WG F 18
WORKSHOP ON COASTAL FLOODING AND SPATIAL PLANNING

Report of a workshop held on 22 and 23 October 2015
Zurbano Palace
Madrid, Spain

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This is the **final draft** report of the WG F thematic workshop on coastal and urban planning, held in Madrid, Spain in October 2015.

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

Acknowledgment:
We would like to mention the fantastic work that the facilitators, note-takers and attendees carried out. Thank you to all of you.

Picture 1: General overview of the workshop.

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1 Executive Summary

As part of a series of workshops on the implementation of the Floods Directive, a thematic WG F workshop took place in Madrid, Spain on the topic of coastal flooding and spatial planning on 22 and 23 October 2015. The workshop was hosted by the Spanish Government. During the workshop, 24 member states, the European Commission and other stakeholders were represented by 74 delegates.

The workshop focused on two different and related aspects of flood risk management:

- Experiences of coastal flooding.
- Urban planning and flood risk management.

In preparation for the workshop two comprehensive questionnaires were circulated to all member states for completion, covering a wide range of aspects related to coastal flooding and urban planning. Responses were received from 13 member states (17 questionnaires) of the coastal flooding questionnaire and 20 member states (24 questionnaires) of the spatial planning questionnaire. The responses from the questionnaires 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 risks, to capture experiences and lessons learnt from recent floods and actions arising from the Floods Directive which have made a difference to coastal flood mapping and risk management, in particular, in spatial planning policies. The previous workshops on this issue are the one on Land Use Planning and Water Management with focus on Flood Risk Management, celebrated in Norway in 2007, and the Workshop on Flood Management in Local Planning held in Austria and Slovenia in 2008. This workshop tried to evaluate the outcomes, improvements and challenges for the future of both the two previous workshops and the relation between spatial planning and the Floods Directive.

Looking to the future it also aims to identify the key climate change issues to be considered in coastal flood mapping and/or risk management measures that will support planning, response and recovery for future flood events.

Workshop theme discussions

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

- Coastal flooding in Europe and the Floods Directive
- Assessing the impacts of climate change on coastal flood risk in Europe
- Methodologies used in coastal flood mapping and the consideration of climate change in coastal flood risk management
- Coastal flood risk management and successful measures
- Spatial planning in flood prone areas: key aspects and recommendations for streamlining between spatial planning and flood prone areas in the FRMPs

Overall workshop conclusion

The overall conclusion from this flood workshop is that, across much of the EU, thanks to the Floods Directive, the different MS are producing a lot of information about coastal flooding, hazard and risk maps, and new measures which, generally speaking, are managing to improve technical knowledge about coastal flooding, but there are important differences between MSs. There are a wide range of necessities to improve the coordination.

In terms of the relationship between spatial planning and flood risk management, the majority of the MSs already have integration, but, in general terms, the FRMP are going to help to increase this coordination. There is a real necessity to define the flood prone areas beyond the APSRF. There are good examples of countries with a good level of integration, that can be used for the MSs which need to improve their legislation.

This report collates the many observations made during the workshop and presents recommendations under these thematic sessions. All papers and presentations made at the workshop are available on the EU CIRCABC web site through CIRCA BC hyperlink (WG F contents).

Picture 2: General overview of the Zurbano Palace during the meeting.

Workshop conclusions and recommendations (coastal flooding)

- There is a need for improving the consistency of the Flood Hazards/Risk Maps and the methodologies used for developing those maps. Coastal flood mapping is a complex problem where many different variables and dynamics are involved. This has the effect of many uncertainties within the models used and the methodologies for calculations, resulting in a wide range of approaches. Furthermore, some maps include defences, others do not. The result is that maps are consistent within a Member State but risk results cannot be compared among state members.

Recommendation: WGF members to share the latest developments in the calculation of flood hazards (methodologies, modelling approaches, dynamics involved in the calculation, scales, etc), and how this is used to prepare hazards/risk maps.

- There is a need for improving the consistency on how Climate Change is considered in Flood Hazards/Risk Maps. WGF members agree that climate change should be included in the map calculations but it is not clear what climate change scenario is to be used. Furthermore, Climate change is usually considered in Flood Risk Management measures, but the inclusion in coastal flood mapping must be improved.

Recommendation: WGF members to share the latest developments on how to consider Climate Change in Flood hazards/risk assessments.

