WGF17 WORKSHOP

Flood preparedness, resilience and adaptation

FINAL DRAFT Report of a workshop held on 9 and 10 March 2015
Ellips Building
Flemish Government
Koning Albert II – laan 35
1030 Brussels, Belgium

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This is the **final draft** report of the WG F thematic workshop on flood preparedness, resilience and adaptation, held in Brussels, Belgium in March 2015.

Disclaimer:
The views represented in this report do not necessarily represent the views of all participants or the organisations they represent.

Cover image: Erecting temporary flood barriers, Oxfordshire, England

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Executive Summary

As a part of series of workshops on the implementation of the Floods Directive, a thematic WG F workshop took place in Brussels, Belgium on the topic of flood preparedness, resilience and adaptation on 9 and 10 March 2015. The workshop was co-hosted by the Flemish Government and Flanders Environment Agency and co-organised by representatives from the European Commission, WG F representatives from the UK and Sweden, and the European Water Association. During the workshop, 22 member states, the European Commission and other stakeholders were represented by 50 delegates.

The workshop focused on three key inter-related aspects of flood risk management, drawing significantly on the lessons learned by member states across the EU from a diverse range of flood events, in terms of flood source and scale, which have been experienced in recent years. The areas of focus and issues considered were:

- how prepared are member states for flood events?
- how resilient are member states to flood events in terms of the ability to absorb the impact of an event, and recover from it quickly?
- what actions are being taken, at all levels, to adapt to climate change impacts with regard to flooding?

In preparation for the workshop a comprehensive questionnaire was circulated to all member states for completion, covering a wide range of aspects related to preparedness, resilience and adaptation, as well as recent flood event information to illustrate many of the issues raised. Responses were received from 22 member states covering many forms of flooding, and different geographical and climatic areas. The responses from the questionnaire are summarised in the report and were used to help develop the content of the workshop.

The main objectives were to discuss the lessons learned by member states from recent flood events, and the experience of implementing the Floods Directive requirements, to inform policy and technical actions that would make a positive difference to preparing for floods, developing resilience against floods, and adapting to the impacts of climate change.

Workshop theme discussions

During the workshop the following themes and issues were discussed through a series of presentations and smaller group discussion sessions:

- Floods Directive tools and actions to raise preparedness and resilience
- lessons for communications and coordination of responses during flood events, community awareness and involvement, and protecting vital societal functions
- improvements in technology to improve preparedness, response and recovery for future floods
- current actions being taken to adapt to climate change with regard to flooding
- adaptation actions at different levels of government and at business and community level to raise resilience to future flooding in a changing climate.

Overall workshop conclusion

The overall conclusion from this flood preparedness, resilience and adaptation workshop is that, across much of the EU, there is a good level of **preparedness** and **resilience** to flooding which has been significantly enhanced through the implementation of the Floods Directive. Measures are also being implemented with regard to climate change **adaptation,** although this aspect is less advanced than the preparedness and resilience themes.

There is a wealth of experience that each member state can draw on, based on the lessons learned from different flood events in other member states. The pathways to learning from other member states are open through WG F, and there is significant benefit to be gained by considering how to transfer lessons, policy and practice from one member state to another. By doing so, our collective preparedness, resilience and adaptive response will be enhanced.

Main observations and conclusions are:

- **flood risk is highlighted as a major issue for virtually all member states within the context of each member state's national risk assessment**. There is a strong perception that climate change will result in an increase in the frequency and severity of flood events
- **significant action is being taken across the EU to prepare for floods,** both through the delivery of requirements of the Floods Directive, and through implementing lessons from recent flood events
- **technological improvements with regard to meteorological and flood forecasting, and communication of flood warnings are required**, particularly with regard to pluvial flooding, to support preparedness for, and resilience to, these events
- **communication of flood risk at all levels needs to be improved** so that there is a better understanding at national, regional and local levels across a range of stakeholders, enabling the necessary actions to be taken to prepare for and be more resilient to flooding
- **trans-boundary flood risk management has been enhanced through the implementation of the Floods Directive,** helping to define a common approach to flood risk management by focussing on the river basin scale
- **there is a strong perception that climate change will result in an increase in the frequency and severity of flood events**, although there is uncertainty in some geographical areas and for some forms of flooding
- **there are significant challenges with communication and awareness raising** with the public and stakeholders around issues related to flood risk and climate change
- **spatial planning and control of development on flood plains** and other areas at risk of flooding is a recurring theme of concern in many member states
- **flood events can expose the vulnerability of critical infrastructure, resulting in "cascade" effects**, as well as being the core trigger event for multiple infrastructure failures.

Workshop recommendations

- **There is a need for enhanced flood forecasting and flood warning systems for short duration pluvial flood risk**, to deliver more accurate warnings with longer lead times to support better preparedness before the onset of an event, and more targeted, co-ordinated emergency responses during an event.

  Recommendation: WGF members to share the latest developments in pluvial flood forecasting and warning, and how this is used to prepare for pluvial flood events. *Note: A Workshop on Pluvial Flooding is already identified within the Work Programme 2016-18*.

- **Effective communication across a wide range of flood risk management issues and associated aspects of climate change is critical.** This includes communications with the public, business / commercial sectors, media, politicians and other stakeholders.

  Recommendation: WGF give consideration to a Workshop on flood risk communication as part of the Work Programme 2016-18 building on the findings of the workshop held in Romania, 2012.

- **Spatial planning and development control needs to be strengthened to prevent inappropriate development on flood plains or in other flood risk areas.** Flood plains typically represent areas exposed to fluvial or coastal flood hazards. By contrast, areas vulnerable to surface water and groundwater flooding are not always obvious. Greater consideration in spatial planning should be given to all forms of flooding. ***Note:*** Spatial planning is one of the themes for the short workshop in Madrid in October 2015 back-to-back with WG F 18.

- **The "cascade" effects of a flood event affecting critical infrastructure in one location leading to significant impacts beyond the boundary of the asset affected should be integral to flood risk management solutions.** Consideration of the multiple impacts of flooding on infrastructure should also be considered, as a flood event is often the single trigger event for critical incidents across multiple sectors.

  Recommendation: Member states to consider how sharing of information could reduce "system" vulnerability to flooding, and develop improved resilience to avoid cascade risks. This includes sectors affected by flooding and those risk management authorities at international, national, regional and local levels responsible for delivery of flood risk management measures and responses. WG F should consider holding a short (1-day) workshop on "Flood Risk and Critical Infrastructure" addressing: flood hazard to CI, vulnerability of CI to flood damage, potential cascade pathways, and managing flood risk to CI and cascade effect risks.

This report collates the many observations made during the workshop and presents recommendations under these thematic sessions. Material and records relating to the workshop activities are presented as a series of appendices to the report. All papers and presentations made at the workshop are available on the EU CIRCABC web site:
https://circabc.europa.eu/w/browse/d315123e-9818-47fe-915b-d8c644eb06cd

The library file path to the presentations is as follows (note, this is not a hyperlink):

/CircaBC/env/wfd/Library/floods_programme_1/b_wg_f_on_floods/17th meeting - 11-12_03_2015/Workshop on Flood Preparedness, Resilience and Adaptation

Section 1 – Workshop introduction

1.1 Introduction

Workshop title:	Flood preparedness, resilience and adaptation
Date:	9 – 10 March 2015
Venue / host:	Flanders Government, Ellips Building, Koning Albert II-laan35, 1030 Brussels, Belgium
Organising committee:	Roger Orpin, Department for Environment, Food and Rural Affairs (DEFRA), UK Sadia Moeed, Environment Agency, UK Iain Blackwell, European Water Association Barbro Näslund-Landenmark, Swedish Civil Contingencies Agency, Sweden

1.2 Background

At the meeting of Working Group F (WG F) of 1 and 2 April 2014, it was agreed that a workshop would be held in Brussels on the topic of 'Flood preparedness and resilience' taking into account climate change.

Following coastal surges, winter storms and major flooding affecting the UK, France and other member states during autumn and winter 2013/14, a thematic workshop was proposed on flood preparedness and resilience at the April 2014 Working Group F meeting. The Floods Directive provides the tools to enable member states to plan and respond more effectively, and in so doing raise their resilience to flood events of all types. 'Preparedness' and 'resilience' are essential elements of climate adaptation at a time when the frequency and severity of major flood events in many parts of Europe appears to be increasing, consistent with climate change predictions. The workshop thus links with a previous workshop on 'Climate change and flood risk management' (September 2009), with the link to climate change and adaptation being retained due to the connected nature of the themes, and the need to take a strategic long term view of flood risk management across Member States.

The target audience for the workshop was those involved with policy, technical and strategic implementation issues, including WGF members, emergency planners, emergency responders, policy makers, and flood risk managers.

1.3 Objectives and outputs

The core objectives of the workshop were:

- lessons learnt in relation to preparedness/resilience from recent flood events for countries and across Europe
- to discuss the key policy and technical issues around preparedness/resilience that make a difference that would help countries prioritise their main flood risks

- to discuss and draw conclusions/recommendations on how we use the activities of the Floods Directive to raise the overall level of preparedness of member states to manage flooding
- to review and identify key adaptation actions which support the EU Adaptation Strategy and initiatives relating to flood risks
- to report conclusions and recommendations to WG F for second cycle consideration.

This report is the output of the workshop and incorporates:

- the papers presented at the workshop, including recent developments across Europe.
- a summary of the questionnaire responses
- summaries of the discussions held and key issues and themes emerging from the workshop sessions
- an outline of issues requiring further analysis and discussion.

1.4 Workshop structure

The programme for the workshop is included in Appendix I. The workshop comprised two main sessions, the first on the afternoon of 9 March 2015, and the second in the morning of 10 March 2015, as follows:

- Session 1: Learning from recent events
- Session 2: Adapting for the future

Within each session, the format was similar, with each session being opened with a 'Setting the scene' presentation by a representative from the European Commission. Following this, there were three presentations covering different aspects of the topics to be covered in the breakout sessions.

After the presentations, attendees were split into four breakout groups, each of which looked at two topics relevant to the session. The subject of each breakout group was based on the workshop questionnaire, which was circulated and completed by member states in advance of the workshop. The breakout groups were as listed below, with each topic being considered by two different groups of attendees. This allowed each workshop attendee to contribute to two of the four topic discussions.

Session 1: Learning from Recent Events

- Topic 1: What Floods Directive tools/actions have been most useful in raising preparedness and resilience?
- Topic 2: Lessons for communications – coordination of response – effective warning to cover both Government and community perspectives
- Topic 3: Lessons for community awareness and involvement
- Topic 4: Lessons for protecting vital societal functions e.g. critical infrastructure, hospitals, schools

Session 2: Adapting for the future

- Topic 1: What main actions are being taken to adapt to climate change with regard to flooding?
- Topic 2: What improvements in technology would make a difference in preparedness, response and recovery for future floods?
- Topic 3: What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?
- Topic 4: What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?

Following each main session, there was a feedback and discussion session. After the end of session 2, there was a brief summary presentation, drawing together some of the key themes that had emerged during the breakout sessions, and some of the key conclusions.

1.5 Reporting structure

The reporting structure for the workshop broadly follows the *"Guidance on the Structure of Thematic Workshop Report Formats and Content"* (27 October 2009, WG F Meeting No.6).

Section 1 provides the introduction and background to the workshop.

Section 2 summarises the main findings from the pre-workshop questionnaire which was completed by a total of 22 Member States. A small number of responses were received after the workshop. The findings from these have been included within this report.

Section 3 provides a summary of Session 1 "Learning from recent events"

Section 4 provides a summary of Session 2 "Adapting for the future"

Section 5 draws together the workshop summary and conclusions based on the main learning from each of the sessions and the subsequent feedback and discussion.

The series of **Appendices** includes information such as the workshop programme, list of delegates, questionnaire responses, presentations, and breakout session notes.

Section 2: Summary of questionnaire responses

2.1 Overview

A questionnaire was circulated pre-workshop to all member states. In total, 25 responses were received from 22 member states. This included two responses from the Czech Republic (national government response and a separate response from Odra River Board) and three responses from the UK (England, Wales and Northern Ireland) where flood risk is a devolved issue. The responses to the questionnaire were used to help inform the key issues for the workshop.

Figure 1 shows the member states that returned a response to the questionnaire. This shows great diversity in geographic regions providing a basis for considering the responses to cover the full range of flood risk management issues faced by the EU as a whole related to preparedness, resilience and adaptation. The spread of responses covers all forms of flooding, and geographical variation from colder northern latitudes to hotter drier Mediterranean areas; mountainous and lowland countries and regions; island and landlocked nations with major international river basins.

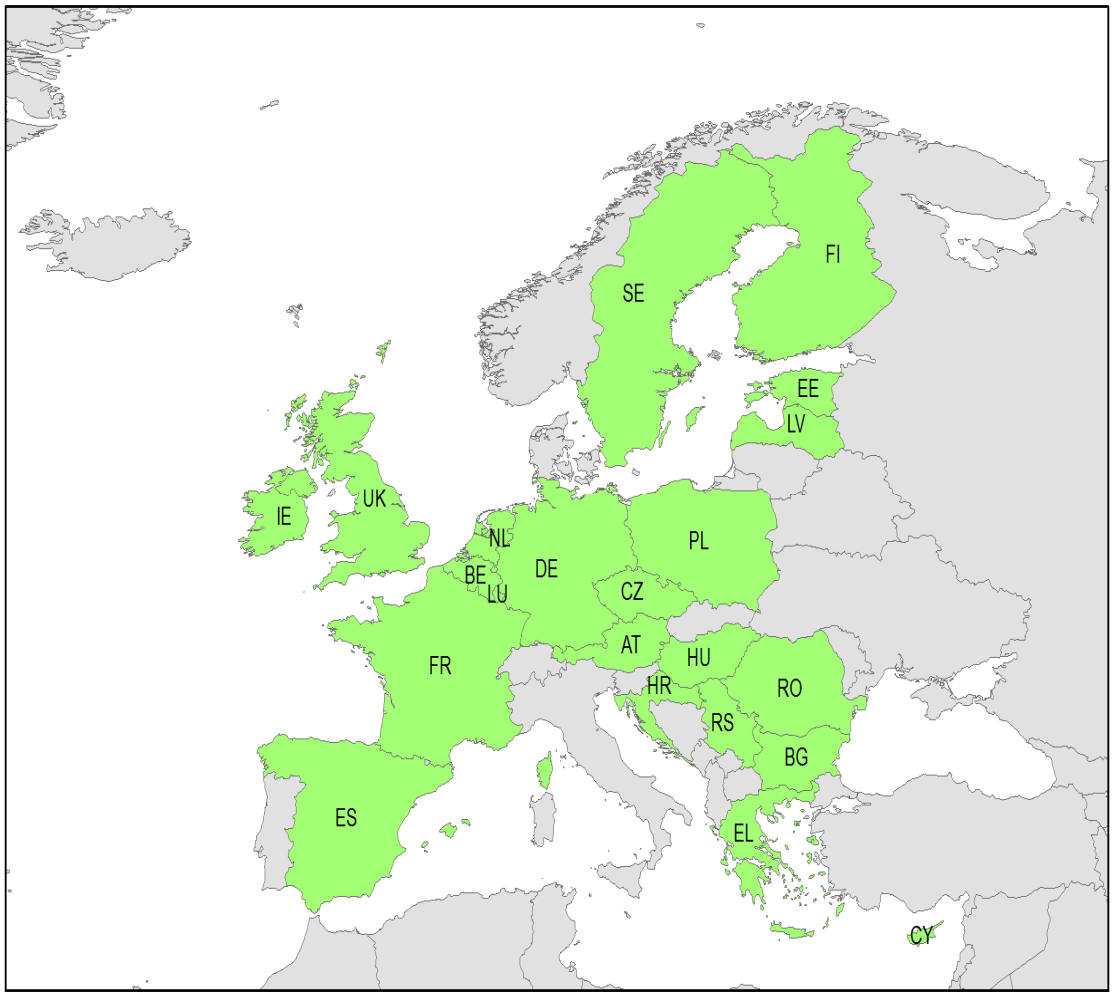


Figure 1 Map showing member states providing a response to the questionnaire

2.2 Learning from recent events

Below is brief summary of the main points from the questionnaire responses. More details of actual responses can be found in Annex III.

