FREEMAN focus developed a reusable methodology to get an insight in the resilience level of specific communities. The focus is on finding a method that would be directly applicable in practice, but build on a solid scientific basis. This scientific basis is reflected in the choice of dimensions and definitions used. To derive the final set of indicators a balance had to be found between scientific soundness, and realistic data availability in real-life.

Within FREEMAN three essential resilience dimensions are considered: flood modelling tools (consisting of flood modelling tools and flood management plans), flood institutions and flood risk perception and communication. These dimensions are interlinked and directly influence each other. These dimensions correspond with a few of the international accepted dimension as defined (amongst others) by Joerin et al. (2011) and Cutter et al. (2010). For each dimension a set of indicators had to be determined. In order to be able to measure those indicators a set of variables had to be defined. It is advisable to measure each indicators by using multiple variables and sources (data triangulation). This process is depicted in the Figure 62. These variables and indicators were gathered and validated through extensive literature review, expert judgement and practical know-how.

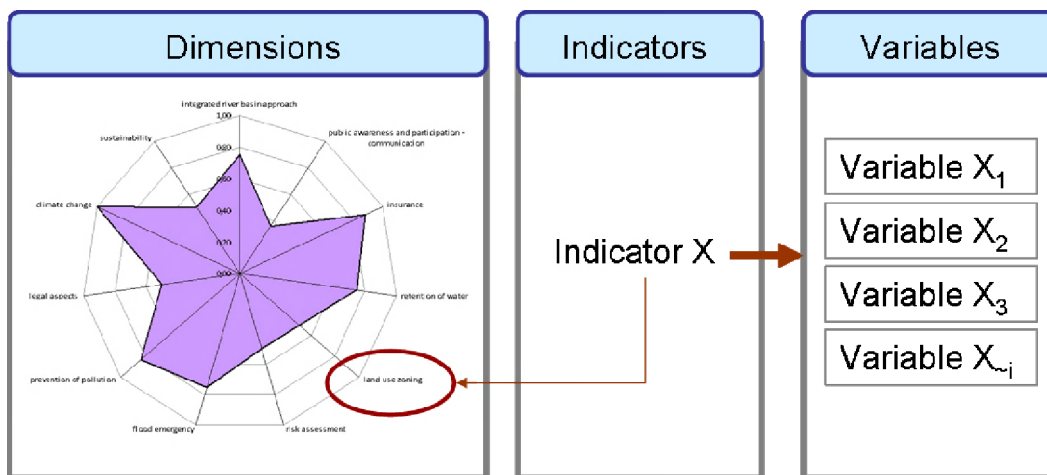


Figure 62: Deriving a set of variables

In practice the level of resilience can be assessed through a stepwise approach. The first step consists of a detailed investigation of the target area:

- Overview of the institutional organization of the area
- Overview of flood risk, available tools and maps
- Overview of affected population.

This creates the qualitative basis defining the gaps, strengths and weaknesses.

The next step allows further quantification of the variable set, which results in a separate, unique score per variable. The scores are automatically standardized and produce values ranging from 'very weak' to 'outstanding'. During the final step the variables are grouped into their original dimensions, by means of a validated methodology. A unique score is thus retrieved, giving a powerful and useful indication of the overall flood resilience within the target area. Results are represented by means of spider diagrams (Figure 62, first box). These graphs give a visual idea of the overall resilience of a specific study area. The results allow to formulate further recommendations towards stakeholders.

The FREEMAN approach to resilience is of a practical nature. The aim was to find a methodology that could actually be used by decision makers, flood managers and one that could be interpreted by the general public as a whole.

However, defining resilience will remain a challenge and it is assumed that scientific discussions and research will further evolve. Possible relationships among different related components (e.g. vulnerability, adaptive capacity) remain contested and the debate is still ongoing. Today, an increasing interest within the concept of resilience as such can be observed. Authorities and institutions slowly see resilience a mechanism for mitigating the impacts of floods to local communities. Finding applicable methods for bringing resilience into practice could aid this process.

7 Implications for stakeholders

The FREEMAN project has produced a proposal for practical consideration of the resilience concept in the processes stirred up, or influenced, by the implementation of the Floods Directive (2007/60/EC). We have conducted event analysis, developed best practice examples, identified strengths and weaknesses of the flood governance regimes, and shed light on the understanding of the perception of the flood risk in the case study areas and countries. All these insights and lessons learned, we hope, will be beneficial for the implementation of the Floods Directive.

Moreover, we have conducted extensive consultations, and by doing so attract attention to, and raised awareness about, the concept of resilience. Our research demonstrates that it is of uttermost importance to engage a broader public and citizens along with the institutional representatives and experts, in the exercise of risk assessment and later in the assessment of flood risk management measures. We believe that public and cross-institutional dialogue is necessary to define the risk scenarios against which the community vulnerability is assessed.

The project results outline the role of and contributions from various organisations, involved or affected by the flood risk management, towards an integrated disaster risk reduction strategy. Furthermore, the project has produced case studies that may be used or referred to in capacity building exercises further enhancing the ability and skills of the above organisations. Furthermore, we have shown how flood risk tools (management plans and early warning systems) can be designed and deployed for a better understanding of risk. Equally important though is the recognition of the limitations of these tools, frequently documented throughout this document, that can inform efforts to understand one's own vulnerability to floods.

The impact and acceptance of the FREEMAN effort is different in each of the case studies -the role of the project partners within the flood management structure as well. However, at the end all involved actors, especially the responsible authorities have to make a choice whether or not and to what extent to incorporate ideas stemming from the FREEMAN research.

What would possible implications mean?

From the residents' point of view, most relevant implications refer to risk communication and perception as well as informal social networks. If (potentially) affected residents have a high level of awareness in conjunction with an appropriate level of worry, responsible authorities may expect a higher level of preparation. Why is worry important? If citizens are aware of a hazard including its probability and implications, but misjudge or underestimate the consequences for their own assets and health status, an appropriate preparation for this hazard might be unlikely. A risk awareness enables people to conduct a risk-benefit trade-off. The result may be decision for taking the risk, because the effort of protection is too high. This might be responsible for an individual, but can at the same time be an additional risk for other members of the community. In other words risk awareness does not necessarily entail risk preparedness.