- Effective communication across a wide range of flood risk management issues and associated aspects of climate change is critical. It is agreed that coastal flood maps are very useful for defence investment plans, development plans, emergency response, etc. However, there is a need for a clearer explanation to the public so that they can understand what these maps are made for. This includes communications with the public, business / commercial sectors, media, politicians and other stakeholders.

Recommendation: WGF to give consideration to organising a Workshop on flood risk communication as part of the Work Programme 2016-18, elaborating on the findings of this workshop held in Madrid, 2015.

Workshop conclusions and recommendations (spatial planning)

- Spatial planning is the key to avoid increases in flood risk: Most member states have improved their acts and rules for increasing the coordination between spatial planning and flood risk management, but in most countries it is still necessary to improve them, because there are some gaps remaining. The FRMPs include measures to improve this coordination, being one of the most important groups of measures.

Recommendation: MSs to update their rules following and the experiences taking into account we shared in the workshop.

- The recommendations to help design a good regulation could be the following:
  - The regulations should apply at a country and/or regional/federal level more than municipality level.
  - The rule should include graduated bans for each different scenarios for fluvial and coastal flooding, according with the risk of the different land uses.
  - The rule should include some exceptions, well defined, because, in some cases, occupying the flood prone areas can be inevitable.
  - For pluvial flooding, the rule should define criteria (e.g. return period) for design drainage and sewage systems, and criteria for designing buildings and infrastructures when this return period is exceeded.
  - This regulation should be applied in the whole territory, beyond the APSFRs, for this reason, it is necessary define to flood prone areas in each new settlement.

Recommendation: MSs to compare their relevant regulations to ensure that all of these issues are addressed.

- Green approach is being considered in the different member states; nevertheless, it is necessary to increase this implementation. Climate change is beginning to be considered, in some cases as a recommendation. Due to the uncertainty, it is necessary to develop new studies and a general strategy. A good strategy is to define how the receptors must be designed or adapted in the current flood prone areas, or a future with climate change taken into consideration.

Recommendation: MSs to share all information and methodologies not only that regarding coastal flooding. The European Commission should help MSs find a common strategy for the consideration of climate change in flood risk management policy.

1.1 Introduction

Workshop title: Coastal flooding and spatial planning
Date: 22 – 23 October 2015
Venue / host: Zurbano Palace, Madrid
Organising committee:

- Ana García Fletcher, Ana Isabel Acebo. *Directorate General of the Coastal and the Sea. Ministry of Agriculture, Food and Environment. Spain*.
- Barbro Näslund Landenmark. *Environment Ministry*. *Sweden.*
- Clemens Neuhold. *Federal Ministry of Agriculture, Forestry, Environment and Water Management. Austria*.
- Eva Baron. *Ministry of Infrastructure and the Environment. The Netherlands*
- James Morris. *Welsh Government. UK- Wales.*
- Jonathan McKee. *Department of Agriculture and Rural Development. UK- Northern Ireland.*
- Mark Adamson and John Martin. *The Office of Public Works. Ireland*
- Mónica Aparicio, Carmen Coleto, Conchita Marcuello, Jorge Ureta, Fco Javier Sánchez. *Directorate General of Water. Ministry of Agriculture, Food and Environment. Spain.*
- Raul Medina. *University of Cantabria. Spain*

1.2 Background

At the meeting of Working Group F (WG F) of 9 and 10 October 2014 at Rome, it was agreed that a workshop would be held in Madrid on the topic of 'Coastal flooding and spatial planning', with the objective of improving the coordination and interchange of knowledge of how the different countries deal with coastal flooding, including mapping and measures.

Regarding spatial planning, the main workshops related with the issue could be the one on Land Use Planning and Water Management with focus on Flood Risk Management celebrated in Norway in 2007 and the Workshop on Flood Management in Local Planning held in Austria and Slovenia in 2008. It is now more than 7 years since these workshops took place and during this period the Member States have already developed the Preliminary Flood Risk Assessment and the Flood Hazard and Risk Maps for the Areas of Potential Significant Flood Risk and are developing the Flood Risk Management Plans according to the Floods Directive. The workshop tried to collect information and evaluate the outcomes, improvements and challenges for the future of both the two previous workshops and the relation between spatial planning and the Floods Directive.

1.3 Objectives and outputs

The core objectives of the workshop were:

- To share different lessons learnt in relation to coastal flooding around Europe.
- To share experiences to show how is the level of integration between spatial planning and floods risk management across Europe.