2.2.1 How well prepared is your member state for flooding?

In response to this question most member states (77%) assessed themselves to be 'well prepared' with two member states - Germany (DE) and Hungary (HU) - responding that they were 'very well prepared'. Four member states felt they were partly prepared – in one case this reflected that the member state was well prepared for some, but not for all, types of flood risk.

2.2.2 How resilient is your member state to flooding?

The majority of member states said they were either 'well prepared' (42%) or 'partly prepared' (46%). Two member states - Austria (AT) and Luxembourg (LU) - felt they were 'very resilient'. There was recognition that resilience could vary depending on the location and severity of flooding.

2.2.3 How advanced is your MS in adapting to climate change for more extreme flooding?

Just over half (52%) of member states felt they were 'partly prepared', with a further third (32%) reporting they were 'well prepared'. Finland (FI) was the only member state to say it was 'well advanced' in adapting to climate change.

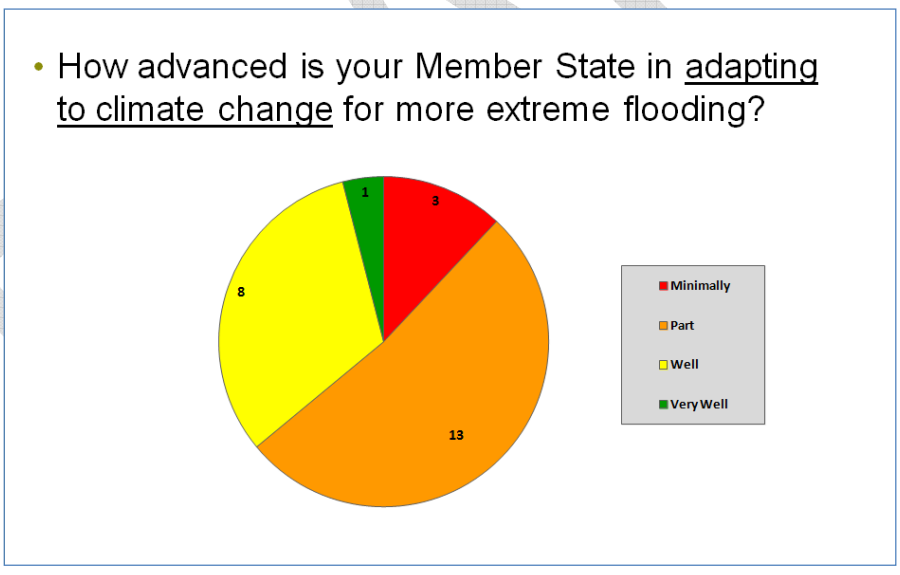


Figure 2 Adaptation to climate change

2.2.4 What are you most worried about with regard to preparedness, resilience or climate change adaptation?

There were a large number of different responses to this question. The top three issues raised were:

- community awareness of flood risk and what can be done to prepare (15 responses)
- financial and personnel resources (9 responses)

- flood defence resilience in a changing climate (8 responses)

Other popular responses (7 responses each) were: early warning systems to prepare for flooding; modelling and the uncertainty of climate change; lack of planning and development control; and emergency response co-ordination between organisations and the capacity to respond to events.

2.2.5 Feedback on recent flood events

Member states were asked to provide information on a maximum of three recent flood events. A short summary of some of the findings is below.

- The most common type of flooding was fluvial flooding followed by pluvial flooding. Often these were reported to occur in combination.
- Residential properties were impacted in almost all of the events reported on, followed by commercial property and roads. Most flood events affected a variety of receptors.

More details can be found in Annex III of this report, and in the full questionnaire responses spreadsheet available on the EU CIRCABC web site (see 2.2. above)

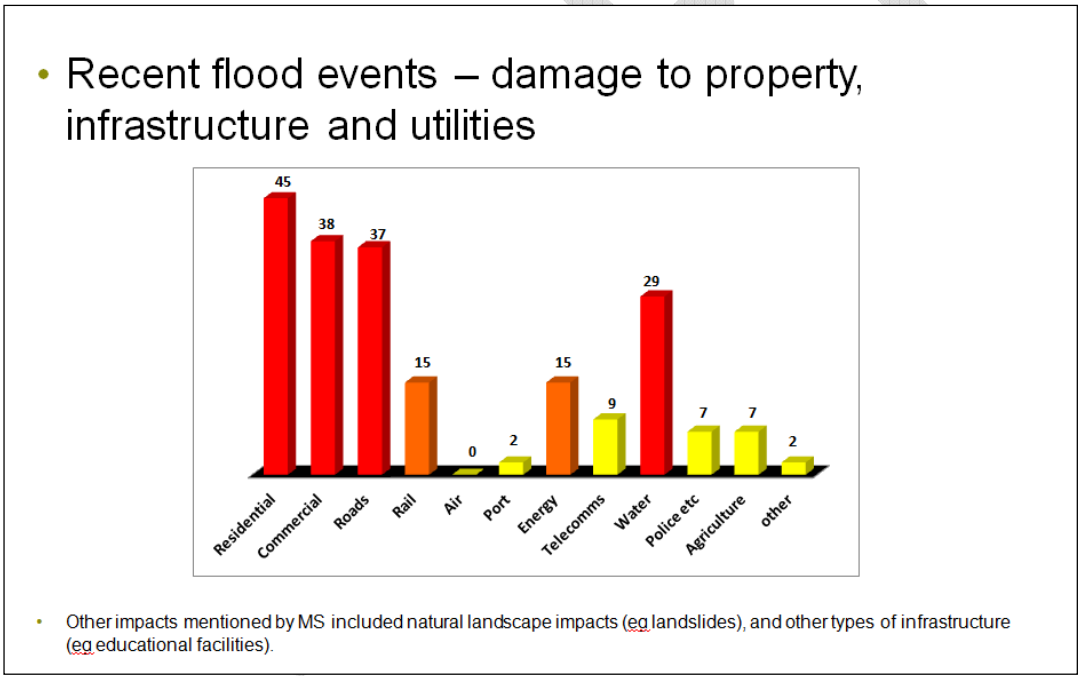


Figure 3 Damage to property, infrastructure and utilities from flooding

2.2.6 Main lessons learnt from recent flood events

The main lessons learnt from recent flood events can be summarised under four main headings:

1) Extent, performance and condition of assets (defences) proved inadequate in many cases.
    - Whilst new assets performed well, older assets were often in poor condition or had not been upgraded in line with the current understanding of flood risk; and

- Information on the condition of assets was often poor or not available.

2) Well-co-ordinated emergency plans are critical.

   - Need co-ordination between national and regional levels;
   - Need clear roles, responsibilities and lines of command;
   - Emergency response must be well resourced; and
   - Emergency plans must be regularly exercised to test and develop them.

3) Need for good forecasting systems to allow for early warning and communication of the developing situation during sustained flooding.

   - Need to improve the ability to forecast intense rainfall/flash flooding; and
   - Need trans-boundary co-operation where floods cross national boundaries.

4) Communication and engagement

   - Need to build relationships with communities (public and businesses) before, during and after flooding;
   - Educate and support the public to take the right actions; and
   - Recognise that considerable resource is needed for effective communication during floods.

2.2.7 What Floods Directive tools/actions were most useful in raising preparedness and resilience?

The most useful were the flood hazard and flood risk maps (14 responses) followed by Preliminary Flood Risk Assessment (PFRA). Flood Risk Management Plans (FRMPs) and a national catalogue of measures which allows for better measures to be developed were also cited as useful.

2.2.8 Level of individual responsibility and the extent of community action groups

A majority of member states responded that there was either a low or medium level (89%) of individual responsibility to reduce their own risk. Between two thirds to three quarters of member states had few or no community action groups.

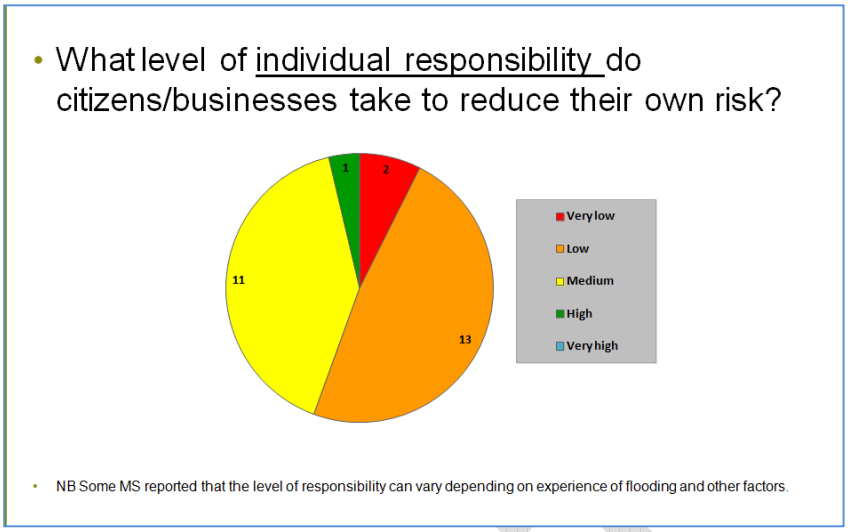


Figure 4 Individual responsibility for flood risk

2.2.9 Emergency planning

The most common (64%) response of member states was that they conducted emergency exercises annually. Currently only two member states had not run such exercises but one of these was planning to do so. Over 80% of respondents felt that the Floods Directive outputs had informed emergency planning exercises. The main benefits of conducting exercises were identified as:

- improved co-operation and co-ordination among risk and crisis players;
- greater visibility and awareness of flood risk in the community;
- better sharing of information; and
- means of identifying problems and contributing to a continuous improvement culture among participants.

2.3 Adaptation to climate change

The second part of the questionnaire focussed on climate change adaptation. A short summary of findings is given below.

2.3.1 Do you believe climate change will increase flood risk in your country in future, and what are the impacts and types of flood risk affected?

70% of Member States answered that climate change would increase flood risk with others saying they did not know. Nearly all respondents felt climate change would increase both the scale and frequency of flooding. There was concern principally about the three main types of flood risk - fluvial, pluvial and sea flooding.

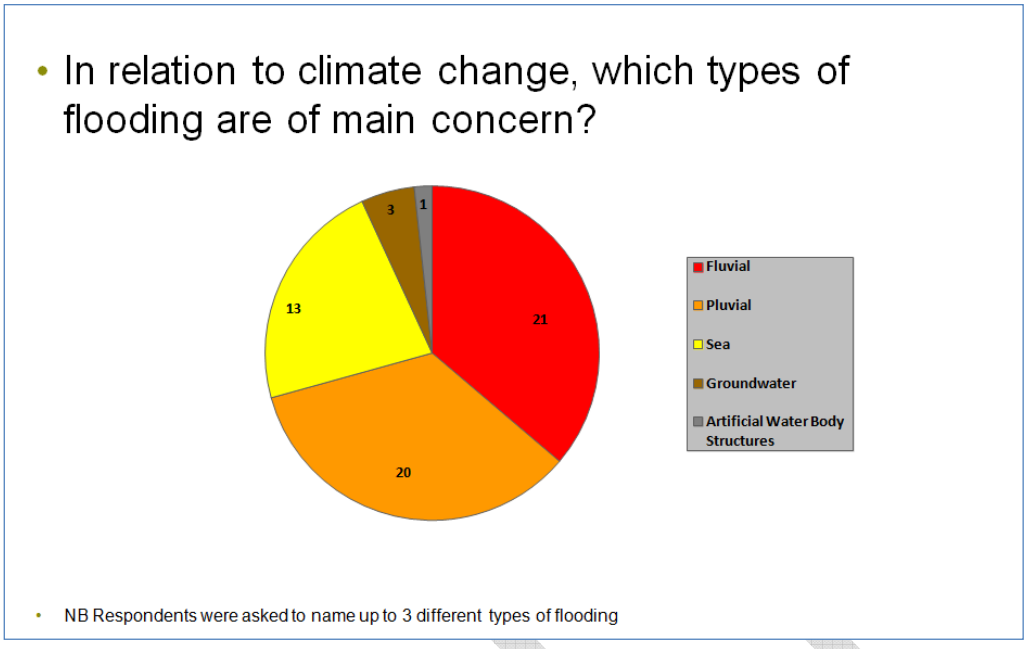


Figure 5 Climate change – types of flooding of concern

2.3.2 What main actions are being taken to adapt to climate change with regard to flooding?

The three main actions identified were:

- climate change vulnerability, impact and adaptation studies at a national and/or regional level (14 responses);
- raising public and business awareness of the impacts of climate change (13 responses);
- flood risk management measures and assets designed and built (or adapted) to take account of climate change (13 responses).

2.3.3 What improvements in technology would make a difference to preparedness, response and recovery of future floods?

There were two clear improvements that were felt to make a difference – improved flood warning systems and the associated communication of flood warnings (11 responses); and meteorological modelling and forecasting of spatial variation of intensity of extreme rainfall/pluvial flooding (9 responses).

2.3.4 Does your member state have a national adaptation plan (NAP)?

Approximately two thirds of member states had a NAP, with the remainder having a NAP under development.