At this point information provision, consultation and education are tasks that should not stringently be provided by the responsible authorities, but the expertise of the flood managers requires high levels of responsibility. Those experts, at a minimum should make sure that relevant knowledge is easy to access and understood. This also holds for monitoring and early warning systems: flood managers must provide sufficient, comprehensible and easy to access information for people.

On the other hand local stakeholders and residents need to actively browse this information, and ideally keep themselves up to date. The particular implication for individuals of a flood-prone community as well as flood managers (also outside this community) is an active and permanent learning and communication process.

For flood management authorities this implies a permanent incorporation of stakeholder interests in their flood management activities. Flood management plans should be reviewed by local stakeholders with a chance of co-operation, and if necessary with a more interactive consultation and learning process. Flood monitoring and flood forecasting tools (only the front ends) should be easily accessible and comprehensible for residents. Examples from the Belgian case study demonstrated the feasibility of providing such tools. In this way the acceptance of knowledge should be part of the work of experts. The consequence for stakeholders (both experts and residents) in a flood-prone area can only be to accept their own role as well as the role of the other party and arrange with the flood risk. This requires a minimum amount of pro-activeness to ensure a high level of resilience and not merely coping if required.

8 Policy recommendations on national and European level and further research needs

Based on the insights and lessons learned from the FREEMAN project, this section summarises the key policy recommendations that pave a way to integrated flood risk management designed to meet the critical challenges now and in the future, as the effects of human induced climate change become more pronounced. Furthermore, we summarise the key areas for further research, the advancement of which can contribute significantly to the same end.

Policy recommendations

The modern flood risk governance recognises the critical importance of all stages of disaster risk management, including prevention and protection, preparedness, response, recovery and review. More than that, all the stages have to be well integrated and balanced in terms of resources and attention paid to. A seamless horizontal and vertical integration of all risk institutions (legislation, policies and organisations) remains a critical priority.

The horizontal integration has to ensure that water and land management, territorial and urban planning, civil protection, financial aid and risk management work towards the same end. Territorial and urban planning, as well as land management, play an important role in risk prevention, by limiting the development in flood prone areas, and by encouraging flood risk-sensitive land use and management practices. Water management's central role in flood risk management entails identification of areas prone to flood hazard of different intensity and frequency, and implementation of protection measures, both structural and non-structural, aimed to reduce the exposure and/or vulnerability to floods. The competence of Civil Protection Service extends over preparedness and response. CP attends to the residual risk, that is risk that persists after adopting all cost efficient and/or collectively decided risk prevention/protection measures. Up-to-date early warning systems and well-thought emergency plans are key instruments for further curtailing the residual risk. Last but not least, financial risk management comes into play in recovery and review phase, helping to overcome the losses. Although seemingly a straightforward task, the horizontal integration is a daunting task.

The vertical integration regards the coordination of the risk institutions across different administrative levels, ranging from local through regional to national. The vertical integration has to ensure the match of capacities (skills, discretion, command), resources (both financial and human), and accountability.

1) Understanding lessons from past disaster strikes

The past disaster strikes offer costly, but valuable lessons. These lessons need to be understood and translated into tangible improvements of risk governance. This is far from being a common practice. A systematic aftermath review of significant damaging events is rarely conducted and if it is, it is not done in a sufficient depth. The review has to provide insights into economic costs and social hardship suffered from the disaster strikes, taking into account the direct, indirect and intangible damage to economic sectors, human health, community wellbeing, and environment. The knowledge of the full social costs of a disaster is fundamental for an efficient recovery aid and assistance, and for improving the understanding of our vulnerability to nature's 'caprice'. Furthermore, the review should help to identify the drivers of risk, including the gaps in normative framework and its practical implementation and enforcement, and perverse incentives to engage in activities that amplify the risk. The event analysis should include

institutional responses to disaster strikes, skills of the early warning systems and preparedness arrangements.

In the first reading of the proposed EU Floods Directive the European Parliament requested the assessment of rescue and recovery measures in the risk management plans, thus including the review part of risk management cycle to the focus of the Directive. Even if this recommendation was not taken up in the final text of the Directive, we strongly recommend that the lessons learned are systematically collected and considered in the planned revision of the risk management plans.

2) Consideration of future climate and environmental changes, and social trends

Climate change induced alteration of rainfall pattern (form, intensity and timing of rainfall) is very likely to have significant effects on frequency and intensity of floods. Sea level rise (SLR), increased sea surface temperature (SST) and wind speed is likely to increase the impacts of storm surges and coastal flooding. Notwithstanding, the EU Floods Directive (FD) made consideration of the future climate change optional until the first review of the preliminary flood risk assessment in 2018 (Article 14 and recital 14).

We recommend that the authorities in charge of FD implementation consider the climate change induced effects on intensity and frequency of floods already in the first implementation cycle, especially for the planned structural defence measures. The flood risk management should be embedded in, or closely coordinated with, the adaptation strategies to climate change.

More than that, the flood risk management should be considered an integral part of the adaptation to 'climate variability and change' (cv&c), considering also the broader environmental changes and social trends. The flood risk should be considered together with water security and coastal and marine ecosystem protection.

Water security should be framed in terms of climate variability and change (cv&c) impacts upon both the supply of and the demand for freshwater resources. On the supply side, emphasis should be placed on changes in water supply quality and quantity as a result of altered precipitation, runoff and recharge patterns and rates, and saltwater intrusion into coastal aquifers. On the demand side, particular reference need to be placed on domestic water demand, the demands of the tourism sector and the demands of the agricultural sector for irrigation of crops.

Decline of ecosystem services for livelihood and disaster risk reduction should be framed in terms of deteriorated water quality; land and ecosystems lost due to sea level rise; decline of wild and farmed fish stocks; reduced ability of ecosystems to regulate timing and magnitude of runoff and aquifer recharge; compromised ability of ecosystems to regulate the abundance of human pathogens and/or disease vectors, and reduced ability of ecosystems to mitigate or offset the effects of the natural hazard threats in coastal areas.