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 questionnaires responses
- summaries of the discussions held and key issues and themes emerging from the workshop sessions
- the conclusions of the workshop.

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 22 October 2015, and the second in the morning of 23 October 2015, as follows:

- Session 1: Coastal flooding in Europe and Coastal Flood Mapping
- Session 2: Flood Risk Management Plans: Coastal and spatial planning

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 several presentations covering different aspects of the topics to be covered in the breakout sessions and a special presentation with the conclusion of the two questionnaires.

- **Session 1: Coastal flooding in Europe and the Floods Directive.**

- Presentations on Flood Events and Lessons Learnt in relation to coastal flooding in different MS:
    - NL, 50 years of coastal protection. Lessons learnt)
    - IE, Assessing tidal flood risk in Ireland)
    - ES, Lessons learnt on CFR Management in the Basque Country
    - UK, Wales, Response to 2013/14 coastal storms and lessons learnt in Wales
    - EL, Assessment of flood risks from the sea in Greece

- Assessing the impacts of climate change on coastal flood risk in Europe (JRC)

- Summary of Questionnaires in relation to Coastal flooding

- Breakout session: Methodologies used in coastal Flood Mapping and the consideration of Climate Change in CFR Management, answering questions such as:

- Topic 1: Main difficulties found when mapping
- Topic 2: In which way have you included CC?
- Topic 3: Any issues with the joint probability of coastal and fluvial flooding
- Topic 4: Main methodologies and recommendations
- Topic 5: Usefulness of the studies outcomes

- **Session 2: Flood Risk Management Plans: Coastal and spatial planning**

- Presentations on CFR Management and successful measures

  - DE, CFRM with regarding adaptation to climate change.
  - FI, Recommendations for minimum building elevations on the Finnish coast.
  - BE, Project "signal areas" spatial planning to reduce flood effects.

- Presentation on Spatial Planning in Flood prone areas:
  - Outcomes from previous workshops.
  - Summary of Questionnaire: Spatial Planning in flood prone areas in Europe.

- Breakout sessions: key aspects and recommendations on streamlining between spatial planning and flood prone areas in the FRMPs, answering questions such as:
  - Topic 1: Recent developments on Spatial planning in each MS/RBD.
  - Topic 2: Have you endorsed any legislation to protect from coastal/fluvial flooding
  - Topic 3: In which way do you consider the FD is enhancing the link between SP and floods risk management
  - Topic 4: Recommendations and lessons learnt

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** provides a summary of Session 1 "Coastal flooding in Europe and Coastal Flood Mapping
- **Section 3** provides a summary of Session 2 "Flood Risk Management Plans: Coastal and spatial planning"
- **Section 4** 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, useful links and questionnaire responses.

2 Session 1: Coastal flooding in Europe and Coastal Flood Mapping.

2.1 Report on workshop presentations on Flood Events and Lessons Learnt.

During the first phase of the workshop, different presentations took place. Below is a summary of the presentations given, reflecting both EU and several national perspectives:

2.1.1 Coastal flooding in Europe and the Floods Directive

Ioannis Kavvadas (IK) of the COM provided an overview of coastal flooding in the European Union (EU). IK described the floods types as described by WG F. The Preliminary Flood Risk Assessments (PFRAs) carried out as part of the Floods Directive show that coastal flooding is the third most important type of flooding, and will probably be the same for future floods. The Areas of Potentially Significant Flood Risk (APSFR) show that coastal flooding is significant. Sixteen MSs initially included coastal flooding in their assessment. Eleven MSs assessed coastal flooding to be significant. In four MSs it was not considered and it was not reported by nine MSs. Four MSs applied Article 13.1b.

In terms of flood hazard and risk mapping, 11 MS had mapped coastal flooding and eight MSs had mapped combined coastal and other sources of flooding. BE and SE did not map coastal flooding and CY, MT, RO did not see it as significant. IK provided a summary of the MSs who had mapped coastal flooding. IK also provided details of the probabilities used by MSs. Probabilities were calculated from time series or models.

2.1.2 Presentations on flood events and lessons learnt in relation to coastal flooding in MSs

2.1.2.1 Fifty years of coastal protection in the Netherlands

Jean-Marie Stam provided an overview of coastal flooding in the Netherlands (NL). Some 60% of NL is flood prone with 40% of the land below sea level. This land contributes 70% of the Gross National Product and 50% of the population lives in this area. NL's experience is relevant for: sandy coastlines; densely populated areas; and combining different functions and interests. There have been three main steps in the past 50 years in the NL in terms of coastal flood defence:

- First Delta Programme in 1953
- Dynamic maintenance of the coast commencing in 1990
- Second Delta Programme in 2008

The catalyst for the first Delta Programme was the 1953 coastal surge. Floods standards were set in Dutch Law and a six yearly monitoring and assessment programme of the works implemented. It took 40 years, 1956 to 1996, to set this system up during which there was societal change.