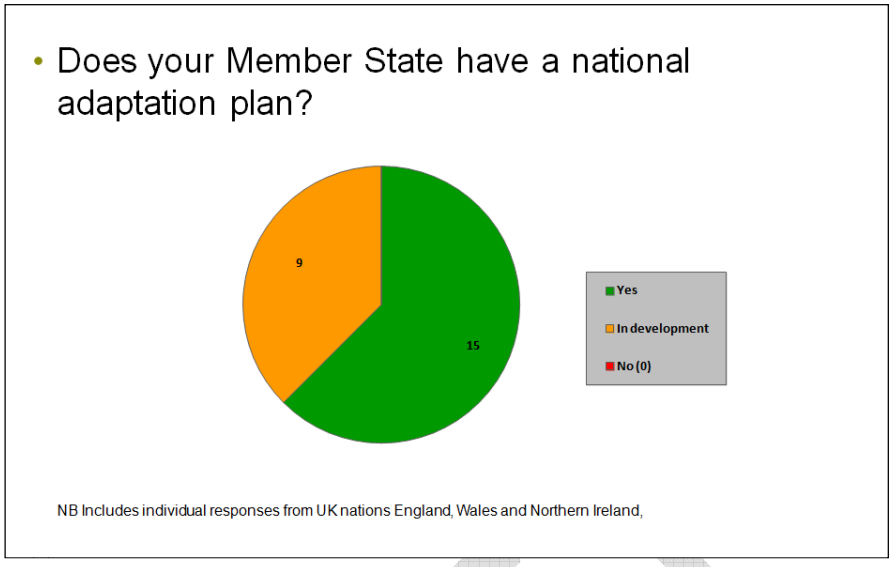


Figure 6 National adaptation planning

2.3.5 What further adaptation actions at a national/regional/local government level do you think will raise resilience?

The three main actions given are summarised as:

- greater adaptation of spatial planning (11 responses);
- flood protection measures that allow for future adaptation (8 responses)
- more accuracy in climate change projections, and improved analysis and understanding of risks, vulnerable areas and impacts (7 responses).

The need for local communities and businesses to take more responsibility for increasing their own resilience (7 responses), and more resilient buildings and infrastructure through better design and construction (6 responses) were also mentioned.

2.3.6 What future adaptation actions at business and community level do you think will raise resilience?

The main action was to engage with and raise awareness of climate change with the public, communities and businesses to increase personal responsibility and help people understand what they can do to increase their own resilience to flooding. There was a wide range of other actions including the need for better understanding by the private sector to increase adaptation; spatial planning; greater research on climate change impacts on floods; adaptive building and the promotion of property level protection.

Section 3: Report on workshop discussion sessions – Learning from recent events

3.1 Presentations on recent flood events and lessons learnt

Below is a summary of the presentations given, reflecting both EU and national perspectives.

3.1.1 Response and preparedness - Setting the scene

Andrew Bower, European Commission Humanitarian Aid and Civil Protection department (ECHO)

Andrew Bower (AB) of the European Commission's Directorate-General (DG) for Humanitarian Aid and Civil Protection (ECHO) gave an overview of their activities in disaster prevention and risk management, managed through DG ECHO Unit A3, which hosts an emergency response centre. The European Commission's (COM) Flagship Union Civil Protection Mechanism focuses on the whole disaster risk management cycle. The focus for the presentation was on prevention, response and preparedness.

At the heart of DG ECHO Unit A3 are risk assessments. There is now a commitment by member states to carry out risk assessments. On the basis of these assessments the COM will carry out a cross-sectoral overview and mapping exercise. Member states will have to provide a report/summary of risk assessments by 22 December 2015.

These risk assessments will also feed into other COM policies such as the Climate Change Adaptation and Cohesion Policy. With respect to developing national risk assessments, a set of guidelines was developed in December 2010(2 SEC (2010) 1626. Contributions from 21 member states indicated:

- data compatibility was important
- a clear methodology as to how to carry out a risk assessment
- use of a risk matrix

The guidelines may be reviewed in future. The risk matrices have been provided for guidance. This is an ongoing process and there is different level of completion across different member states. The most common hazard identified by member states was floods (20 of 21 MSs reported these). The criteria used by MSs are different, which makes comparison difficult. The Joint Research Centre (JRC) is looking at methodologies used by different MSs to see if there is any overlap. An overview of the risks is available online.

Flooding is one of 12 risks addressed. Andrew Bower outlined the policy relevance in terms of the following:

- Floods Directive
- climate change adaptation
- integrated threat assessment
- risk management capability
- assessment guidelines

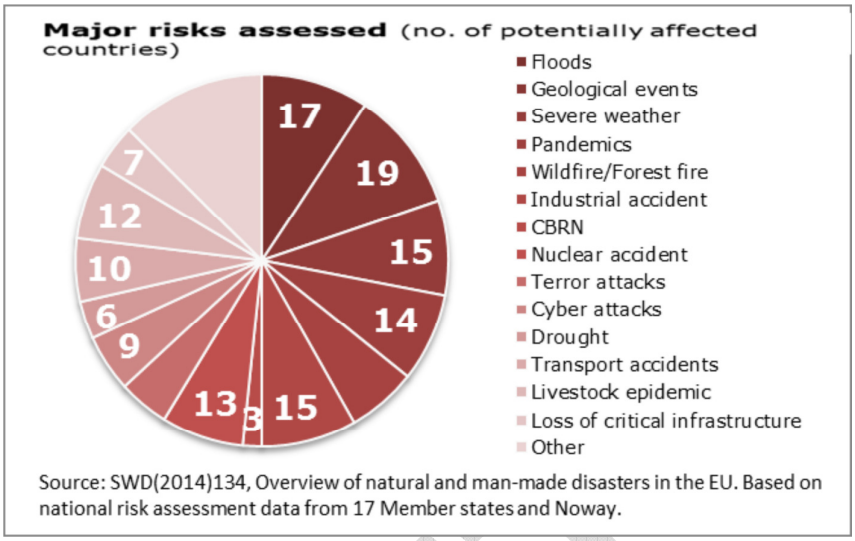


Figure 7 Overview of natural and man-made disasters in the EU

This will build on existing cooperation (e.g. Danube and Baltic initiatives). In parallel with this work there is a requirement to assess risk management capability. Each MS has to assess capacity at technical, administrative and financial levels. Dimensions looked at will be the risk assessment, planning and implementation measures.

There is a need to improve knowledge. There are a number of research projects (e.g. DamSafe, CBA Flood, SMART Water) working with the JRC Global Flood Partnership. There will be a networked approach towards a knowledge centre.

Mainstreaming prevention is the general focus of DG ECHO which includes:

- EU Climate change adaptation (April 2013)
- cohesion funds (2014 – 2020)
- Horizon 2020
- increased use of disaster insurance policies (a green paper was published 2013)

In terms of international cooperation there has been the following involvement:

- attendance at post-2015 Hyogo Framework for Action. COM played a key part in drafting a new framework that should be adopted in Sendai in Japan in March 2015
- informing the post-development agenda and Sustainable Development Goals (SDGs)
- international cooperation on disaster risk management (including neighbouring countries to EC plus international partners such as USA, Japan)

3.1.2 Recent flood events and lessons learnt in England - Environment Agency, England, UK

Craig Woolhouse (CW) gave an overview of the Environment Agency (EA) lessons learnt from recent floods and where the EA has been 'ahead of the game'. One of the EA's roles is in identifying flood risk and constructing flood defences. It is also important to have appropriate flood forecasting, warning and response to deal with the residual risks. Since 2000 there have been some significant floods in England and Wales, for example: summer

2007: 53,000 houses flooded; summer 2012: 8,000 houses flooded; winter 2013/14: 11,000 houses flooded.

Craig Woolhouse stated that there have been lots of lessons learnt and the technical response is in a good position. Whilst there were a large number of properties flooded between December 2013 and March 2014, 1.2 million homes were protected.

Figure 8 Pumping flood water on the Somerset Levels and Moors, South West England, winter 2013/14

In the Somerset Levels in south-west England a small number of communities were flooded for up to three months. In Boston on the east coast properties were flooded by a coastal surge. In Boston there were more houses flooded than in the Somerset Levels; however, in Somerset the flooding lasted longer.

CW stated that in England the EA could improve the way that it intervenes during floods. The EA is investing in pumps and temporary defences. The EA has completed 890 flood defence repair contracts in 10 months and spent approximately £200 million on flood defences. The EA has found that it is important to communicate effectively, through a range of media.

There was a marked contrast between the 1953 and 2013 coastal surge. No lives were lost in 2013 compared to 307 people who died in 1953. The Waverley Review on the 1953 flood published in 1954 stated that:

- London must be protected
- investment was recognised; however, this must be where there is most economic benefit, hence the standard of flood defences varies
- forecasting and warning must be improved to prevent loss of life

	January 1953	December 2013
Breaches	120 major	3 major
Properties flooded	24,000	2,600
Deaths	307	0
Agricultural Land flooded	65,000 hectares	6,800 hectares
People evacuated	32,000	18,000
Infrastructure impacts	2 Power stations 12 Gas Works 100 miles of roads 200 miles of rail	Major impacts at Immingham Port No power stations and major gas works/services affected Local road and rail
Flood Warnings	0	71 severe flood warnings Over 160 000 direct messages
Incident plans	0	National and east coast pre-planning and exercising

Figure 9 Comparison of impacts of tidal surge along the east coast of England in 1953 and 2013

The EA took advantage of the 60th anniversary of 1953 floods to carry out exercises and plans. As a result emergency responders felt more confident. Lessons were also learnt from Hurricane Sandy in USA in 2012. The human response to risk is important if we are going to reduce the risk to life. People have a natural "optimism bias". There is currently a flood story included in a major radio series in UK which helps to raise awareness.

CW concluded by stating that:

- with more frequent floods there are more lessons to learn
- it is important to learn the lessons not just identify them
- we must plan and exercise for known threats with the public and partners
- investing in forecasting gives you time to save lives
- securing people's actions is difficult

3.1.3 Being prepared for flooding: a Northern Ireland perspective - Rivers Agency, Northern Ireland, UK

Jonathan McKee (JM) provided some background to flooding in Northern Ireland. Approximately 45,000 properties are at risk. This is 1 in 18 of all properties. Four out of the five wettest years have occurred since 2000. Significant flooding occurred in August 2008 when 1,500 properties flooded, and in 2012 when 1,200 properties flooded, mainly in the city of Belfast.

The flood events showed that there was a response and capability gap, as well as infrastructure capacity limitations (e.g. pipes and culverts were not big enough). In Northern Ireland two main aspects have been considered to improve preparedness:

- improve government response
- communities being more prepared

Figure 10 Flooding in the city of Belfast, Northern Ireland, 2008

The government response is being improved by having a lead government department for flooding emergencies:

(i) Planning is important (e.g. emergency planning exercises)
(ii) Communication is important (e.g. situation reports)
(iii) Providing expertise to other responders (e.g. police)
(iv) Other co-ordination activities bringing together other activities

JM outlined the Community Resilience Groups (CRG). In Northern Ireland a regional CRG was established. There is a need to have a wide range of stakeholders at the meetings. A standardised approach to enhance community resilience and a mechanism to prioritise community engagement has been developed. Northern Ireland's small size is advantageous to this. In 2014 there was engagement with ten communities at known flood risk.

JM stated that the key messages from the work that had been undertaken were:

- understanding the benefits and limitations of weather forecasts
- understanding the limitations of government and infrastructure
- self-help initiatives that could be used (e.g. individual property protection)
- disseminating river level alert message via text
- developing of community resilience plans
- developing of household resilience packs

JM stated that a future objective is to review how effective flood warnings are. There are challenges. A partnership approach is required and there is need for leadership. However, the benefits far outweigh the costs.

3.1.4 Flood risk management in the City of Karlstad, Sweden

Anna Sjödin (AS) is the flood risk manager for the city of Karlstad in Sweden which is affected by a number of different flood risks including:

- River Klarälven
- Lake Vanern
- stormwater
- high water levels in the river seeping through permeable gravels which surfaces in the delta area

Figure 11 Situation of the City of Karlstad, Sweden

The city of Karlstad was designated as an Area of Potential Significant Flood Risk (APSFR). Future climate change could increase rainfall by 20%. This means there may be more winter and autumn flooding. AS gave the background to various floods. In 2007 the post of Flood Risk Management coordinator was created. A Flood Risk Management Plan was adopted in 2010. Technical flood prevention has been carried out. There have also been communication initiatives including:

- flood hazard maps, water levels, information on the web
- flood hazard walks with the public and stakeholders
- a contingency plan for flooding produced
- urban planning for the city with respect to floods including:
    - elevated ground levels
    - protection of sewerage systems
    - green storm water management
    - elevate important roads
    - natural buffer zones to use as mitigation areas

In Sweden there is good collaboration between local, regional and national levels as well as academia. This means people can learn from each other. Karlstad is part of the UNISDR's 'Making Cities Resilient' campaign. This allows experience to be shared. A national network of these MCR cities has been formed and five of the Swedish cities designated as APSFRs are participating, allowing an exchange of knowledge.

3.2 Breakout discussion outcomes – Recent flood events and lessons learnt

Participants were split into four breakout groups and each group considered two of the topics given in the boxes below. Each group was then asked to feed back to all participants the agreed main points for each of the two questions they considered. These main points are briefly summarised below. Notes were taken in each group to capture the wide range of points made. These are summarised in Annex V.

Topic 1 - What Floods Directive tools/actions have been most useful in raising preparedness and resilience?

Flood Hazard and Flood Risk maps were felt to be the most useful for a variety of reasons including: helping to understand the spatial extent of flood risk; can be used to make the public aware of flood risk particularly where this information had not been previously available; helps to raise political awareness of flood risk and; improves understanding leading to better overall flood risk management.

Flood Risk Management Plans were also very useful as they helped to develop coordinated spatial planning and improve emergency response together with developing measures to manage flood risk.

Public Engagement was identified as the third most important element for the following reasons. It has helped people to be part of the process of flood risk management, helping them to understand and be more aware of flood risk.

Areas of Potential Significant Flood Risk (identified from Preliminary Flood Risk Assessments) were in some member states the first national assessment of flood risk. PFRAs have helped to identify the areas at most significant risk of flood risk and helping to improve emergency response to plans

The various Directive requirements have supported **national and international co-operation**, and the development of networks to assist large scale river basin management

Topic 2 - Lessons for communications – coordination of response – effective warning to cover both Government and community perspectives.

The importance of community engagement and communication clarity were highlighted. There were two themes that developed under this heading.

- People can do more to help protect themselves if communication is good and people understand the risk and what they can do to protect themselves.
- Communication clarity is important with clear messages including that elimination of flood risk is not possible. There is a need for communication in both directions top down but also community upwards.