Hydro-geological risk can be framed in terms of changed frequency and/or intensity of extreme climatological and meteorological events such as storms, heatwaves and droughts; hydrological events such as flood and precipitation-triggered landslides; and secondary disasters such as industrial accidents and epidemic/infestation triggered by the above extreme events.

3) Independent assessment of the risk governance: legislative gaps, enforcement of the policies

It is a best practice to initiate an independent, external review of performance, strengths and weaknesses of flood risk institutions. For example, the National Civil Protection Department in Italy commissioned an independent review of own activities to OECD. Similarly, the Pitt Commission reviewed the performance of the flood institutions in the aftermath of the 2007 flood in UK. We believe that it is the interest of each flood risk management organisation to initiate similar review in the context of the EU Floods Directive. The European Commission could develop guidance and establish best practices for such a review exercise.

4) Public participation in the course of Floods Directive implementation

Public participation and dialog in the context of Floods Directive can serve to multiple purposes including increased risk awareness, development of robust and socially accepted risk scenarios and management measures, and development of effective risk communication strategies.

Further research needs

1) Social costs of disaster, including intangible and environmental losses

Over the past few decades, the world witnessed a striking increase in the economic losses caused by natural disasters, driven by population and economic growth. An effective prevention necessitates accurate knowledge of what is at stake. Even so, our understanding of the full social costs of the past disasters is all but erratic and incomplete. At best, only direct losses are known and this only for some of the key sectors. Little attention is paid to indirect, induced and intangible effects, albeit these together may exceed the direct losses in the case of droughts, and account of a bulk of damage in the case of flood. As a consequence, the actual losses are underestimated and policy responses which are based on such a data are insufficient or inadequate to mitigate the future disaster risks.

2) Resilience, developing practical examples and best practices

Despite many efforts to pin down resilience in terms of operation and measurable frameworks, there is little agreement about how the concept refer to the other components of vulnerability (notably coping capacity) or what is the most appropriate scale, level of (dis)integration, and functional relationship and trade-off between the various constituents of resilience.

3) Extreme events under future climate

Human-induced climate change has the potential to alter the prevalence and severity of extremes events such as heat waves, cold waves, storms, floods and droughts. Detecting, let alone predicting, these change is a difficult task that will not be accomplished until the impacts of climate change become more pronounced. Yet better understanding of the vulnerabilities to extreme events under current and future climates may help to avoid further aggravating of the adverse impacts on human health, society and the environment. Bringing the natural hazard risk prevention and climate adaptation efforts together is a first step down to road to make this happen. The risk assessment to extreme events under future climates should take into account the compound effects of the individual threats (water security, decline of coastal and marine ecosystem services, and disaster risk) and their cumulative and amplifying impacts.

4) Comparison of the early warning systems across the member states and risk communication ways

There are numerous calls on developing even better skilled, integrated, and operational early warning systems.

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Annexes

- Annex 1: Example Intervention Plan Discipline 5
- Annex 2: Overzichtlijst Acties Voorgesteld door CIW
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Annex 1: Example Intervention Plan Discipline 5

Voorbeeld van monodisciplinair noodplan discipline 5

Aan te passen aan de eigen situatie en organisatie. Maak het zo concreet en praktisch als mogelijk. U kunt inspiratie opdoen in de actiefiches.

1. Toepassingsveld

Dit monodisciplinair interventieplan is het draaiboek dat de organisatie en de wijze van optreden van discipline 5 – INFORMATIE - regelt.

Dit plan treedt in werking bij de afkondiging van een >gemeentelijke/provinciale/federale< fase. Het plan kan ook afzonderlijk worden geactiveerd door de bevoegde overheid.

2. Opdrachten

tijdens de noodsituatie	na het opheffen van de noodsituatie
<ul style="list-style-type: none"> * waarschuwen van de betrokken bevolking * informatie aan de betrokken bevolking over (de evolutie van) de situatie * richtlijnen aan de betrokken bevolking en informatie over de maatregelen die door de overheid genomen worden * informatie aan de bevolking in het algemeen (ruime publiek) 	<p>informatie aan de betrokken bevolking over de maatregelen voor de terugkeer naar een normale situatie</p>

Buiten elke noodsituatie om, heeft discipline 5 (als lid van de veiligheidscel) ook de opdracht om mee te werken aan de organisatie van een voorafgaande informatie van de bevolking over de noodplanning.

Deze vorm van informatie heeft betrekking op:

- **de risico's waaraan de bevolking kan blootgesteld worden**
- **de maatregelen die de overheid neemt om de kans op een incident of een ramp zo klein mogelijk te maken**
- **de maatregelen die de bevolking zelf kan nemen in geval van een noodsituatie.**

3. Interne organisatie

3.1 Eindverantwoordelijkheid

De eindverantwoordelijkheid voor de informatie bij noodsituaties ligt bij de >burgemeester/provinciegouverneur/minister<. Hij leidt het coördinatiecomité, bepaalt de beleidsbeslissingen en heeft het meeste gezag en autoriteit, zowel symbolisch als politiek, om het woord te voeren naar pers en bevolking.

3.2 Directeur Informatie

De organisatie van de informatie berust bij de directeur informatie (Dir-Info). Hiermee wordt bedoeld de voorbereiding, de uitwerking en de coördinatie van alle activiteiten die met de informatieverstrekking bij een noodsituatie te maken hebben. De >functie in dagelijkse situatie< neemt de taak van Dir-Info op.

De Dir-Info:

- **maakt deel uit van het coördinatiecomité en volgt de gebeurtenissen in het coördinatiecomité nauwgezet**
- **houdt de feiten bij, corrigeert deze bij elke situatiewijziging, houdt nauwgezet bij welke beleidsbeslissingen worden genomen, wat er wordt beslist met betrekking tot de te nemen maatregelen, inzet van middelen, enz.**
- **koppelt voortdurend terug aan het coördinatiecomité over de informatie die door de pers en de bevolking wordt gevraagd**
- **zorgt ervoor dat enkel die informatie naar buiten gaat die door het coördinatiecomité wordt gedragen**
- **staat in voor de coördinatie van de communicatie-acties (persberichten, persconferentie, informatienummer, website, ...)**
- **houdt de andere leden van het coördinatiecomité alert voor het informatie-aspect**

De Dir-Info wordt bijgestaan door andere medewerkers voor:

- **het opmaken en versturen van persberichten**
- **contacten met de pers**
- **het opzetten en actualiseren van een website**
- **het bijhouden van een logboek**
- **afstemming met het informatiecentrum voor de betrokken bevolking en voor verwanten van slachtoffers**
- ...