In 1990 dynamic maintenance of the coast line commenced following a heavy storm season and costly repairs to the system of dunes. The new philosophy was "hard where necessary: soft where

possible" which was flexible and effective. The year 1990 was used as the "reference coastline". Volumes of sand nourishment were stabilised.

In 2008 the second Delta Programme started. This included a reassessment of flooding standards taking into account climate change and changes in society. It is important to note that a large flood did not act as a catalyst for this programme. The second Delta Programme covers three themes: Flood protection; Sustainability and Spatial adaptation and has included large scale dune nourishment innovations (e.g. building with nature).

The conclusions were as follows:

- Coastal protection is a combination of hard and soft measures
- Hard measures take decades to complete and a flexible approach is needed
- Changes for spatial adoption include regional and local authorities

COM asked if "sand" is considered in the NL as a natural retention measure. NL said it could be considered to be. It was asked how much is spent maintaining sand nourishment. NL said that for a 300 km stretch, two-thirds of which is dunes it costs between €5 to €10 per m^3. This does not include cost of maintaining barriers.

2.1.2.2 Assessing tidal flood risk in Ireland

John Martin (JM) provided an overview of the modelling, mapping and forecasting of coastal flooding in Ireland (IE). There are six major cities in IE located on major estuaries which mean they suffer from inter-tidal flooding. There is a long history of coastal flooding events in Ireland. A high tide plus surge combined with high fluvial flows can cause coastal flooding.

The Irish Coastal and Protection Strategy Study (ICPSS) was commissioned by the Department of Marine and Natural Resource. A Phase 1 draft report was issued in 2004. In 2009 there was a transfer of responsibility for coastal flooding and coastal protection to the Office of Public Works (OPW).

The key outputs from the ICPSS and PFRS were:

- Extreme sea levels for combined tide and surge for 0.1% and 0.5% annual exceedance probabilities
- Coastal flood hazard extent and depth maps for 0.1% and 0.5% annual exceedance probabilities
- Coastal erosion maps for 2030 and 2050
- Confidence mapping for the flood and erosion maps
- Future coastal hazards have also been looked at for various climate change scenarios.

Undefended coastal flood hazard and depth maps were completed prior to the Preliminary Flood Risk Assessment (PFRA). One in three of the 90 Areas of Potentially Significant Flood Risk (APSFR) in IE are in coastal flood risk areas. Tide plus surge modelling has been carried out as part of the Catchment Flood Risk Assessment and Management (CFRAM) programme for 90 APSFRs. Wave overtopping and modelling has been carried out looking at overtopping of flood defences including six combinations of water levels and waves.

In terms of operations the Irish Storm Surge Forecasting Service is based on a MIKE21 flexible mesh model, two dimensional model. This provides forecasts 65 hours in advance. Forecasts are available via a password protected website with an excellent accuracy.

NL asked how accurate the surge forecasting is. JM said that the peak forecast time is within 15 minutes and the peak level is within 10 to 15 cm.

It was asked what the procedure was for developing the system JM said that Emergency responders had access to system and three astronomical tides were predicted to be high. Local communities worked with emergency responders. It was asked how many people visit the website for forecasts JM replied very few because it is password protected. It was also asked if it is possible to use the forecasting tool for infrastructure planning forecasting tool JM said no but it is possible to use the maps. Finally COM asked about prediction points. JM said that these were modelling points.

2.1.2.3 Basque country Spain: Lessons learnt

Christian Stocker (CS) said that historically there have been many flood events in the Basque country. In winter 2013/2014 there was coastal flooding and flooding caused by intense rainfall in August 1983. In winter 2013/2014 the flooding was caused by low pressure. Bilbao's flood defences were damaged. In San Sebastian there was damage to infrastructure including several bridges. The damage in winter 2013/2014 from storms was estimated to be € 25 million. Between 2004 to 2014 the costs of reconstruction was estimated to be €50 million. This does not include the economic losses.