The importance of coordination between different authorities and infrastructure providers can improve outcomes to flood risk management. In particular flood exercises enable different authorities to understand differing roles and how they can improve interaction.

The importance of flood forecasting and how to communicate warnings was flagged up as an issue particularly relating to flash flooding where it is difficult to forecast accurately. The messaging with flood warnings also needs to be clear so that the public understand what the warning means, and what actions they need to take.

Topic 3 - Lessons for community awareness and involvement

There was a variety of themes that came from this topic. The main ones were:

Flood maps are not helpful for engaging communities to understand personal risk. Some member states expressed the view that, in broad terms, many people do not readily understand typical flood hazard and flood risk mapping output.

Using real floods to raise awareness brings to life what the consequences of a flood event can be. Shortly after an event is often a good time to engage with communities to understand their concerns, and share what can be done to prepare for flooding.

Social media should be used more effectively as a means of communication. This could include a wide range of issues from issuing flood warnings, to the public reporting on flooding in real time e.g. providing photos and locations of incidents.

Blend top down and bottom up work, two way communications. This enhances the chance that communities will take some responsibility themselves if they feel they are fully engaged.

Exercising with community involvement again helps communities understand what happens in a flood event, who does what and what role they can play.

Engage politicians at all levels so that there is a better coordinated approach with consistent messages, and a better understanding of, for example, technical issues, local considerations, progress being made, and delivery constraints.

Raise awareness using a variety of tools, including community groups with experience of flooding to communicate good practice and lessons learnt.

Topic 4 - Lessons for protecting vital societal functions e.g. critical infrastructure, hospitals, schools

Good planning and design of new and retrofitted infrastructure needs to include an appropriate approach to adaptation to ensure long term resilience and sustainability

Better coordination between public and private sector for critical infrastructure is important in Member States where there is a mix of ownership, and where there is a strong inter-dependency between different infrastructure owners / operators.

Integrated risk management approach, recognising links between critical infrastructure and the impacts of failure – the cascade effect. For example, loss of electrical power supply impacting on a wide range of other infrastructure.

Communication channels need to be clearly established between different risk management authorities and different critical infrastructure owners / operators.

Local knowledge - Understand the vulnerability, impacts and threats to be able to plan and exercise effectively, thereby building resilience to allow continuity of function.

Be aware of media interest particularly during flood events. Establishing links with media helps with appropriate communication of messages.

Section 4: Report on Sessions – Adapting for the Future

4.1 Presentations on 'Adaptation actions in a changing climate'

4.1.1 Climate change and adaptation: setting the scene - Adaptation Unit of DG Climate Action (CLIMA)

Juan Pérez Lorenzo (JPL) gave an overview of adaptation for a changing climate. The Intergovernmental Panel on Climate Change (IPCC) AR5 fifth assessment report indicates that there is a need for mitigation and adaptation. Extreme weather events are having a significant impact all over the European Union. The intensity of these events is likely to increase. There is a need to have adaptation measures for slow onset events (e.g. sea level rise) and also extreme events (e.g. flash floods). There will be seasonal changes in heavy precipitation. However, it is currently not possible to attribute recent floods in the EU to climate change (e.g. UK 2007, Germany, 2013).

JPL outlined LIFE funding, including adaptation priority areas, as well as detailing the main challenges for urban areas. JPL also detailed a new initiative called 'Mayors Adapt' that commenced in March 2014, which promotes urban leadership in adaptation to climate change. These are voluntary commitments by cities to mainstream adaptation measures into strategies. Over 100 cities have committed to this initiative.

JPL presented the European Climate Adaptation Platform (Climate-ADAPT). This is a platform hosted by the European Environment Agency (EEA). It is the main website with information on adaptation measures. JPL detailed the European Structural and Investment Funds. There was a decision by the Council to have at least 20% of funds for the period 2014 to 2020 to put towards climate change adaptation.

With respect to the resilience of infrastructure standards, there has been a standardisation request with the main objective being climate resilient infrastructure in three priority sectors: transport infrastructure, including maritime transport infrastructure; energy infrastructure; buildings/construction; plus ICT infrastructure that are closely interconnected with, and support the functioning of these sectors.

JPL also looked at dealing with uncertainty. A direct cause and effect for recent floods in the EU and climate change cannot be established but a trend is emerging. There are various low-regret measures (not to be confused with no-cost measures) that can be implemented (e.g. early warning systems, risk management plans, mapping flash flood 'hotspots', spatial planning). Most member states have a national adaptation strategy or have started drafting one. However, many of the documents are very preliminary, although many are being reinforced.

4.1.2 Adaptation strategies across Europe - European Environment Agency (EEA)

Wouter Vanneuville (WV) presented the EEA report on national adaptation policies in European countries, which was produced in 2014. This is one in a series of reports. This report was produced because there was a lack of a European-wide overview of adaptation

activities at national levels. On Climate-ADAPT the country pages are the most visited; and good practices and examples from countries have the potential to illustrate adaptation and inspire.

The report was developed by an on-line self-assessment comprising 44 questions. There was one coordinated answer per country. The report represents the largest and most comprehensive overview of national (and sub-national) adaptation activities available for Europe so far. To date 30 countries have returned their self-assessment. A 'naming and honouring' approach has been taken to the report.

Figure 12 National adaptation policies processes in European Countries – 2014, EEA, 2014

WV outlined the key findings. These included that 21 countries have a national adaptation strategy and twelve have a national action plan. Thirteen countries reported that they are in the implementation or monitoring and evaluation stages. WV outlined the following results including: Why do countries have adaptation?; What are the barriers?; What sectors are covered and which have priority?; Which methods are used for designing adaptation options?; How are stakeholders involved?

WV stated that the further you go away from national government the lower the level of stakeholders in co-design of policy. WV finished by outlining the future directions for national adaptation in Europe that included having a more standardised basis for monitoring, reporting and evaluation schemes and capacity building and advanced communication methods in order to foster adaptation policy at all levels.

4.1.3 Climate change adaptation and community resilience in flood risk management - Leibniz Institute of Ecological Urban and Regional Development (IOER), Germany

Professor Jochen Schanze (JS) presented on the climate change challenges for flood risk management including: anticipation and resilience; scenario-based anticipation approaches and resilience of constructions and organisations. JS stated that the IPCC has adopted a risk-based approach rather than an approach focusing on vulnerability. The major challenges were outlined as the: complexity of flood risk systems and the uncertainty of future development of the systems covering aleatory uncertainty and epistemic uncertainty owing the quality of models and data. JS covered anticipation and resilience of and to future or possible future changes to flood risk systems. Climate change impacts on flood risk and flood risk management are not just complex but also highly uncertain. Anticipation and resilience are two approaches for dealing with the aleatory uncertainty.

Both approaches could address the physical world as well as management strategies and hence should be based on common consistent concepts. However, requirements for treatment with the physical and organisational issues require specific views. While some advancement has been reached in anticipation and description of physical resilience, there is still a lot to do to also consider organisational resilience. In particular, combinations of anticipation and resilience seem to be a pressing challenge of flood risk management.

JS concluded by saying that:

- climate change impacts on flooding are not just complex but also highly uncertain
- anticipation and resilience are two approaches for dealing with the aleatory uncertainty
- both approaches could address the physical world as well as management strategies
- whilst some advancements have been reached in anticipation and description of physical resilience, there is still a lot to do to also consider organisational resilience
- in particular, combination of anticipation and resilience are a pressing challenge of flood risk management

4.1.3 Lessons from climate change adaptation strategies - Finnish Environment Institute, Finland

Antti Parjanne (AP) explained that Finland was one of the first countries in the world to prepare a national adaptation strategy in 2005. Temperature rise in Finland is 1.5 to 2 times higher than the global average. In 2015 Finnish Government approved the Climate Act.

AP gave an overview of the evaluation of the implementation of adaptation policy and measures between 2009 and 2013. There have been various adaptation measures implemented in the water resources (e.g. Revision of the National Land-use Guidelines; Dam Safety Act; Flood Risk Management Act; Flood Preparedness in Building guidance). The recommendations from the evaluation included:

- mainstreaming and integrating the adaptation in planning, development and decision making
- improving risk assessment and management methods and tools
- strengthening adaptation actions at regional and local level
- understanding and taking into consideration the direct and indirect impacts of global climate change
- continuing research into adaptation
- communicate, communicate and communicate!

As part of the Climate Act a National Climate Change Adaptation Plan 2022 is being carried out with the objective of having the capacity to manage the risks and to adapt to changes in Finland by 2022. There are a number of actions that are key; the most important being:

- action plans that take account of the international repercussions of climate change
- promoting the drafting of regional and local adaptation studies
- promoting adaptation as part of international cooperation
- improving climate risk assessment and management
- developing business opportunities related to adaptation

AP outlined how climate proofing would be mainstreamed with respect to water resources and flood risk management practices. This includes:

1. Estimate climate change impacts and transpose parameters to sector-specific impacts
2. Define vulnerabilities and climate risk
3. Select adaptation and safeguard resilience

AP stated that the next steps were co-ordination and follow up of the implementation. There will be an annual assessment and a mid-term evaluation in 2018. The Finnish Government will adopt a National Adaptation Plan at least once in every 10 years. AP concluded by stating that more research is still needed; there is need to involve businesses more; and the mainstreaming of communication.

4.2 Breakout discussion outcomes – Adapting for the future

The format of session 2 was similar to session 1 with participants split into the same four groups and each group asked to consider two of the topics in the boxes below. Each group then fed back the agreed main points from the discussions which are captured below. Detailed notes were taken in each break out group and these have been summarised in Annex V.

Topic 1 - What main actions are being taken to adapt to climate change with regard to flooding?

Developing future scenarios taking account of climate change helps to understand the likely range of risk communities will face.

Strategic planning for climate change is important but it wasn't clear sometimes who had overall responsibility to do this.

Types of measures being used include:

- legislation e.g. safety standards for flood defences and Climate change legislation
- spatial planning measures so that climate change is taken into account in decisions being made now
- emergency planning / crisis management improved by understanding what future risks may be
- hard structural measures (e.g. building higher flood defences, or planning so that defences can be adapted in the future) and soft structural measures (e.g. managing water as near to the source as possible through retention)

Communication - Raising public awareness of the possible impacts of climate change, improving understanding of the possible impacts, and sectoral communication. This was felt to be a particularly difficult area to address.

Topic 2 - What improvements in technology would make a difference in preparedness, response and recovery for future floods?

The following were the main improvements that would make a difference:

Forecasting and warning systems (in particular flash floods and local rainfall events in quick response catchments).

Improving research and science – understanding climate change scenarios, improve understanding of vulnerability, decision making systems for integrated water management.

Improving resilience and resistance for developments e.g. improving the resilience of homes, commercial property and infrastructure to flooding; adaptive smart homes.

Improved IT hardware to deal with small catchments e.g. for some areas of the UK, the scale of flood forecasting has been improved but it requires a huge amount of computer power to do so.

Real time information – how to communicate and use. It is difficult to get accurate information of the real time extent of floods. One useful way to do this is to encourage the public to report flood events through social media.

Topic 3 - What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?

State level – Government to provide legislation, frameworks and tools (and prioritise funding) to facilitate the integration of adaptation and resilience measures into development / infrastructure.

Regional level – spatial planning to include adaptation measures, building codes & standards (adaptive building)

Local level – adapt to local natural hazards

Development of a network of hydrometric data to identify trends to understand what climate change means locally in terms of e.g. changes to river flows, sea levels, rainfall intensity / patterns.

From the discussion it was clear that there was a great variation in how member states approach this issue.

Topic 4 - What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?

Raise awareness - communicate what flood risk and climate change means to businesses and communities (consider national and local links) which leads to better engagement. However, it was felt to be difficult to raise awareness unless there had been an actual flood event.

Spatial planning is important to help understand the potential future risk and what standards and safety levels need to be achieved. All forms of flooding should be considered within the context of spatial planning and development in flood risk areas.

Schemes for property level resilience (grants / financial incentives) can help to improve the resilience of properties at risk of flooding.

Insurance cover – buy-in from the insurance industry can be a lever to avoiding building properties at an unacceptable level of flood risk.

Section 5: Workshop Summary and Conclusions

5.1 Learning from recent events - discussion

Preparedness, resilience and adaptation are strongly linked themes across the flood risk management sector, none of which sits in isolation. Addressing any one of these is likely to partially address each of the other two aspects.

Working Group F provides a strong pan-European learning community to the mutual benefit of all member states. There have been many recent flood events of different types and scales with lessons that can be learned and applied in other contexts. Sharing learning from these case studies and events through WG F can provide the basis for learning to improve preparedness, resilience and adaptation in member states.

Communication

A common thread linking different member states' experiences of recent flood events is **communication in preparedness, resilience and adaptation**.

Who? – We communicate with a wide range of interested parties including stakeholders, the public, media, politicians, local and regional national government, and critical infrastructure owners/operators. Across the range of issues that we need to consider, we do this before an event, during an event and after an event.

What? – Many aspects require clear and consistent communication, and a two-way flow of information to raise awareness around the preparedness, resilience and adaptation themes. The issues of "what" to communicate are tailored to the intended audience. By way of a few examples this may include issues such as:

- weather and flood forecasting, and flood warning
- what can be done to prepare for a flood well in advance of its occurrence?
- what different organisations within a MS can and cannot do (because of remit or resource for example)
- where information can be accessed about any aspect – for example risk mapping, flood warning, responsibilities, investment programmes, real-time forecasting
- what hazard exists at a location from different flood sources?
- who can provide assistance with post-event recovery?
- clear responsibilities within emergency planning
- positive messages during an event in terms of what has been protected.

How? – The means of communication around different issues, and with whom, is very varied and needs to be tackled on many fronts on an ongoing basis through a range of media.

Floods Directive tools

Alongside the communication theme which underpins many of the lessons learnt, various tools and actions that come out of the Floods Directive confirm the value of these activities in order to better prepare for flooding, develop resilience, and allow future adaptation.

The identification of Areas of Potential Significant Flood Risk (APSFR) through the Preliminary Flood Risk Assessment (PFRA) process has provided a basis for prioritising areas of focus in terms of preparedness and resilience. Subsequent to this, the Flood Hazard and Flood Risk maps provide a useful communication tool among flood risk practitioners, although it is noted that when engaging with the general public, their use can be limited due to a range of factors including:

- how people consider risk and probability;

- their experience of past events (or absence of them);
- how people view and understand data being shown on a map, and translating that into what an extreme event may look like in reality.

Following on from the flood hazard and risk maps, the preparation of Flood Risk Management Plans which will seek to develop a range of structural and non-structural measures, from the river basin scale to local basis, will deliver improved preparedness, resilience and adaptation.