3.3 Woordvoering

De >functie< (vb. Dir-Info, informatieambtenaar, ...) is de contactpersoon voor de pers/woordvoerder, behalve als de >burgemeester/gouverneur/minister< zelf de pers te woord staat of indien hij iemand anders als woordvoerder aanduidt.

De lijnen voor de contacten met de pers, woordvoering en de kernboodschappen moeten gekend zijn bij de verschillende disciplines.

3.4 Op het (ramp)terrein

Op het interventieterrein is een vertegenwoordiger van discipline 5 aanwezig. Deze persoon maakt deel uit van de operationele commandopost, onder leiding van de directeur van de Commandopost Operaties (Dir CP-Ops).

Deze persoon:

- **informeert zich voortdurend over (de evolutie van) de situatie ter plaatse, over de organisatie van het interventieterrein? en de zonering? die wordt geïnstalleerd**
- **staat in voor de opvang van de pers die zich ter plaatse bevindt**
- **begeleidt de pers bij een (eventueel) bezoek aan de rampsite (te bepalen in samenspraak met de Dir CP-Ops, Dir-Info en het coördinatiecomité)**

4. Verwittiging

De Dir-Info wordt telefonisch verwittigd van een noodsituatie door >...<.

Inhoud van de verwittiging:

- **indien vooralarm: noodsituatie voorlopig in de >gemeentelijke/provinciale< fase – opschaling naar >provinciale/federale< fase mogelijk**
- **indien alarm: begeef u naar het coördinatiecomité in >...<**
- **feitelijke informatie: wat is gebeurd, waar, hoe laat, slachtoffers, materiële schade, risico's voor omgeving, ...**

De Dir-Info verwittigt op zijn beurt de medewerkers van discipline 5 en maakt met hen de eerste afspraken (>bijvoorbeeld: functieverdeling zoals vooraf bepaald<)

- **wie begeeft zich op het terrein / wie assisteert bij het coördinatiecomité**
- **wie regelt de verdere verwittiging van andere medewerkers**
- **wie doet het nodige voor de website, het informatienummer, ...**

5. Doelgroepen

5.1. Betrokken bevolking

De betrokken bevolking is de bevolking die rechtstreeks en onmiddellijk te maken heeft met de noodsituatie omdat ze zich in de buurt ervan bevindt. Het zijn de mensen die bij een eventuele evacuatie worden opgevangen in een onthaalcentrum dat voor die gelegenheid wordt opgericht.

5.2. Bevolking in het algemeen

De bevolking in het algemeen, waar ook in België of zelfs daarbuiten, die niet onmiddellijk met de noodsituatie te maken heeft maar die wel geïnteresseerd kan zijn in informatie over de noodsituatie.

5.3. Pers

De pers is voor discipline 5 een doelgroep op zichzelf, gelet op de “plaats” die zij innemen in noodsituaties en hun manier van werken. De (inter)nationale, regionale en lokale geschreven en audiovisuele pers zijn partners om de bevolking te informeren en dat vereist tegelijk dat de overheid de contacten ermee moet organiseren.

5.4 Aanverwanten van slachtoffers

Informatie aan familieleden van slachtoffers vereist een specifieke aanpak. Deze doelgroep behoort NIET tot discipline 5. Familieleden van slachtoffers worden doorverwezen naar specifieke diensten die gespecialiseerd zijn in het opsporen, de opvang en de identificatie van slachtoffers en de opvang van familieleden en verwanten van slachtoffers. >Dat kan DSI (Dienst Sociale Interventie van het Rode Kruis) zijn, maar ook het gemeentelijk niveau of het OCMW van een gemeente kan instaan voor de opvang van slachtoffers en familieleden.<

6. Communicatiemiddelen en -acties per doelgroep

6.1 Doelgroep: betrokken bevolking

Middelen

- pers
- website
- teletekst regionale/nationale tv
- informatienummer
- omroepwagens / public address (politie)
- specifieke alarmeringskanalen: sirenes, sms, ...

▷ middel: pers

Informatie over:

- de situatie
- de maatregelen die de doelgroep(en) in acht moet(en) nemen

▷ middel: website

Informatie over:

- de situatie
- de maatregelen die de doelgroep(en) in acht moet(en) nemen

▷ middel: teletekst

Informatie over:

- de maatregelen die de doelgroep(en) in acht moet(en) nemen

▷ middel: informatienummer

Informatie over:

- de maatregelen die de doelgroep(en) in acht moet(en) nemen

NB: Het oprichten van een infocentrum voor slachtofferinfo kan eventueel met behulp van het DSI (Dringende Sociale Interventie van het Rode Kruis). Zij hebben specifieke ervaring over hoe te reageren op ongeruste vragen, hoe mensen gerust te stellen, welke informatie wel en niet te geven, naar wie of naar waar mensen door te verwijzen, enz.