In 1983 there were floods in Bilbao caused by intense precipitation (~100 mm/hour). In Bilbao the water was 4 m deep and the velocity was high which resulted in 39 casualties. The economic losses were estimated to be €1.2 billion.

Further risk can be prevented by avoiding building new settlements in flood-risk areas. Various prevention measures were discussed including: flood protection; spatial planning; and real time forecasting.

2.1.2.4 Response to 2013/2014 coastal storms in Wales and lessons learnt

James Morris (JM) said that in Wales 208,000 properties are at risk from river and coastal flooding. Around 104,500 properties are at risk from coastal flooding. There is 415 km of coastal flood

defences protecting £8 billion of assets. Coastal erosion risk is low, only affecting some 800 properties.

In 2013/2014 a one metre storm surge occurred and 1,400 properties evacuated. There were 355 properties that were flooded, over £8 million of damage to flood defences. There was no loss of life and the flood defences protected 99% of at risk coastal areas. This prevented £3 billion of damage. The December 2013 event affected mainly North Wales, whereas the January 2014 affected all of Wales. The Welsh Minister of Natural Resources carried out a rapid two phase coastal review. Phase 1 focused on the impact and cost of the storms, completed within a month of the January storms. Phase 2 identified lessons learnt to improve Wales' future resilience to coastal storms. A delivery plan detailing how the 47 recommendations would be actioned was published in January 2015 on the first anniversary of the floods. Six key priorities were outlined:

- Sustain investment in coastal and flood and erosion risk management
- More support to communities to help them
- Improved information on coastal flood defence and erosion management systems
- Greater clarity of roles and responsibilities
- An assessment of skills and capacity of Risk Management Authorities
- Locally developed and delivered plans for coastal communities and infrastructure operators

A pan-Wales approach allowed true integration in identifying lessons and priorities for action. Working rapidly maintained momentum. Here has been ongoing improvement with an extra £150 million for coastal adaptation announced. A coastal exercise has been conducted in March 2015 to help prepare responders. Shoreline Management Plans (SMP) have been prepared for the entire coastline. There are sometimes difficult choices between defending and adapting. In some cases SMPs can be a bit "insensitive". For example, Fairbourne is a tourist resort built in 1896 but it is not sustainable to continue to defend this community of 300 homes. This raises questions as to how can the town be relocated? Are there examples from Europe?

In the next few years it will be important to: improve understanding; look to examples across Europe and invest in research to understand the social and economic impact of coastal change, must continue to invest and defend downs and cities along the coast.

IE asked about the press and media response and whether there was consultation with the communities. JM said that there was wide consultation. However, he said that the SMPs are technical documents and that it was television that brought the message home. UK said that there is some work in England looking at how communities in England will adapt. JM said that the Welsh Government will be funding training to get everybody same standard.

2.1.2.5 Assessment of risks of coastal floods in Greece

Paris Panagopoulos (PP) gave a presentation on the assessment coastal flood risks in Greece. It was initially felt that flood risk from the sea in Greece is limited. The main factors affecting coastal flooding were outlined (i.e. astronomical tide, storm surge, tsunamis, wave setup and run up). The astronomical tide in Greece is small <0.1 m above mean sea level. A two dimensional storm surge model was produced. The driving forces are shear stresses from the wind and atmospheric pressure on the water surface. The coastline was discretised and the maximum rise found to be 80 cm.

The wave generation process was explained. The maximum wave height for the 1 in 50 year event was found to be approximately 0.8 m which was as expected. Overtopping mechanisms were not taken into account. The evaluation of coastal hazard was based on the 1 in 100 year coastal water levels. Climate change will be taken into account in the second cycle of the Floods Directive. In terms of the PFRA coastal areas with Areas of Potentially Significant Flood Risk (APSFRs) were identified as flat areas with significant land uses, where the expected sea level rise for 100 years is more than 1.0m. A brief overview of the threats posed by tsunamis was given.

The COM said they had attended one of the Working Groups (WGs) under the civil protection mechanism looking at man-made and natural risks. An informal survey was undertaken to see if the WG was coordinating with their flood counterparts. COM said that it would be useful for MSs' national flood serviced to coordinate with their flood counterparts.

2.1.2.6 Flood hazard and risk maps in Spain

Professor Raúl Medina (RM) gave an overview of flood hazard and risk maps in Spain. RM explained that flood hazard has been estimated by means of an extensive database of waves, surge and tides and the utilization of the IH2VOF two dimensional model, that is used to solve wave run up. The database has been generated using downscaling techniques and waves and sea level data were calibrated against buoys.