With specific regard to international river basins, it is recognised that there is, and will remain, an ongoing need for co-operation in terms of data sharing and operational management, particularly with regard to integrated catchment management covering water resources, flood risk, and environmental management.

Critical Infrastructure

Flood events also expose gaps in operational knowledge, data, and infrastructure dependency between different infrastructure owners/operators, and public and private sectors. An example could include the knock-on effects of power generation facilities being impacted, resulting in loss of power to rail infrastructure, water and wastewater infrastructure and hospitals. Given the importance of "critical" infrastructure, the planning of new infrastructure or retrofitting existing infrastructure should take account of resilience and adaptation requirements.

5.2 Adapting for the future - discussion

Within the adaptation "space" the flood risk management community needs to deal with significant uncertainty and complexity over long timeframes (up to 100 years typically). This leads to the need to consider "low regret options" when assessing how to adapt to a changing climate. Common low regret actions include flood warning, urban planning, development control, and low cost resilient building design.

Whilst there is uncertainty with future climate, there is strong evidence that the weather extremes that we experience across Europe with our current climate cause greater economic loss than any other natural hazard (*Mapping the impacts of natural hazards and technological accidents in Europe*, EEA report No. 13, 2010). It is these weather extremes that are a strong driver for adaptation. Other drivers for adaptation are urban growth and land use change, both of which influence flood risk independent of climate change.

Adaptation strategies and measures are, in general, not as well developed as the preparedness and resilience aspects, notwithstanding that these three elements are linked. The means by which adaptive capacity can and will be achieved will be through a range of structural and non-structural measures. This includes:

- asset management and retrofit
- new flood risk management infrastructure
- organisational flexibility
- legislative and policy developments to facilitate adaptation
- flood warning
- urban planning and development control
- building codes
- insurance
- infrastructure design standards

There are a wide range of common issues with regard to climate change adaptation facing member states that cut across the full range of flood sources and scales of event to which member states are exposed, including:

- spatial planning as a tool for adaptation - avoiding development in vulnerable areas taking amount of climate change impacts
- the need for improved climate change projections, and improved understanding of the impacts
- flood risk management measures, both structural and non-structural to build adaptive capacity
- raising awareness / information dissemination of climate change with the public to increase personal responsibility
- public sector, community and business participation, engagement, communication around the theme of adaptation

5.3 Workshop Conclusions and Recommendations

5.3.1 Observations and conclusions

- **Flood risk is highlighted as a major issue for virtually all member states within the context of each member state's National Risk Assessment** (which is intended to identify all major risks) currently being reported to the European Commission through DG-ECHO. Not only does this emphasise the importance of keeping flood risk management at the forefront of member states' policy and delivery, it also positions the EU well to share lessons and experience in a global context through, for example, UNISDR and the Hyogo Framework for Action, and more recently the Sendai Framework for Action.
- **Significant action is being taken across the EU to prepare for floods.** The delivery of the requirements of the Floods Directive, such as the completion of Preliminary Flood Risk Assessments (PFRA) and preparation of national scale mapping of multiple flood hazards, has been instrumental in understanding flood hazard and risk, and in prioritising locations where action is required to improve preparedness. Ongoing actions with the preparation of Flood Risk Management Plans (FRMP) and the subsequent delivery of the FRMPs will further enhance preparedness. Other aspects of preparedness relate to emergency planning and crisis management responses, which are often subsequently enhanced following a flood event, to capitalise on the learning from events.
- **Technological improvements with regard to the inter-linked activities of meteorological forecasting, flood forecasting and flood warning systems are important** to improve preparedness for flooding, thereby enabling communities to be more resilient to it. This is particularly true of extreme short duration rainfall forecasting leading to pluvial flood events.
- **Communication of flood risk at all levels needs to be improved** so that there is a better understanding at national, regional and local levels, across a range of stakeholders, enabling the necessary actions to be taken to prepare for and be more resilient to flooding.
- **Trans-boundary flood risk management has been enhanced through the implementation of the Floods Directive**. It has helped to define a common approach to flood risk management. By focussing on the River Basin scale, co-operation and mutual understanding of the flood risk has improved in areas such as better forecasting, better river management and enhanced emergency response.

- **There is a strong perception that climate change will result in an increase in the frequency and severity of flood events**, although there is uncertainty in some geographical areas related to fluvial flooding in particular as some drivers for flood risk are complicated by changes in winter snowfall so there may be less potential for snowmelt related floods.
- **There are significant challenges with communication and awareness raising** around many issues related to flood risk and climate change with the public and others.
- **Spatial planning and control of development on flood plains is a recurring theme of concern** in many member states, leading to residential and commercial property, as well as critical infrastructure being (at times) located in flood prone areas. Despite improvements over many years, development in flood prone areas continues to happen.
- **Flood events can expose the vulnerability of critical infrastructure,** resulting in a 'cascade' effect due to the flooding of critical infrastructure leading to further negative consequences elsewhere on other assets, operations or the environment.

5.3.2 Recommendations

- **There is a need for enhanced flood forecasting and flood warning systems for short duration pluvial flood risk**, to deliver more accurate warnings with longer lead times. These improved forecasts could be combined with pre-existing pluvial flood model outputs covering a range of events (duration and frequency) for areas of concern. This combination should result in better preparedness for the onset of the event, and more targeted, co-ordinated emergency responses during an event in areas anticipated to be affected.
  Recommendation: WGF to share state-of-the-art status of pluvial flood forecasting and warning, and how this is used to prepare for pluvial flood events. Note: A Workshop on Pluvial Flooding is already identified within the work programme 2016-18.
- **Effective communication across a wide range of flood risk management issues and associated aspects of climate change is critical.** This includes communications with the general public, business / commercial sectors, media, politicians and other stakeholders. Whilst many technical and operational aspects of flood risk management are well understood by those working within the flood risk management sector, communicating technical issues effectively is a complex task that requires further attention. Two-way communication across the sector is also important, both at a geographical level (international, national, regional and local), and at a cross-sector level (between different infrastructure operators where there are inter-dependencies).
  Recommendation: WGF give consideration to a Workshop on "Flood Risk Communication" as part of the work programme 2016-18 building on the findings of the workshop held in Romania, 2012.
- **Spatial planning and development control needs to be strengthened to prevent inappropriate development on flood plains or in other flood risk areas.** Flood plains typically represent areas exposed to fluvial or coastal flood hazards. By contrast, areas vulnerable to surface water and groundwater flooding (and some other flood sources) do not always manifest themselves through clear topographical features. Greater consideration in spatial planning should be given to all forms of flooding.
  Note: Spatial Planning is one of the themes for the short workshop to be held in Madrid in October 2015 back-to-back with WG F 18.
- **The 'cascade' effects of a flood event affecting critical infrastructure in one location leading to significant impacts beyond the boundary of the asset affected should be integral to flood risk management solutions.** Co-operation and data sharing amongst the public and private sector organisations responsible for different elements of critical infrastructure

operations will enable a complete 'system vulnerability' assessment, thereby allowing preparedness and resilience measures to be targeted appropriately to reduce system and, ultimately, societal vulnerability. The term 'critical infrastructure' may have a very specific meaning in each member state; in this context critical infrastructure includes elements such as energy supplies, water and wastewater systems, telecommunications, transportation, emergency services operations, education and health facilities.

Recommendation: Member States to consider how sharing of information could reduce 'system vulnerability' to flooding, and develop improved resilience to avoid cascade risks. This includes those sectors affected by flooding and those risk management authorities at an international, national, regional and local level responsible for delivery of flood risk management measures and responses. WG F should consider holding a short (1-day) workshop on "Flood Risk and Critical Infrastructure" addressing: flood hazard to CI, vulnerability of CI to flood damage, potential cascade pathways, and managing flood risk to CI and cascade effect risks.

Annex I – Workshop agenda

Flood preparedness, resilience and adaptation
9 and 10 March 2015

Monday 9 March

Session 1: Learning from recent events
Chairperson: Mary Stevens, Defra UK

13:00 - 13:30 Registration

13:30 – 13:45 Welcome and introduction: Mary Stevens, Defra UK/Ioannis Kavvadas

13:45 – 14:15 Setting the scene: Andrew Bower, DG-ECHO
20 mins presentation, 10 mins Q&A

14.15 - 15.15 Presentations on 'Recent flood events and lessons learnt'
Craig Woolhouse: Recent flood events and lessons learnt in England (15 mins)
Jonathan McKee: Being prepared for flooding – a Northern Ireland perspective (15 mins)
Anna Sjodin: Flood risk management in the City of Karlstad, Sweden (15 mins)
Discussion (15 mins)

15:15 - 15:30 Summary of questionnaire responses - Roger Orpin, Defra, UK

15:30 - 16:00 Coffee break

16:00 - 17:30 Breakout session 1 (4 groups – 2 topics per group)

Topic 1	*What Floods Directive tools/actions have been most useful in raising preparedness and resilience?*
Topic 2	*Lessons for communications – coordination of response – effective warning to cover both Government and community perspectives*
Topic 3	*Lessons for community awareness and involvement*
Topic 4	*Lessons for protecting vital societal functions e.g. critical infrastructure, hospitals, schools*

17:30 -18:00 Feedback (by facilitators) and discussion
Chairperson: Mary Stevens, Defra, UK

18.00 End of Session 1

20:00 Workshop dinner in Brasserie Meat Me (Marivaux hotel)
http://www.hotelmarivaux.com/nl/brasserie-meat-me

Tuesday 10 March

Session 2: Adapting for the future
Chairperson: Mary Stevens, Defra, UK

09:00 - 09:15 Summary points from Session 1 and introduction to Session 2
Roger Orpin, Defra UK / Mary Stevens, Defra UK

09.15 – 09:30 Setting the scene: Mr Juan Perez Lorenzo, DG-CLIMA, (15 mins)

09:30 - 10.30 Presentations on 'Adaptation actions in a changing climate'

Wouter Vanneuville, European Environment Agency - Adaptation policies across Europe (15 mins)
Professor Jochen Schanze, Germany - Climate change adaptation and community resilience in flood risk management (15 mins)
Antti Parjanne, Finland. - Lessons from climate change adaptation strategies (15 mins)
Discussion (15 mins)

10:30 – 10:50 Coffee break

10:50 - 12:15 Breakout session 2 (4 groups – 2 topics per group)

Topic 1	*What main actions are being taken to adapt to climate change with regard to flooding?*
Topic 2	*What improvements in technology would make a difference in preparedness, response and recovery for future floods?*
Topic 3	*What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?*
Topic4	*What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?*

12:15 -12:40 Feedback (by facilitators) and discussion
Chairperson: Mary Stevens, Defra, UK

12.40 - 12.55 Summary of workshop outcomes, Iain Blackwell, EWA

12:55 – 13.00 Closing remarks, Mary Stevens, Defra, UK

13:00 End of workshop

Annex II – List of Participants

Last Name	First Name	Member State / Stakeholder / NGO
Adamson	Mark	Ireland
Anderson	Jo	United Kingdom
Arangelova	Maria	Bulgaria
Babić	Marijan	Croatia
Bernal	Lucia	European Commission
Blackwell	Iain	European Water Association
Bussettini	Martina	Italy
Butler	Clare	Ireland
Cadek	Peter	Slovakia
Devroede	Neel	Belgium / Flanders
Dumas	Lucile	European Investment Bank
Gkini	Maria	Greece
Gombás	Károly	Hungary
Grøndahl	Louise	Denmark
Haesevoets	Annelies	Belgium / Flanders
Helmer	Jean-Michel	France
Hornich	Rudolf	Austria
Jean-Pierre	Silan	EurEau
Jendrike	Harald	Germany
Kavvadas	Ioannis	European Commission
Lahousse	Audrey	Belgium
Lumbroso	Darren	HR Wallingford
Martin	John	Ireland
McKee	Jonathan	United Kingdom, Northern Ireland
Misiga	Pavel	European Commission
Moeed	Sadia	United Kingdom
Näslund-Landenmark	Barbro	Sweden
Negru	Simona-Olimpia	Romania
Neuhold	Clemens	Austria
Nika	Konstantina	Greece
Novak	Vladimir	Slovakia
Orpin	Roger	United Kingdom
Parjanne	Antti	Finland
Radulescu	Daniela	Romania
Reynard	Nick	United Kingdom
Rindasu-Beuran	Ionel-Sorin	Romania
Sakin	Isil	Turkey
Salvado	José	Portugal
Schwarz	Katharina	Germany
Seliga-Piórkowska	Aleksandra	Poland
Sjödin	Anna	Sweden
Sokolić	Sandra	Croatia
Stam	Jean-Marie	Netherlands

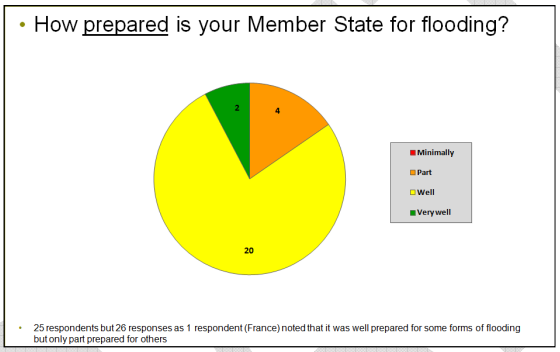
Stevens	Mary	United Kingdom
Tejkalova	Jana	Czech Republic
Thomas	David	United Kingdom, Wales
Ulm	Reet	Ministry of Environment
van Os	Hans	JASPERS
Vanneuville	Wouter	European Environment Agency
Woolhouse	Craig	United Kingdom

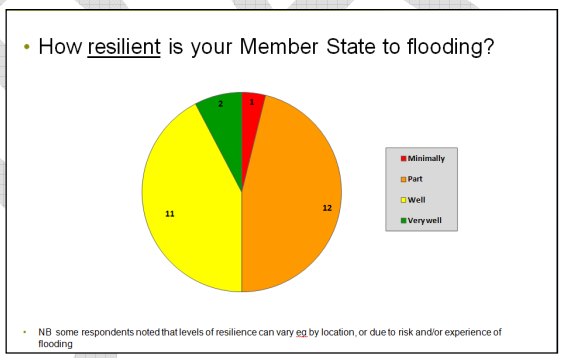
Annex III - Questionnaire Responses

A pre-workshop questionnaire was circulated to all member states in advance of the workshop. A total of 25 responses from 22 member states were received (including 4 responses received after the workshop).

Figure 1 on page 7 of the report shows the 22 member states who responded to the questionnaire. Three responses were received from the UK (England, Wales, and Northern Ireland) where flood risk management is a devolved matter and two from the Czech Republic (one at national government level, and one from the Odra River Board).

Analysis of all questionnaire responses is included below.