▷ middel: public adress (politie)

Informatie over:

- de maatregelen die de doelgroep(en) in acht moet(en) nemen
- advies: luister naar de media

▷ middel: specifieke alarmeringskanalen

Informatie over:

- de maatregelen die de doelgroep(en) in acht moet(en) nemen
- advies: luister naar de media

6.2 Doelgroep: bevolking in het algemeen

Middelen

- pers
- website
- teletekst regionale/nationale tv

▷ **middel: pers**

Informatie over:

- **de situatie**
- **de maatregelen voor de betrokken bevolking**
- **verkeersinformatie voor de bevolking in het algemeen**

▷ **middel: website**

Informatie over:

- **de situatie**
- **de maatregelen voor de betrokken bevolking**
- **verkeersinformatie voor de bevolking in het algemeen**

▷ **middel: teletekst**

Informatie over:

- **de situatie**
- **de maatregelen voor de betrokken bevolking**
- **verkeersinformatie voor de bevolking in het algemeen**

6.3 Doelgroep: pers

Middelen

- **persbericht**
- **persbriefing/-conferentie**
- **informatiecentrum**
- **website**

▷ **middel: persbericht(en)**

wanneer	<ul style="list-style-type: none">• bij aanvang van oprichten coördinatiecomité• tussentijds (eventueel)• afblazen van de noodfase
inhoud	<ul style="list-style-type: none">• informatie over locatie en aard van de ramp• aantal slachtoffers• maatregelen te nemen door de bevolking, eventueel evacuatie• verkeersmaatregelen• infonummer voor de bevolking• infonummer voor de pers• adres website• inzet middelen (eventueel afsluitend)• verloop hulpverlening (eventueel afsluitend)

▷ **middel: persbriefing/ -conferentie**

Wanneer (hangt samen met duur ramp)	<ul style="list-style-type: none">• tussentijds• na afblazen noodfase
Wie	<ul style="list-style-type: none">• coördinator hulpverlening (burgemeester, gouverneur, minister)• verantwoordelijken van de verschillende disciplines
Inhoud	<ul style="list-style-type: none">• persbericht• samenvattende info bij einde• infobundel over noodplanning en crisisbeheer

- ▷ **middel: perscentrum**
- Continu ter beschikking staan van de pers (o.a. telefonisch) om te antwoorden op hun vragen.
- De pers wordt opgevangen in het lokaal perscentrum en wordt daar geïnformeerd. Er is een voortdurende afstemming met de Dir-Info over de gevalideerde informatie, aard van de vragen, mediadruk, gevoerde communicatie-acties, ...

- ▷ **middel: website**
- Bevat:
- **persberichten**

Annex 2 : Overzichtlijst Acties Voorgesteld door CIW

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Annex 3 : Hoorzittingen Vlaams Parlement

5 Hoorzittingen Vlaams Parlement

5.1 Verenigde Commissie

Naar aanleiding van de overstromingen in november 2010 heeft het Vlaams Parlement een Verenigde Commissie (de Commissie Leefmilieu, Natuur, Ruimtelijke Ordening en Onroerend Erfgoed en de Commissie Mobiliteit en Openbare Werken) in het leven geroepen, die zich over de overstromingsproblematiek in Vlaanderen heeft gebogen.

In de periode januari tot maart 2011 heeft deze Verenigde Commissie in het Vlaams Parlement regelmatig vergadering gehouden. Vertegenwoordigers van verschillende organisaties hebben er hun bevindingen, bedenkingen en aanbevelingen gegeven over de problematiek van het waterbeheer en de wateroverlast in Vlaanderen.

Achtereenvolgens kwamen aan het woord:

- vertegenwoordigers van de Coördinatiecommissie Integraal Waterbeleid (F. VANSEVENCOTEN en L. DE ROECK) en de bekkencoördinatoren van het Denderbekken en Netebekken (A. SEVENANT, B. ABRAMS) over de stand van zaken van het Vlaamse waterbeleid en een analyse van de voorbije overstromingen (13 januari 2011);
- wetenschappers (prof. J. BERLAMONT (KU Leuven); dr. F. MOSTAERT (Waterbouwkundig Laboratorium), prof. P. MEIRE (UA - Leerstoel integraal waterbeleid), dr. A. CRABBÉ (UA, bestuurswetenschappen) en P. DE SMEDT (UG, Centrum voor Milieu- en Energierecht) over de uitdagingen op het vlak van integraal waterbeleid en watersysteemkennis (20 januari 2011);
- maatschappelijke actoren (landbouworganisaties en milieuorganisaties) (P. BROECKX & L. FRANCOIS (BB), K. KARELS (ABS) en E. GRIETENS (BBL), W. VAN GILS (Natuurpunt)) met betrekking tot een analyse van het beleid (25 januari 2011);
- de waterloopbeheerders (L. CLINCKERS (NV W&Z) en E. PORTUGAELS (NV De Scheepvaart voor de bevaarbare waterlopen Vlaams Gewest), P. THOMAS (VMM), P. HERTOOG, F. SMEETS, D. SOENS (VVP), C. CLAEYS (VVSG), J. VAN LOOY en F. CREMERS (VVPW) voor de onbevaarbare waterlopen) met betrekking tot een analyse van het beleid (10 februari 2011);
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- AON (S. TEMMERMAN, K. ENGEL, L. ROMBOUT) en ASSURALIA (W. ROBYNS) over de problematiek van risico, crisismanagement, rampenplanning, verzekering (3 maart 2011);
- de Provinciegouverneurs (C. BERX, L. DE WITTE) en hun rol bij de noodplanning en bij het integraal waterbeleid (22 maart 2011).

De Verenigde commissie bracht in het kader van de problematiek van waterbeheer en wateroverlast op 7 april en 8 april een werkbezoek aan het Environment Agency en Thames Water in Londen.

5.2 Hoorzitting met de CIW

De CIW, die het waterbeleid in Vlaanderen coördineert, kwam als eerste aan de beurt in de reeks hoorzittingen. De voorzitter en de secretaris stelden er de CIW voor (opdracht, samenstelling, taken, werking, realisaties) en gaven toelichting bij de rol van de CIW in de overstromingsproblematiek. Het CIW evaluatierapport op hoofdlijnen van de overstromingen van november 2011 werd er voorgesteld. De focus hierbij lag op de aanbevelingen die in het evaluatierapport zijn opgenomen. De bekkencoördinatoren van het Denderbekken en het Netebekken gingen dieper in op de specifieke situaties mbt de overstromingsproblematiek in hun bekken.

5.3 Conclusies hoorzittingen

De verslagen en conclusies van de Verenigde Commissie waren niet tijdig beschikbaar om te kunnen worden mee opgenomen in voorliggende Globale evaluatie van de CIW.

De verslagen en conclusies zullen kunnen geraadpleegd worden via www.vlaamsparlement.be .