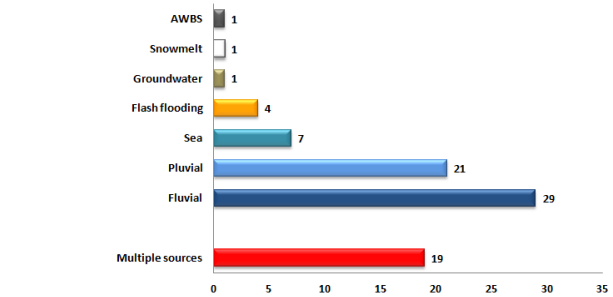


Key concerns:

- Community awareness of flood risk and what can be done to prepare
- Financial and personnel resources – for new schemes and for maintenance
- Flood defence asset resilience in a changing climate
- Other issues mentioned:
  - Early warning systems
  - Climate change uncertainty
  - Planning and development control in flood risk areas
  - Emergency response and flood event response co-ordination
  - Infrastructure resilience

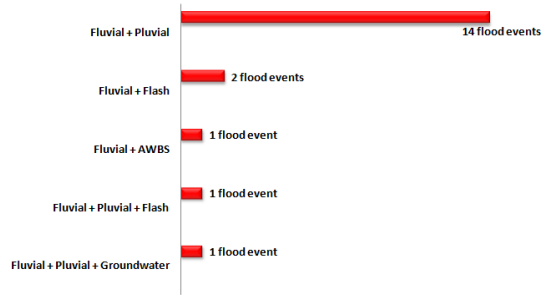
Recent flood events by type of flooding

- Examples of recent flood events – breakdown by type of flooding.



AWBS = Artificial Water Body Structure

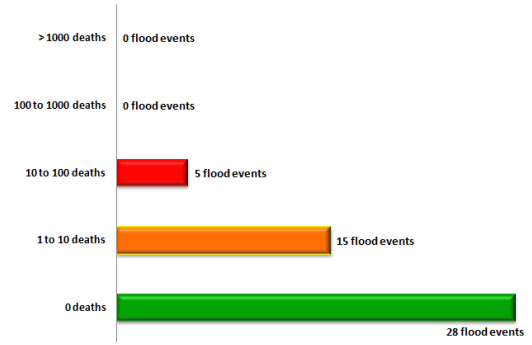
- Breakdown of multiple source flood events, by contributory types of flooding.



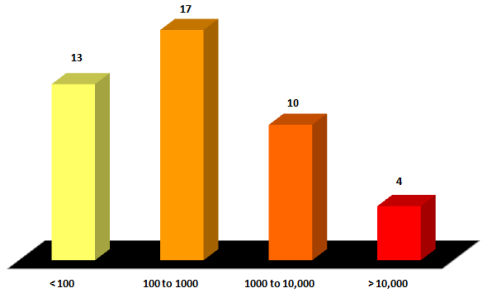
AWBS = Artificial Water Body Structure

Recent flood events - impacts

- Recent flood events – number of deaths



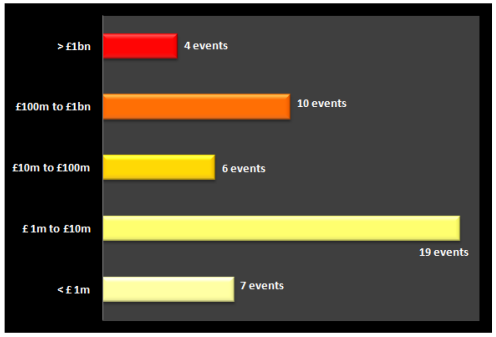
Recent flood events - number of properties flooded



- 44 results. For 4 of the 48 flood examples reported, no answer was given or respondent reported that investigations are still ongoing.

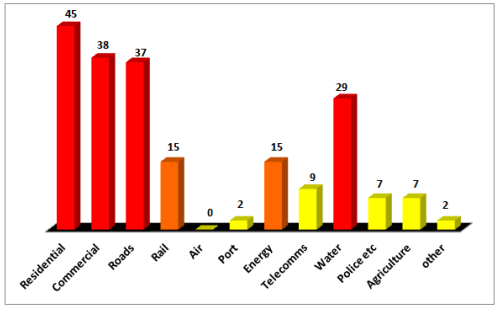
Recent flood evnets - impacts

Recent flood events – estimated cost of damage



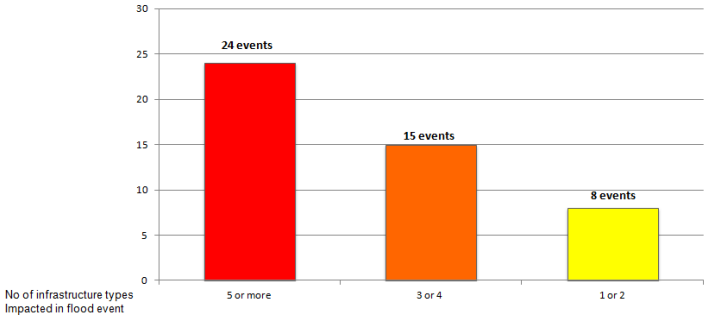
- NB 46 responses. Some MS reported that assessment is still ongoing. Full costs may not be captured in all cases. Some MS noted that agricultural, landscape and some wider economic costs are not included.

Recent flood events – damage to property, infrastructure and utilities



- Other impacts mentioned by MS included natural landscape impacts (eg landslides), and other types of infrastructure (eg educational facilities).

Recent flood events - number of different property/infrastructure/utility types impacted.



Most useful FD tools for preparedness and resilience

Top issues from questionnaire responses:

- Flood hazard and risk maps (14)
- Preliminary Flood Risk Assessments (PFRAs) to help determine priorities (5)
- National catalogue of measures (allows better measures to be developed) (3)
- Flood Risk Management Plans (3)
- Identification of APSFRs (1)

Further discussion in breakout session 1, topic 1

Lessons for communications

Top themes from lessons learned:

- Good understanding of risk, based on up-to-date mapping, for effective flood risk management; flood warning; emergency planning; and public awareness (10)
- Good forecasting systems for effective early warning, and to communicate developing situation (10)
- Well co-ordinated emergency plans at regional and national levels (10)

Further discussion in breakout session 1, topic 2

Lessons for community awareness and involvement

Top themes from lessons learned:

- Need to improve community awareness and involvement with regard to flood risk and actions people can take to reduce vulnerability (21)
- Communications must be embedded in multi-agency emergency plans, with clear responsibilities, so that the community hears one message (3)
- Recognise that significant communication resources are required to build community awareness and give effective messages during flooding (3)

Further discussion in breakout session 1, topic 3

Lessons for protecting vital societal infrastructure

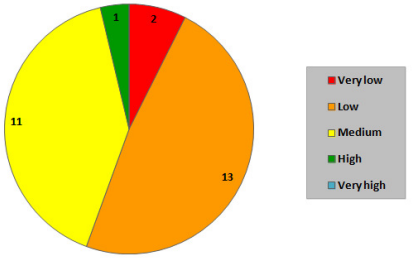
Top themes from lessons learned:

- Extent, performance and condition of defences proved inadequate or insufficient in many cases (9)
- Older assets were often in poor condition eg lack of maintenance (9) eg
  - lack of maintenance
  - failure to upgrade to account for new factors eg landuse change, expansion of communities over time
- Significant collaborative efforts needed to improve resilience of critical infrastructure (3)

Further discussion in breakout session 1, topic 4

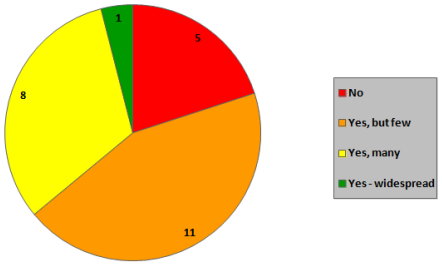
Citizens and responsibility

- What level of individual responsibility do citizens/businesses take to reduce their own risk?



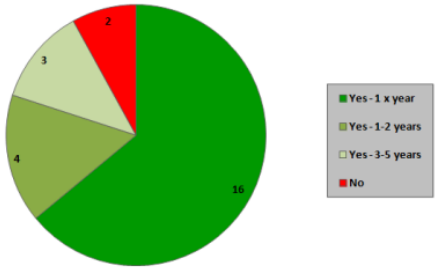
- NB Some MS reported that the level of responsibility can vary depending on experience of flooding and other factors.

- To what extend do community action groups exist in your Member State?

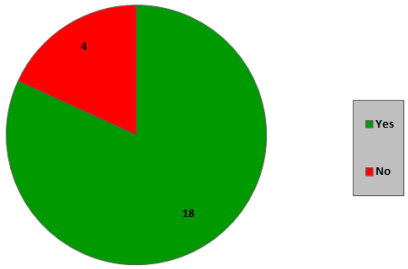


Emergency planning

- Does your Member State conduct emergency planning exercises?

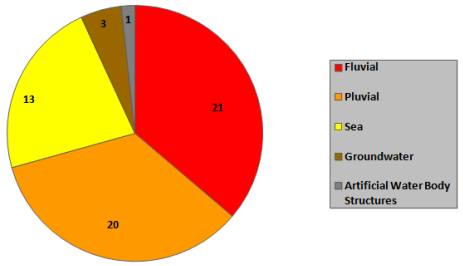


- Have Floods Directive outputs informed your emergency planning exercises?



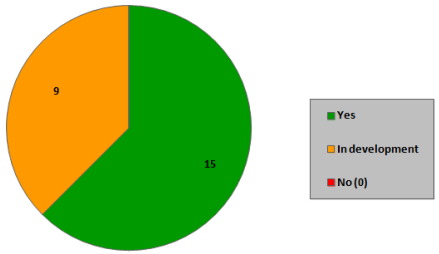
Climate change adaptation

- In relation to climate change, which types of flooding are of main concern?



- NB Respondents were asked to name up to 3 different types of flooding

- Does your Member State have a national adaptation plan?



NB Includes individual responses from UK nations England, Wales and Northern Ireland,

Actions being taken to adapt to climate change

Top issues from questionnaire responses:

- Climate change vulnerability, impact and adaptation studies and strategies at a national and/or regional level (14)
- Raising public and business awareness of the impacts of climate change (13)
- Flood risk management measures and assets built (or adapted) to account for climate change, and with resilience in mind

Further discussion in breakout session 2, topic 1

Actions for governments

Top issues from questionnaire responses:

- Greater adaptation of spatial planning to take account of climate change (11)
  - avoid development in floodplains and vulnerable areas, including considering resettling communities)
- More accurate climate change projections; improved analysis and understanding of risks and impacts (geographical, sectoral and societal) (7)
- Flood protection measures (8)
  - solutions that allow future adaptation
  - more use of natural retention and land management

Further discussion in breakout session 2, topic 3

Actions for business and communities

Top issues from questionnaire responses:

- Raise public awareness /disseminate information on climate change to increase personal responsibility
- Engage with communities and businesses to build trust and improve:
  - community/business participation in flood risk management planning process
  - uptake and participation in flood action groups
  - awareness of flood warning services
  - Understanding of actions to reduce vulnerability

Further discussion in breakout session 2, topic 4

Technological actions to improve adaptation to climate change

Top issues from questionnaire responses:

- Need for improved flood warning / early warning systems, and associated communication of flood warnings (11)
- Meteorological modelling and forecasting of spatial variation and intensity of extreme rainfall leading to flash / pluvial flooding

Further discussion in breakout session 2, topic 2

Annex IV – Guidance notes for workshop breakout sessions

The notes included on the following pages were prepared in draft form in preparation for the workshop, drawing on the questionnaire responses received prior to the workshop to provide an indication of the range of issues that member states had raised within the specific topic areas, and a guide to the subject matter that may be of specific interest for discussion.

Following the workshop, four additional responses were received and the key points were updated accordingly. The notes given for each of the eight topics shown on the following pages represent a summary of the key points identified through 25 questionnaire responses from 22 member states. It is noted that there are three more responses than member states represented, as the UK provided three responses (England, Wales and Northern Ireland) due to differences in administration and legislation, and the Czech Republic provided two responses (a national government response and a separate response from the Odra River Board).

The breakout sessions and topics were as follows:

Breakout session 1, topic 1:	What Floods Directive tools/actions have been most useful in raising preparedness and resilience?
Breakout session 1, topic 2:	Lessons for communications – co-ordination of response – effective warning to cover both Government and community perspectives
Breakout session 1, topic 3:	Lessons for community awareness and involvement
Breakout session 1, topic 4:	Lessons for protecting vital societal functions e.g. critical infrastructure, hospitals, schools
Breakout session 2, topic 1:	What main actions are being taken to adapt to climate change with regard to flooding?
Breakout session 2, topic 2:	What improvements in technology would make a difference in preparedness, response and recovery for future floods?
Breakout session 2, topic 3:	What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?
Breakout session 2, topic 4:	What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?

Summaries of the notes made during the breakout sessions are included in Annex V, reflecting the specific discussion points.

Breakout session 1, Topic 1: What Floods Directive tools/actions have been most useful in raising preparedness and resilience?

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. Below is a summary of the common themes from the questionnaires for the question: *What Floods Directive tools/actions have been most useful in raising preparedness and resilience?*
(The number in brackets next to each theme shows how many of the responses included the theme)

Useful Floods Directive tools and actions:

- Flood hazard and risk maps [14]
- Preliminary Flood Risk Assessments to help determine priorities [5]
- National catalogue of measures (allows better measures to be developed) [3]
- Flood Risk Management Plans [3]
- Identification of APSFRs [1]

Other (non Floods Directive) tools and actions:

- Public communication of risk [3]
- Attending WGF workshops has helped learning and sharing with others or working with others in crisis situations [2]
- Flood forecasting and warning systems [2]
- Public information [1]
- National Flood Defence Plan [1]
- National Flood Protection Implementation Plan [1]
- Regular maintenance of flood protection system functionality [1]
- Regional flood risk management groups (established to ensure regional coordination in flood risk management) eased coordination and knowledge exchange between rescue services, ELY-centres and municipalities also during flood situation [1]
- Developed a national flood policy review which has helped with FRMP and Maps [1]
- Sustainable land use practices [1]
- Water retention measures [1]
- Impacts of climate change [1]
- Systems for crisis management already established pre FD [1]
- Community involvement and awareness [1]
- Need to establish water management in real time [1]
- Improve coordination of response [1]

Breakout session 1, Topic 2: Lessons for communications – coordination of response – effective warning to cover both Government and community perspectives

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. The responses included lessons learnt from recent flood events. Below is a summary of the common themes emerging from the lessons learnt with regards to: *communications – coordination of response – effective warning to cover both Government and community perspectives*
(The number in brackets next to each theme shows how many responses included the theme)

Top three themes:

- Good understanding of risk resulting from up-to-date mapping as the basis for effective flood risk management; flood warning, emergency planning and public awareness [10]
- Good forecasting systems to allow for early warning, and communication of developing situation during sustained flooding. [10]
- Well co-ordinated emergency plans at regional and national levels [10].

Other themes:

- Clear communication responsibilities and channels embedded in incident and emergency plans, so that information is communicated to, and can be acted on in timely manner, by decision makers [6]
- Trans-boundary co-operation in forecasting, river management / regulation, and emergency response where flood events cross national borders [5]
- Exercise flood incident management and emergency response plans to test communication channels [3].
- Improve ability to forecast extreme rainfall / flash floods. [2]
- Good information and mobilisation plans for third party equipment, personnel (e.g. military, volunteers etc.). Protocols for prioritisation, deployment and tracking. [2]
- Dedicate resources outside times of flooding to improve public awareness of risks, warnings and understanding of what to do in a crisis.[2]
- Improve understanding of combined impacts e.g. large waves and strong winds to be able to forecast and communicate risk and actions for responders and communities to take. [1]
- Gathering information about impacts on the ground during extreme flooding, and communicating this to decision makers, can be very difficult. [1]
- Robust protocols for logging decisions during flood events.[1]
- Ensure robust information and communications technology, particularly for sustained flooding [1]
- Commit adequate resources for communicators at all levels - incident managers, emergency responders, media and public communicators.[1]
- Plan for 'most likely' and 'reasonable worst case' scenarios to secure resources. [1]

- Coordination of implementation of prevention measures across urban municipalities needs to be strengthened [1]
- Need community involvement in emergency situations to support activities of authorities; [1]

Breakout session 1, Topic 3: Lessons for community awareness and involvement

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. The responses included lessons learnt from recent flood events. Below is a summary of the common themes emerging from the lessons learnt with regards to: *community awareness and involvement.*

(The number in brackets next to each theme shows how many of the responses included the theme)

Top themes:

- Need to improve community awareness and involvement with regard to flooding risks, and what actions to take [21]
- Communications responsibilities must be embedded in multi-agency emergency response plans - so there is one message for the community [3]
- Recognise that significant resources are required to build awareness among communities and to manage effective communications during flooding emergencies [3]
- Exercises help build community awareness. [3]

Other themes:

- Improve community understanding of what to do in invent of extreme rainfall/flash floods [2]
- Make use of digital and social media. If good information is available on these channels,, communities will share it (twitter, Face Book etc) [2]
- Build relationships with communities all year round – not just when flooding occurs [2]
- Commit resources for media spokespeople. Consistent faces and voices can build trust and credibility with the community.[1]
- Effective communication brings some challenges e.g. well publicised websites, digital channels etc can be overwhelmed. Ensure adequate IT capacity for extreme levels of demand [1].
- Community awareness can be low; in big cities residents are not well prepared to face extreme weather events [1]
- On the other hand, community awareness and emergency mechanisms in an area can be very well developed; precautionary measures with evacuation of settlements were adopted. [1]
- Improve community understanding of dam/reservoir risks and plans [1]
- Improve community understanding and response plans in coastal risk areas [1].
- Coastal surge events attract high media interest – this can raise anxiety, sometimes unnecessarily (1)

- Clear information for communities about access to support schemes, compensation; links with insurers, and effective response from authorities so that insurance claims can be resolved speedily (1)
- Involve community in post-flood review from early stage, to deliver good solutions with community support [1]
- Following an event, awareness of communities and local authorities is raised, and preparedness and measures for preventing floods are taken into account more seriously [1]
- Open data – enable others, including communities, to use information to inform others. And use third party assets to gather information during flooding e.g. river webcams. [1]

Breakout session 1, Topic 4: Lessons for protecting vital societal functions e.g. critical infrastructure, hospitals, schools

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. The responses included lessons learnt from recent flood events. Below is a summary of the common themes emerging from the lessons learnt with regards to: *protecting vital societal functions e.g. critical infrastructure, hospitals, schools*

(The number in brackets next to each theme shows how many of the responses included the theme)

Top three themes:

NB Only a small number of respondents made separate reference to critical infrastructure, hospitals, schools or other vital societal functions, but the majority of respondents listed lessons on protecting geographical areas and people. It is therefore assumed that the lessons apply generally, and are equally relevant to protecting vital societal functions.

- Extent, performance and condition of assets (defences) proved inadequate or insufficient in many cases (10).
- Although newer defences performed well, older assets were often in poor condition, and had not been maintained or upgraded to account for new understanding of risk resulting from e.g. land-use changes, expansion of communities etc over time* (9)
- Significant collaborative effort needs to be applied by authorities and critical infrastructure operators to improve resilience to flooding. (3)

Other themes:

The vast majority of lessons related to asset standards, condition and implementation of measures e.g.:

- Lack of information on assets – need good registers and records of assets and condition, and protection they provide to settlements, industry, agriculture (4)
- Low awareness of protocols, rules and regulations for operating assets during flooding (3)
- Regular assessment of asset condition (3)
- Regular maintenance and clearance of obstructions is critical (3)
- More investment in, and use of mobile assets e.g. demountable defences and pumps, would help, but need good records of what exists / where, and agreed protocols for deployment (3)
- More integrated approach, using space to store water, land management, vegetation etc, especially with climate change (3)
- Impact on agricultural production has an economic cost (3)
- Need more resources for protection measures, maintenance etc – people and €€ (at time of economic austerity) (2)

- Impact on schools/educational facilities has an economic cost (1)
- Dense urbanization makes it very difficult to implement flood prevention measures (lack of available spaces) [1]
- Measures with artificial breaks of levees and controlled flooding of riparian lands were adopted in order to attenuate peak discharge and protect settlements [1]
- An example from one event for a MS highlighted some vulnerabilities and potential impacts on societal functions: 400 people were evacuated, 1 casualty, 11 were hospitalised because of hypothermia. Harbours, ports and shipping were disrupted and roads flooded. 33 electricity transmission stations affected (up to 3000 people without electricity up to 3 days) with electricity switched off to exclude more damage [1]

One MS (Hungary) noted that a complete redefinition of the country's defences was needed in light of flooding experience.

Breakout session 2, Topic 1: What main actions are being taken to adapt to climate change with regard to flooding?

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. Below is a summary of the common themes from the questionnaires for the question: *What main actions are being taken to adapt to climate change with regard to flooding?*
(The number in brackets next to each theme shows how many of the responses included the theme)

Top three themes:

- Studies and strategies on climate change vulnerability, impact and adaptation at a national and/or regional level [14]
- Awareness raising to public and businesses of the impacts of climate change [13]
- Flood Risk Management measures and assets constructed (or adapted) to take climate change in to account, and built with resilience in mind. [13]

Other themes:

- Financing of major flood defences and flood risk management programmes / schemes [6]
- Improved flood hazard and flood risk (i.e. impact on receptors) knowledge studies [5]
- Strengthened regulation, legislation and policy with regard to e.g. flood defence standards, development control [5]
- Including climate change as part of the economic investment decision [5]
- Development control and planning considerations in flood risk areas [5]
- Improved data observations and dissemination of data to inform decisions and analysis including e.g. flood forecasting and flood warning [4]
- Building / integrating climate change adaptation / resilience activities across sectors / regions [3]
- Floods Directive implementation [2]
- Construct properties and infrastructure in an “adapted” / resilient manner [2]
- Improved preparedness for flood events and improved emergency planning [2]
- Event feedback into system [2]
- Flood Warning service [1]
- Research projects to better understand climate change [1]
- Dams and dikes safety taking account of the increasing frequency of floods [1]
- Water management in real time with regard to both floods and drought [1]

Breakout session 2, Topic 2: What improvements in technology would make a difference in preparedness, response and recovery for future floods?

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. Below is a summary of the common themes from the questionnaires for the question: *What improvements in technology would make a difference in preparedness, response and recovery for future floods?*
(The number in brackets next to each theme shows how many of the responses included the theme)

Top two themes:

- Need for improved flood warning / early warning systems, and associated communication of flood warnings [11]
- Meteorological modelling and forecasting of spatial variation and intensity of extreme rainfall leading to flash / pluvial flooding [9]

Other themes:

Data and Data Management / Processing for Operational Management

- Improved GIS, mapping, and data for flood hazard mapping etc. [3]
- Real time river modelling and flood forecasting [3]
- Improved tools for emergency planning and crisis management, including crisis management "games" to raise awareness [3]
- Data collection by drone / satellite imagery during events and after events to assist in understanding scale and location of flooding during an event [2]
- Improved Digital Terrain Models for mapping [1]
- Additional data collection systems installed - tide gauges, met radars etc. for improved data [1]
- Automated Stations with sensors that monitor water quality [1]
- Software and hardware for coordination and control during hydraulic structures operation [1]
- The safety of hydraulic engineering structures will be increased by Automatic stations with sensors that increase dam safety, automatic sensor stations that measure the snow layer, and gauging stations for inflow discharges, intakes and diversions [1]
- New Decisional Support System (DSS) for integrated water management, created to support decision centres in flood management [1]
- National system for water management in real time - will be automated, based on information received from measuring stations with possibility to forecast water resources and inundation areas. Could make short, medium and long-term forecasts, which will improve the response of the competent authorities and population during the floods [1]

Climate / Weather Modelling and Forecasting

- Climate modelling – Improved resolution, and confidence in results to better understand and predict impacts [4]
- Longer term weather forecasting accuracy to improve warning and preparedness [4]
- Short-term local climate change impacts [1]

Engineering and Construction

- Better materials and devices for flood-proofing of properties / building more resilient homes to reduce damage [2]
- Improved means, and innovative approaches, to temporary flood defences and deployment to reduce damages during events [2]
- Improvements in sustainable urban drainage systems (SuDS) and technology to reduce surface water flooding impacts [1]

Breakout session 2, Topic 3: What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. Below is a summary of the common themes from the questionnaires for the question: *What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?*
(The number in brackets next to each theme shows how many of the responses included the theme)

Top three themes

- Greater adaptation of spatial planning (e.g. to avoid developments in vulnerable areas, floodplains, resettle populations, take account of climate change) [11]
- Flood protection measures [8]
    - More of these and more modernisation / implementation of measures
    - Solutions which allow future adaptation
    - Greater use of natural retention measures, natural land management solutions
- Greater accuracy in climate change projections, greater analysis and understanding of the risks, vulnerable areas and impacts (geographical, sectors of society, societal functions) [7]

Other themes

- Local community, business resilience - greater communication to increase resilience, promotion of local flood groups [7]
- Greater adaptation to construct more resilient buildings and infrastructure (technology and policy) [6]
- Climate proofing all policies, programmes and actions across society, sectoral adaptation plans (improve links between research and policy) [6]
- Climate change embedded in flood risk management strategies and decision making [4]
- Governmental Adaptation Strategy - continuous development and improvement [3]
- Flood forecasting / early warning systems [3]
- Sharing good practice with other members states and neighbouring countries [2]
- Protection of vital societal functions [2]
- Public sector training / delivery of workshops with stakeholders [2]
- Community involvement and awareness [1]
- Close working with national civil defence [1]
- Assessments of lessons learnt after extreme events [1]
- Creating an efficient flood insurance and compensation system [1]
- Catchment based integrated planning (e.g. between water, environment, spatial planning, emergency planning, infrastructure, transport etc.) [1]

- Defining a common approach to flood risk management in transboundary river basins [1]
- Stronger local government ownership of local flood risk (pluvial flooding) through the planning process [1]
- Identify consequences of significant flood risk on the built heritage [1]
- Climate change guidance to service providers and responders [1]
- Programmes for leakage control in urban areas through temporary reservoirs and sewerage networks [1]

Breakout session 2, Topic 4: What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?

Prior to the workshop all member states were sent a questionnaire on flood resilience and adaptation. 21 responses were received from 18 member states prior to the workshop. A further four member states provided responses shortly after the workshop. Below is a summary of the common themes from the questionnaires for the question: *What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?*
(The number in brackets next to each theme shows how many of the responses included the theme)

Top two themes

- Raising awareness / disseminating information on climate change to the public to increase personal responsibility [10]
- Community and business participation, engagement, education and communication [7] to encourage:
    - More uptake / participation in flood action groups to reduce vulnerability [3]
    - Greater awareness of flood warning service [1]
    - Education of younger generation [1]
    - Community and business involvement in Flood Risk Management Plan process [1]
    - Improving communications to build trust between community, business and competent authority [1]
- Spatial planning considerations; avoid development in vulnerable areas [4]

Other themes

- Improve understanding across the private sector to increase adaptation, business continuity, planning and response [3]
- Adaptive buildings / construction methods [2]
- Identify and implement measures to reduce the impact of flood risk (resistance, resilience) e.g. property level protection [2]
- Greater research on climate change impacts on floods [2]
- Incorporating research into strategic planning (e.g. Flood Risk Management Plans) [1]
- Communicating results of research [1]
- Improved national understanding of the vulnerability of communities [1]
- Statutory climate change guidance [1]
- Tools, resources, knowledge transfer between government organisations [1]
- Sectoral adaptation plans for communities and businesses [1]
- Promote property level protection [1]
- Improved property insurance for areas at risk [1]
- Natural land management solutions [1]
- Organizing flood defence and evacuation exercises [1]

Annex V – Notes from breakout sessions

The notes included on the following pages are a summary of the discussions within each topic area. Whilst the guidance notes included in Annex IV provided an indication of possible areas of interest within each topic, they were not used as an 'agenda'.

Within the format of the workshop, each topic was covered by two different groups, thereby bringing in a wider range of viewpoints. In the notes on the following pages, no distinction is made between each group discussion for a given topic, and the notes shown for each topic are an amalgamation of discussion points covered.

The breakout sessions and topic summary notes provided are as follows:

Breakout session 1, topic 1:	What Floods Directive tools/actions have been most useful in raising preparedness and resilience?
Breakout session 1, topic 2:	Lessons for communications – coordination of response – effective warning to cover both Government and community perspectives
Breakout session 1, topic 3:	Lessons for community awareness and involvement
Breakout session 1, topic 4:	Lessons for protecting vital societal functions e.g. critical infrastructure, hospitals, schools
Breakout session 2, topic 1:	What main actions are being taken to adapt to climate change with regard to flooding?
Breakout session 2, topic 2:	What improvements in technology would make a difference in preparedness, response and recovery for future floods?
Breakout session 2, topic 3:	What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?
Breakout session 2, topic 4:	What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?

Breakout session 1, Topic 1: What Floods Directive tools/actions have been most useful in raising preparedness and resilience?