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Terms and definitions

<i>Term</i>	<i>Definition</i>
Adaptive capacity	Is the availability to plan, prepare for, facilitate and implement adaptation options. Factors that determine a community adaptive capacity include its economic wealth, its technology and infrastructure, the information, knowledge and skills that it possesses, the nature of its institutions, its commitment to equity, and its social capital.
Communication	The concept, science, technique and process of transmitting, receiving or otherwise exchanging information and data.
Consequence*	An impact such as economic, social or environmental damage/improvement that may result from a flood. May be expressed quantitatively (e.g. monetary value), by category (e.g. High, Medium, Low) or descriptively.
Coping capacity*	The means by which people or organisations use available resources and abilities to face adverse consequences that could lead to a disaster.
Early Warning System	System to empower individuals and communities threatened by hazards to act in time and in an appropriate manner to reduce the possibility of personal injury, loss of life, damage to property and the environment, and loss of livelihoods.
Emergency management*	The ensemble of the activities covering emergency planning, emergency control and post-event assessment.
Emergency planning*	Emergency planning tends to be undertaken by the local and/or regional authorities in collaboration with other emergency responders (including fire and rescue, police and ambulance services, hospitals, etc.) and usually covers all types of disaster, not just flooding.
Emergency plan*	This outlines the systems that are in place to enable the authorities and emergency services to respond as effectively as possible to mitigate the effects of any "major" emergency.
Exposure*	Quantification of the receptors that may be influenced by a hazard (flood), for example, number of people and their demographics, number and type of properties etc.
Flexibility*	Within the context of assessing the sustainability of flood risk systems, flexibility is the ease with which a flood risk system (or strategic alternative) can adapt to changing circumstances without future regrets about decisions and measures implemented.
Flood*	The temporary covering by water of land not normally covered by water [<i>Definition from the European Directive on the assessment and management of floods (Directive 2007/60/EC); the "Floods Directive"</i>]
Flood event management*	If flooding is imminent or already taking place, there are activities that can be carried out to reduce the impact of the flood. These actions are described as "flood event management" or "flood incident management" or more rarely "operational flood management". There are four main types of activities: <ul style="list-style-type: none"> • Detection of the likelihood of a flood forming (hydro-meteorology); • Forecasting of future river flow conditions from the hydro-meteorological observations; • Warning issued to the appropriate authorities and the public on the extent, severity and timing of the flood; and • Response to the emergency by the public and the authorities, including

Term	Definition
	<ul style="list-style-type: none"> • Operation of barriers, gates, demountable defences, etc. • Provision of temporary flood protection measures (e.g. sandbags) • Evacuation (including the use of safe havens), and • Rescue.
Flood event management planning*	<p>A pre-flood activity, undertaken in close collaboration with emergency planners</p> <ul style="list-style-type: none"> • To establish the need for the above, and • To put in place the required services and infrastructure.
Flood forecasting system*	A system designed to forecast flood levels before they occur
Flood management measures*	Actions that are taken to reduce either the probability of flooding or the consequences of flooding or some combination of the two.
Flood prevention*	Actions to prevent the occurrence of an extreme discharge peak.
Flood protection (measure)*	to protect a certain area from inundation (using dikes etc).
Flood risk*	The combination of the probability of a flood event and of the potential adverse consequences for human health, the environment, cultural heritage and economic activity associated with a flood event. [<i>Definition from the European Directive on the assessment and management of floods (Directive 2007/60/EC); the "Floods Directive"</i>].
Flood Risk Maps*	<p>Flood risk maps indicate the potential adverse consequences associated with floods, usually based on a range of flood event probabilities. These can be expressed, for example, in terms of:</p> <ul style="list-style-type: none"> • Indicative numbers of inhabitants potentially affected by the flooding; • Economic damages or types of economic activity potentially affected by the flooding; or • Location or quantification of accidental pollution caused by flooding.
Flood warning system*	A system designed to warn members of the public of the potential of imminent flooding. Typically linked to a flood forecasting system.
Forecasting	Statements or statistical estimates of the occurrence of a future event.
Fragility*	The propensity of a particular defence or system to fail under a given load condition.
Governance*	The processes of decision making and implementation
Harm*	Disadvantageous consequences — economic, social or environmental. (See <i>Consequence</i>).
Hazard*	A physical event, phenomenon or human activity with the <i>potential</i> to result in harm. A hazard does not necessarily lead to harm.
Hazard mapping*	The process of establishing the spatial extents of hazardous phenomena.
Institutional uncertainty*	inadequate collaboration and/or trust among institutions, potentially due to poor communication, lack of understanding, overall bureaucratic culture, conflicting sub-cultures, traditions and missions.
Inundation*	Flooding of land with water.
Legal and policy conditions	Dealing with circumstances and states in the definition, provision or amendment of existing or new policies and/or legal framework in the context of flood risk management.
Mitigation*	see <i>Flood management measures</i>
Mitigation measures	Actions that are taken to reduce either the probability of flooding or the consequences of flooding or some combination of the two.

Term	Definition
Monitoring, forecasting and warning systems	A coordinated body of sensors and communications devices that observes, detects, or records the relevant variables in order to forecast the future developments and to give a signal of danger, if a predetermined parameter is exceeded.
Natural hazards	Geologic, meteorological or biological situation with a potential for harm to life, health or property, damage to the environment or some combination of these.
Policy instruments	The method mechanism used by government, political parties, business or individuals to achieve a desired effect, through legal or economic means.
Pre-flood mitigation*	Measures and instruments in advance to a flood event to provide prevention (reducing flood hazards and flood risks by e.g. planning) and preparedness (enhancing organisational coping capacities).
Preparedness*	The ability to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.
Public participation	Open, ongoing, two way communication both formal and informal, between a governing body/organisation and its stakeholders – those affected by its actions.
Public perception	The subjective judgment that people make about the characteristics and severity of any process or state (including risk perception).
Resilience (e.g. on property-level)	Is the availability/capacity to recover from (or resist being affected by) some disturbance or perturbation, i.e. to reduce the consequences of water incursion.
Resistance (e.g. on property-level)	Measures to prevent or at least minimise the entry of floodwater into properties.
Response*	The reaction of a defence or system to environmental loading or changed policy.
Risk*	Risk is a function of probability, exposure and vulnerability. Often, in practice, exposure is incorporated in the assessment of consequences, therefore risk can be considered as having two components — the probability that an event will occur and the impact (or <i>consequence</i>) associated with that event. Often this is abbreviated as Risk = Probability multiplied by consequence.
Risk analysis	A methodology to objectively determine risk by analysing and combining probabilities and consequences.
Risk assessment	Comprises understanding, evaluating and interpreting the perceptions of risk and societal tolerances of risk to inform decisions and actions in the flood management process.
Risk awareness	Comprises the perception and cognitive reaction to a condition or event at risk.
Risk communication*	Any intentional exchange of information on environmental and/or health risks between interested parties.
Risk management	The complete process of risk analysis, risk assessment, options appraisal and implementation of risk management measures.
Risk management measure*	An action that is taken to reduce either the probability of flooding or the consequences of flooding or some combination of the two
Risk mapping*	The process of establishing the spatial extent of risk (combining information on probability and consequences). Risk mapping requires combining maps of hazards and vulnerabilities. The results of these analyses are usually presented in the form of maps that show the magnitude and nature of the risk.