Mapping (most useful)

- Useful to have range of maps (extent, depths, risk to life, vulnerable properties, critical infrastructure) for range of probabilities (can see how flood will develop).
- Historic flood maps have helped to inform newly identified risk areas.
- Made information available to the public – helps local authorities and individuals to plan for their own flood resilience. Helps to coordinate effort.
- Has helped to identify areas at risk of flash flooding/high risk areas.
- Helped raise political awareness of flood risk.
- Mapping has helped to understand where future flood risk is.
- Simple mapping can convey simple messages that areas are at flood risk.
- Encourages structured data collection.
- Has encouraged new modelling techniques.
- This work has helped identify user needs.
- Able to influence local land use planning.
- Provides information about design flood levels for assets, able to update the information and understand the effectiveness of assets and better plan for the future.
- Land Use Planning (future resilience).
- FUTURE IMPROVEMENTS: Target User Needs – Specific maps that are understandable and useful to specific users.

Flood Risk Management Plans (2nd most useful)

- FRMPs contain specific measures for developing resilience.
- FRMPs have helped coordination between strategic planning and emergency response, providing a common definition of risk and vulnerability.
- Having a national catalogue of measures in FRMPs helps to emphasise the importance of looking at non-structural measures which helps improve preparedness and resilience at different levels e.g. catchment and sub-catchment levels.

Public engagement/information exchange/improved co-operation (3rd most useful)

- FD Public engagement has helped people to be a part of the process of managing flood risk.
- Public engagement helps to raise awareness.
- Public engagement helps the public understand that they need to take more ownership of managing their risk.

- Proposal to run public Education Campaign on flood risk and what people should do for themselves.
- Helps build networks between key organisations.
- Encourages the development of working groups an task and finish groups.
- Helps to develop communication techniques.

Preliminary flood risk assessments

Main topics raised:

- PFRAs have helped to identify the areas of most significant risk, help ensure emergency response plans etc. for those areas.
- Has helped formulate mitigation measures in a more holistic way.
- Help understand how we could modify land use in those areas
- PFRA process itself was the first broad scale national risk assessment for some countries.
- Has encouraged new cooperation between different sectors and departments.
- In the UK new surface water maps published to help understand the risk from this source of flooding.
- 2nd cycle –
    - Some countries may focus on different sources,
    - May do more to understand the vulnerability of communities, as opposed to just counting houses

Some issues –

- There are huge differences between what each country considers as 'significant',
- Can be difficult to explain to stakeholders if there are disparities in trans boundary river catchments.
- Need more cross border working.
- Agreeing the criteria for 'significant' can be challenging, could set the same criteria, but different countries may value them differently – challenging to standardise Europe – coordination from a public and political perspective is important.

Breakout session 1, Topic 2: Lessons for communications – coordination of response – effective warning to cover both Government and community perspectives

Lessons learnt from communities

Two key themes:

1. **People can do more to help protect themselves**
2. **We can improve how we communicate (clarity of the communication)**

- Clear examples of where community resilience has been successfully promoted – the impacts of flooding are much less. People are able to get back to business as usual much quicker.
- Communication is key, can't regulate individuals to take action, need better education.
- People need to understand that 100% protection is not possible.
- Local communities tend to be overlooked and are not necessarily listened to. They understand their locality best.
- How do you tackle those who won't help themselves? People to understand and respect technical decisions.
- Scope for improving response – top down, as well as communities doing things for themselves – bottom up. Information of flood risk can be provided from top down and develop actions from a bottom up approach.
- UK issue - confusion about who is responsible for different sources of flooding and who people can turn to for what (not an issue for most Member States).
    - Carrying out exercises can help, some Member States involve the public in these exercises.
    - Train the trainers (train a representative of the community, which in turn helps the community understand) – focussing on sites which were most severely impacted.
    - Should start to educate young people. In Austria work with schools where there are local flood projects.
- Media – better use of this. NL has developed an app which shows people the predicted flood depths if they flood. Hurricane Katrina has changed Dutch views and they now want to raise public awareness of flood risk.

Forecasting – communicating the warning better and communicating what people need to do

- There have been improvements overall but over the past 50 – 60 years there has been a trend that authorities will respond when there is a flood event and there is expectation from communities that authorities will manage flooding.
- Messaging needs to be clearer so people understand what to do when they are warned.

- Flash floods – is hard to predict and thus more challenging to forecast and warn communities. This area is identified as needing more development. In general coastal flooding is easier to predict.
- The way in which warnings are disseminated – make sure it reaches people and they understand it.
- Need greater accuracy around warnings to improve people's confidence in that warning leading to actions being taken.
- Good forecasting helps Governments prepare their contingency planning.

Co-ordination

- Improved coordination between authorities, and national, regional, local level.
- Better coordination between infrastructure providers, e.g. transport, reservoir owners (water management, energy generation – separate owners).
    - Example of Dawlish railway line in UK (winter floods 2013/14).
    - Example of Danube – re coordination between reservoirs.
    - For reservoirs – the actions should be taken by flood managers, not reservoirs owners, so it can be better coordinated.
    - Need better coordination with neighbouring communities and government officials.
- Better communication between local authorities and those that are issuing warnings.
- Exercises are key.

Breakout session 1, Topic 3: Lessons for community awareness and involvement.

- It is important that support is given by regional and national Governments to transfer knowledge of flood risk at the local level. In Wales they have started a Flood Risk Awareness programme to support communities. Funding is available for this purpose.
- As a first step there is a need to raise awareness that someone in the community should take responsibility.
- In the UK research has shown that maps do not mean anything to people. Maps are useful for technical analysis but need to find better ways to communicate with the public. The term 'risk' is difficult for the public to understand (e.g. what does a 100 year flood event mean). People want to know what could happen and what they have to do. Such information is already provided in relation to fire risk.
- In Estonia there has been a lot of interest in the new flood maps.
- Other methods of raising awareness can be used such as flood hazard walks in Sweden or flood levels on doors along the Rhine from previous floods.
- Communities have limited financial resources so open sources of data would be useful.
- In Romania half the properties are likely to be affected by flash flooding. People do not understand this risk as it is not on the flood maps. It is mainly poor people that are affected by this type of flooding. This makes local plans important.
- In Northern Ireland it has proved difficult to raise the level of knowledge on flood risk.
- Flood risk is quickly forgotten after a flood event. Only recent flood events keep flood awareness alive. Need to use real flood to raise awareness Use memories of past floods to help visualise what this means. Use flood events from across Europe to highlight risks locally.
- It is easier to engage if areas flood regularly. Generally these communities are much better prepared.
- There is an issue of credibility if there is deemed to be a flood risk but there have been no floods for a considerable amount of time.
- Do we need to communicate residual flood risk to the public? The public need to understand what happens if assets fail.
- An issue of insurance. People are not willing to pay for insurance when they know the Government will pay.
- In Romania a lot of expertise has been lost over the past 20 years but now new structures have to be developed.
- In Luxembourg have very local partnerships and these are working well.
- In general urban areas are more difficult to communicate flood risk as people are more mobile and lack a sense of place. Also flood defences tend to be larger as protecting large financial assets and there is less involvement from the public. Rural communities tend to have a stronger sense of place.

Breakout session 1, Topic 4: Lessons for protecting vital societal functions e.g. critical infrastructure, hospitals, schools.

This question was approached in two different ways by the two groups which considered this topic.

One group focussed on who was responsible for protecting critical infrastructure.

- Romania reported that it is usually the private owners of the infrastructure that are important. E.g. hydro power dams.
- Sweden flagged up that is difficult for small municipalities to work with large private companies who are not necessarily aware of the community issues.
- France is developing a national list of critical infrastructure but as yet no prioritization has been established. Special tools are necessary to identify the points of vulnerability in the case of construction or re-construction of infrastructure.
- Germany have undertaken at the federal level various risk analyses e.g. for floods in 2012.

The second group focused more on communication and planning.

- There is a need to plan in advance and set priorities.
- Exercises and emergency plans are important to understand the area, have practiced arrangements, have plans in place; people understand their roles and responsibilities. Also important to have a hierarchy of society functions to focus on in turn e.g. life, power, water etc.
- Communicating information. Serbia flooding caused the flooding of opencast mines which had large economic impacts. In Ireland flooding causes drinking water supplies to be disrupted to 55, 000 homes. This was a larger story that the small number of properties that were flooded.
- Need to be resilient to the media.

Breakout session 2, Topic 1: What main actions are being taken to adapt to climate change with regard to flooding?

The main actions include:

Types of measures

- Hard structural measures:
    - Construction measures – incorporating scenarios – e.g. bigger flood defences.
    - Providing clear standards for construction.
    - Designing defences and buildings so they can fail safely once the design levels are exceeded.
    - No regrets measures e.g. wider flood defences so that they can be increased in size in the future.
- Soft structural measures - Natural measures:
    - Understanding that it's not about conveyance and getting water away from areas quickly, but managing water where it arrives – i.e. where the rain falls.
- Non-structural measures:
    - Studies, early warning systems, forecasting.
    - Restoration actions.
    - Understanding predictions – how will the risk increase in various scenarios?
    - Spatial planning needs to take better account of future risk.
    - More resilience communities, spatial planning.
    - Understanding vulnerability.
    - Development of legislation. In England and Wales have the Flood and Water Management Act 2010. Other examples include water regulation and adaptation information.
    - Mapping and scenarios which helps inform legislation.
    - Future scenarios, modelling and nationwide studies.
    - Crisis management including rescue operations, improved forecasting, disaster warning, awareness raising and widening early warning systems.

Strategic planning

- Flexible, integrated strategic planning.
- Long term investment strategies to understand different climate change scenarios and how these impact investment, enables governments to make informed decisions.
- Need to understand interaction between the sectors.
- Issues – who manages this? Who brings it all together? Some sectors are more developed than others e.g. FRM.
- Ireland example – Climate Bill could help to coordinate sectoral adaptation plans – climate change adaptation coordination group.

- Hungary example – the national adaptation strategy focuses on mitigation (greenhouse gasses) – struggle to get buy in and interest in FCRM issues as the focus is on mitigation and not adaptation.
- National adaptation frameworks and national strategies which then lead to sectorial adaptation plans could include a FRM sectoral adaptation plan (example of Ireland).
- National standards for delivering flood risk management schemes, including more natural catchment management techniques.

Public awareness / information

- Can be difficult to reach the public on these issues as it deals with long term change.
- The scientists need communication skills to get messages across in a simple way.
- Need to be better at communicating with other sectors, e.g. transport, spatial planning – can be challenging as we would need to provide mapping that demonstrates what e.g. 100 years climate change includes – how can we provide confidence in those projections.
- Mapping (including climate change) is difficult to communicate to the public i.e. for them to understand and for them to believe it – how to generate public belief in climate change scenarios? Politicians that provide leadership in this – champions – can be very influential as well as engaged media.

Breakout session 2, Topic 2: What improvements in technology would make a difference in preparedness, response and recovery for future floods?

Forecasting and warning systems

- Improvements in warning systems.
- Improved warning for flash floods, for small scale events particularly in urban areas.
- Warnings for pluvial flooding including meteorological techniques to predict local rainfall.
- New prediction models, better modelling and forecasting of flash floods.
- Improved digital models, better knowledge of territory and land use variations.
- The UK has reduced the scale they can forecast too. This requires a huge amount of computer power and needs to be able to run data quickly across the ground and use atmospheric information. In England some areas have weather radar at 1.5km and rain gauge data, but this is not across the whole country.
    - Some communities can gain direct access to the data but not clear how well equipped they are to use and act on the information. It takes too long to go through intermediaries.
- For the Moselle River the flood forecasts are made public. Predicting 6 hours ahead for river levels.

Research / science

- Improved understanding of climate change scenarios.
- Better understanding of vulnerability.
- Improved methods of counting flooded properties.
- Decision making systems for integrated water management.
- Understanding impacts on glaciers and mountainous regions, how water and sediments will be released as ice melts.
- How to transfer information to the public.

Resilience / resistance for developments

- More resilient homes.
- Improvements in technology in sewage systems to better manage flows, to manage the systems in real time.
- Improved capacity for systems.
- Adaptive construction, design to be resilient to flooding and also to fail safely
- Technology is vulnerable to failure. In Austria looking at the need for back-up systems.

Communication tools

- Improved warning and informing.
- Better communications technology to improve response.
- Systems to allow the public to report flooding. This would allow for a better understanding how flooding events develop in terms of extent and depth. Also help to check the accuracy of existing mapping.

Breakout session 2, Topic 3: What key future adaptation actions at national/regional/local government level will raise resilience to future flooding in a changing climate?

- At the state level there are regulations and funding frameworks. Need to set a clear framework – e.g. FRMPs. Also set resilience and resistance standards.
- At the regional level spatial planning is important. There is a need to build more resilient cities and to have design codes to build more resilient buildings.
- Development strategies have to be defendable but decision makers can overrule decisions at a local level.
- In Austria have hazard zone plans which were established in the 1970's. These have now been revised.
- Insurance was important. In UK all can be insured against flooding and everyone pays. In Luxembourg it is not possible to insure against flooding.
- Insurance should be linked to the adaptation measures that are undertaken at a property.
- Can be very complex governance at the regional local level. In Sweden there are eight different authorities dealing with these issues.
- There is a lot of variation across the EU on how this is approached.
- At the local level more detail can be developed to reflect local knowledge.
- Greece would like to see more research to specify the effects of climate change at the local level and for different scenarios.
- At a local level the demographics of the population need to be understood. Elderly people are more vulnerable.
- Agriculture has a lot of power.

Breakout session 2, Topic 4: What key future adaptation actions at business and community level will raise resilience to future flooding in a changing climate?

Awareness

- Business reports and awareness; warning awareness; designing and building for the future; sector climate awareness plans.
- In Sweden the view is that must involve stakeholders in the process.
- Lack of education on climate change adaptation often hinders action at the local level. It is necessary to strengthen institutions at the local level.
- Only people that are flooded ware likely to take flood reduction measures.
- It is difficult to get big companies to take action as they do not understand the problems of the municipalities.

Land-use planning and planning

- Better plans for the future; understanding the risk; understanding the level of safety for future housing; adaptation of construction standards; anticipate flood risk reality; climate change adaptation plans.
- In Germany urban planning is an important issue.

Policy instruments: property level measures

- Financial incentives (e.g. part Government and part property owner funded).
- Subsidies for adaptation should be considered.
- In Sweden a toolkit for local government has been developed
- International discussion and catchment approach with regional leaders; compensation for flooding/drought/crop failure.
- In Germany adverse effects are must be considered and a screening tool is being developed for the purposes of FD and WFD. It will be applicable at the local level.
- Insurance could be a lever.
- Rural Development Plans are costly and there is poor coordination between funding streams.
- Some conflicts between climate change adaptation and the need for growth and jobs.
- Government expertise is crucial.
- In France houses are bought so people can leave the area at risk.