Term	Definition
Risk mitigation*	◀ See <i>Risk reduction</i> .
Risk perception*	◀ Risk perception is the view of risk held by a person or group and reflects cultural and personal values, as well as experience.
Risk reduction*	◀ The reduction of the likelihood of harm, by either reduction in the probability of a flood occurring or a reduction in the exposure or vulnerability of the receptors.
Scale*	◀ Difference in spatial extent or over time or in magnitude; critical determinant of vulnerability, resilience etc.
Sensitivity*	◀ Refers to either: the resilience of a particular receptor to a given hazard. For example, frequent sea water flooding may have considerably greater impact on a fresh water habitat, than a brackish lagoon; or: the change in a result or conclusion arising from a specific perturbation in input values or assumptions.
Social resilience*	◀ Social resilience is the capacity of a community (that has the potential to be exposed to hazards) to adapt (by resisting or changing) in order to reach and maintain its survival and functioning.
Social vulnerability*	◀ This can be defined as the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. (<i>cf vulnerability below</i>)
Socio-economic analysis	◀ Analysis of the relationship between economic activity (including investment) and social life.
Spatial planning*	◀ Public policy and actions intended to influence the distribution of activities in space and the linkages between them. It will operate at EU, national and local levels and embraces land use planning and regional policy.
Stakeholders*	◀ Parties/persons with a direct interest (stake) in an issue — also Stakeowners.
Statistic*	◀ A measurement of a variable of interest which is subject to random variation.
Susceptibility*	◀ The propensity of the people, property or other receptors to experience harm.
System*	◀ An assembly of elements, and the interconnections between them, constituting a whole and generally characterised by its behaviour. Applied also for social and human systems.
Uncertainty*	◀ A general concept that reflects our lack of sureness about someone or something, ranging from just short of complete sureness to an almost complete lack of conviction about an outcome.
Vulnerability	◀ Characteristic of a system that describes its potential to be harmed. It depends on the character, magnitude and rate of adverse change to which a system is exposed, its sensitivity and its adaptive capacity.
Water management	◀ The planned development, distribution and use of water resources.

* Definition taken from the Floodsite Report T32-04-01

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Glossary of acronyms and abbreviations

ANAS	◀	National Roads Authority
APAT	◀	Italian Geological Service – Department for Soil Protection of the Agency for Environmental Protection and Technical Services
ARGE	◀	Action Plan for preventive flood protection in the Weser basin
ANIP	◀	Algemeen Noodinterventieplan / General Emergency and Intervention Plans
Aon Belgium	◀	Belgian Insurance Company
AWM	◀	Adaptive Water Management
BauGB	◀	Building Development Act
BMBF	◀	Bundesministerium für Bildung und Forschung
BMP	◀	Basin Management Plan
BNIP	◀	Bijzonder Noodinterventieplan / Specific Emergency and Intervention Plans
CC	◀	Coordination committee
CCIEP	◀	Coordination Committee on International Environmental Policy
CEMAC	◀	Crisis & Emergency Management Centre (Belgium)
CIW	◀	Coördinatiecommissie Integraal Waterbeleid / Coordination Commission for Integrated Water Policy
CMCC	◀	Centro Euro-Mediterraneo per i Cambiamenti Climatici
CNR	◀	Italian National Research Council
COT	◀	Instituut voor Veiligheid- en crisismanagement (The Netherlands)
CP	◀	Protezione Civile / Civil Protection Department
CP - OPS	◀	Operational command post
CRED	◀	Collaborating Centre for Research on the Epidemiology of Disasters
CRUE-ERANET	◀	Coordination of the research financed in the European Union on flood management
DEM	◀	Digital Elevation Model
DG Environment	◀	Directorate-General Environment
Dir-Info	◀	Information director
DoW	◀	Description of Work
ECE	◀	Economic Commission for Europe
EEA	◀	European Environmental Agency
EM-DAT	◀	Emergency Events Database
EFAS	◀	European Flood Alert System
EIB	◀	European Investment Bank
EPS	◀	Ensemble Prediction System
EU	◀	European Union
EWASE	◀	Early Warning System Efficiency
EWC	◀	Early Warning Conference (UN)
EWS	◀	Early Warning System
FAQ	◀	Frequently Asked Questions
FD	◀	Floods Directive (EU)
FFW	◀	Flood Forecasting and Warning System
FLOTHER	◀	The Other Flood : Vulnerability & Resilience
FMP	◀	Flood Management Plan
FNP	◀	Hochwasserschutzplan

FREEMAN	◀	Flood REsilience Enhancement and MANagement
FPS	◀	Home Affairs Federal Public Service
FRM	◀	Flood Risk Management
FWS	◀	Flood warning system
GIS	◀	Geographic Information System
GNDCI	◀	National Group for the Prevention of Hydrogeological Disasters
GWK	◀	Gewässergüteklasse
HarmoniCOP	◀	European FP5 project HarmoniCOP
HAZ	◀	Hildesheimer Allgemeine Zeitung
HIC	◀	Hydrological Information Centre
HFA	◀	Hyogo Framework for Action
HRH	◀	Hoge Raad voor Herstelbeleid
ICT	◀	Information and Communication Technologies
IRBM	◀	Integrated River Basin Management
ISDR	◀	International Strategy for Disaster Reduction
ISPRA	◀	Istituto Superiore per la Protezione e la Ricerca Ambientale
ISRB	◀	International Scheldt River basin district
IT	◀	Information Technology
IWRM	◀	Integrated Water Resources Management
LAWA	◀	German Working Group of the Federal States on Water Issues
LWMP	◀	Local Water Management Plan
MINA	◀	Milieu- en Natuurraad van Vlaanderen
MOG	◀	Gemodeleerde overstromingsgebieden / Modelled Floods
MOW	◀	Departement Mobiliteit en Openbare Werken / Department of Mobility and Public Works
MVG	◀	Mijnverzakkingsgebieden / Mine depression zones
NIP	◀	Noodinterventieplan / Emergency Intervention Plan
NLWKN	◀	Niedersächsische Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz / Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency
NOG	◀	Natuurlijke Overstromingsgebieden / Natural Flood Areas
NWG	◀	Niedersächsisches Wassergesetz / Water Law of the Federal state of Lower Saxony
NWP	◀	Numerical Weather Prediction
OFDA	◀	Office of Foreign Disaster Assistance
PAI	◀	Piano di assetto idrogeologico
PD	◀	Police Department
POG	◀	Potentieel Overstroomde gebieden / Potential Flood Areas
PROP	◀	Regionale Raumordnungsprogramme / Regional Spatial Planning Programme
PTKA	◀	Project Management Agency Research Centre Karlsruhe
RBMP	◀	River Basin Management Plan
ROG	◀	Recent Overstroomde Gebieden / Recent Occurred Floods
ROG	◀	Raumordnungsgesetz / Regional Planning Act
RWO-department	◀	The Department 'Town and Country Planning, Housing Policy and Immovable Heritage'
SARF	◀	Social Amplification of Risk Framework
SERV	◀	Sociaal-Economische Raad van Vlaanderen

SEVESO	◀	A <i>Seveso</i> company is a company that is engaged in the field of treatment, production, use or storage of hazardous substances (e.g. refineries, petrochemical plants, chemical plants, storage facilities for explosives).
SSP	◀	Flemish Spatial Structure Plan
THW	◀	Technisches Hilfswerk
UA	◀	University of Antwerp
UN	◀	United Nations
VLACORO	◀	Vlaamse Commissie Ruimtelijke Ordening
VMM	◀	Vlaamse Milieumaatschappij / Flemish Environment Agency
W&Z	◀	Waterwegen en Zeekanaal / Agency 'Waterways and Sea Canal'
WFD	◀	Water Framework Directive
WHO	◀	World Health Organization
WP	◀	Work Package

Table of project information

Joint project title	◀ FREEMAN Flood RESilience Enhancement and MANagement: a pilot study in Flanders, Germany and Italy
CRUE Project No.:	◀ III
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Project website:	◀ http://www.feem-project.net/FREEMAN/
Objectives	◀ The overall objective of this project is to provide guidance on the integration of 'flood resilience' into operational Flood Risk Management based on selected historic flood events in Flanders/Belgium, Niedersachsen/Germany and Calabria/Italy. Rather than developing a universal way to characterize resilience, we aim to develop a methodology which can contribute to the operational management of flood consequences.
Background	◀ Floods are natural phenomena which cannot be prevented but the adverse impacts can be reduced. In this project, we focus on socio-economic resilience of communities in flood prone areas. In line with the 2nd ERA-Net CRUE call, resilience is 'the capacity of a system or a person to success and develop, in a way socially acceptable, when confronted with stress and an adversity'.
Research	◀ To convey the concept of resilience to decision-makers, flood managers and public, and help to translate its main underpinnings into flood management practices; To identify important drivers that affect (amplify or dampen) flood resilience, as well as strategies and measures that increase flood resilience, by focusing on: 1) risk perception and communication; 2) flood risk assessment and flood forecasting systems and 3) flood policy framework and institutional set-up; To identify quick wins (much gain with little effort) to enhance flood resilience on case study level in close cooperation with the case studies' flood managers; To provide guidance on the integration of flood resilience into flood risk management as a contribution to the implementation of the Floods Directive (FD); To disseminate project results to the policy level, as well as to the scientific community.

Findings	<p>◀ The project results outline the role of and contributions from various organisations, involved or affected by the flood risk management, towards an integrated disaster risk reduction strategy. Furthermore, the project has produced case studies that can be applied in capacity building exercises further enhancing the ability and skills of the above organisations. We have shown how flood risk tools (management plans and early warning systems) can be designed and deployed for a better understanding of risk. Equally important though is the recognition of the limitations of these tools, that can inform efforts to understand one's own vulnerability to floods.</p>
Implications (Outcome)	<p>◀ Information provision, consultation and education are tasks that should be provided by the responsible authorities. Flood managers should make sure that relevant knowledge is easy to access and understand. This also holds for monitoring- and early warning systems: flood managers must provide sufficient, comprehensible and easy to access information. For flood management authorities this implies a permanent incorporation of stakeholder interests in their flood management activities. There should be a chance of co-operation, and if necessary with a more interactive consultation and learning process. Flood monitoring and flood forecasting tools (only the front ends) should be easily accessible and comprehensible.</p>
Publications related to the project	<p>◀ Schelfaut, K., et al., Bringing flood resilience into practice: the FREEMAN project. <i>Environ. Sci. Policy</i> (2011), doi:10.1016/j.envsci.2011.02.009</p> <p>Krywkow et al. 2011. Resilience indicators and risk characteristics for the analysis of flood management.</p> <p>Schelfaut et al. 2011. FREEMAN: Flood Resilience Enhancement and Management</p> <p>Legal status of uncertainty: a reply (A response to the Altamura, M., Ferraris, L., Miozzo, D., Musso, L., and Siccardi, F.: The legal status of Uncertainty, <i>Nat. Hazards Earth Syst. Sci.</i>, 11, 797-806, doi:10.5194/nhess-11-797-2011, 2011)</p>