Since the Spanish shoreline is around 8.000 km long and the wave run up is evaluated every 200 m a huge amount of information has been generated. This information was efficiently managed using data-mining statistical techniques to classify and select the data required estimate the extreme value distribution of the flood extent, every 200 m, throughout the ocean-open Spanish coast. .

The methodology is detailed in Journal of Flood Risk Management paper entitled "A methodology to estimate wave-induced coastal flooding hazard maps in Spain" by Tomas et al., 2015.

2.1.2.7 Assessing the impacts of climate change on coastal flood risk in Europe

Peter Salomon (PS) of the Commission's Joint Research Centre (JRC) outlined JRC's progress on the impacts of climate change on coastal floods. PS gave the background as to why coastal assessments

are needed. There is a need to increase resilience of coastal areas and of physical infrastructure and large investments. The plan is to use the LISCoAsT approach which was first applied in Europe then implemented on a global scale. Sea level rise comes from Coupled Model Inter-comparison Project (CMIP) 5 database. There are five model ensembles and three difference ice scenarios. It has been assumed that tidal effects remain static. The Delft3D model has been set up for storm projections. There is a global wave model to look at these characteristics. Exposure is based on EUROSTAT population projections and land use on the Corine land cover database. The time period covered was 2010 to 2060. The mapping of large infrastructure and key economic assets was outlined. The coastal impact assessment methodology was explained including a reverse calculation of flood protection. PS pointed out that the state of flood defences is important to assess the coastal flood hazard. PS said that the projection of Expected Annual Damage (EAD) according to preliminary results may increase by €10 billion for the low emission scenarios. PS said that the conclusions will all be made available. The quality of the work is dependent on the underlying data quality especially relating to existing coastal flood defences. Thus, it would be highly appreciated if MS provide data to improve this European coastal flood risk example.

2.2 Summary of questionnaire responses: Coastal Flooding

2.2.1 Introduction

In advance of the workshop a preparatory questionnaire was submitted to each Member State of the European Union so that a general overview of coastal flooding and spatial planning within Member States could be created before the celebration of the workshop.

In addition, several questions related to climate change were included, as this matter is essential in flooding analysis and mapping, and different methodology approaches are used (if climate change is considered) to introduce climate change in coastal flooding mapping and risk management.

Results of the questionnaires are helpful to outline the situation within the Member States in main flood considerations (data used, methodologies for calculations, climate change and coastal erosion considerations, lessons learnt from flood events, application of risk management plans, effectiveness of measures…), and were used to shape the discussions at the workshop.

2.2.1.1 Objectives

The objectives of these preparatory questionnaires were:

- to give a high level perspective on the status of Member States with regard to Coastal Flood mapping,
- to capture experiences and lessons learnt from recent floods,

- to capture actions arising from the Floods Directive which have made a difference to coastal flood mapping and risk management,
- to identify key climate change issues to be considered in coastal flood mapping and/or risk management measures that will support planning, response and recovery for future flood events and,
- to shape the discussions at the workshop.

2.2.1.2 Structure of the questionnaires

The preparatory questionnaires were divided into three main groups of questions, which cover all the key points to be discussed during the Workshop, namely:

1. Context for Coastal Flood Mapping

Questions of this first main section of the questionnaires were intended to give a high level perspective on the status of Member States with regard to Coastal flood mapping

2. Lessons from Recent Flood Events

In this second section of the preparatory questionnaires, two templates were provided with different questions that were intended to summarize the details of the flood events that occurred in the European Union countries within the last years and also the lessons learned from these flood events.

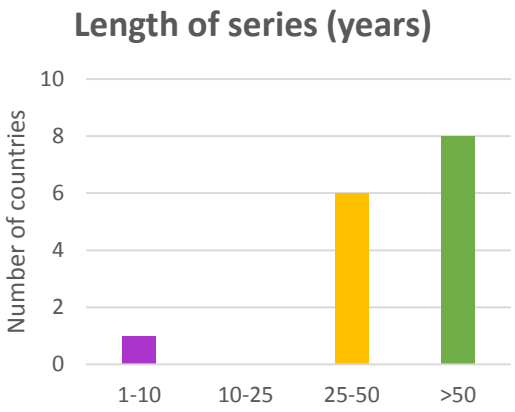
3. Coastal Flood Risk Management Plans and Measures of the FRMP addressing coastal flooding

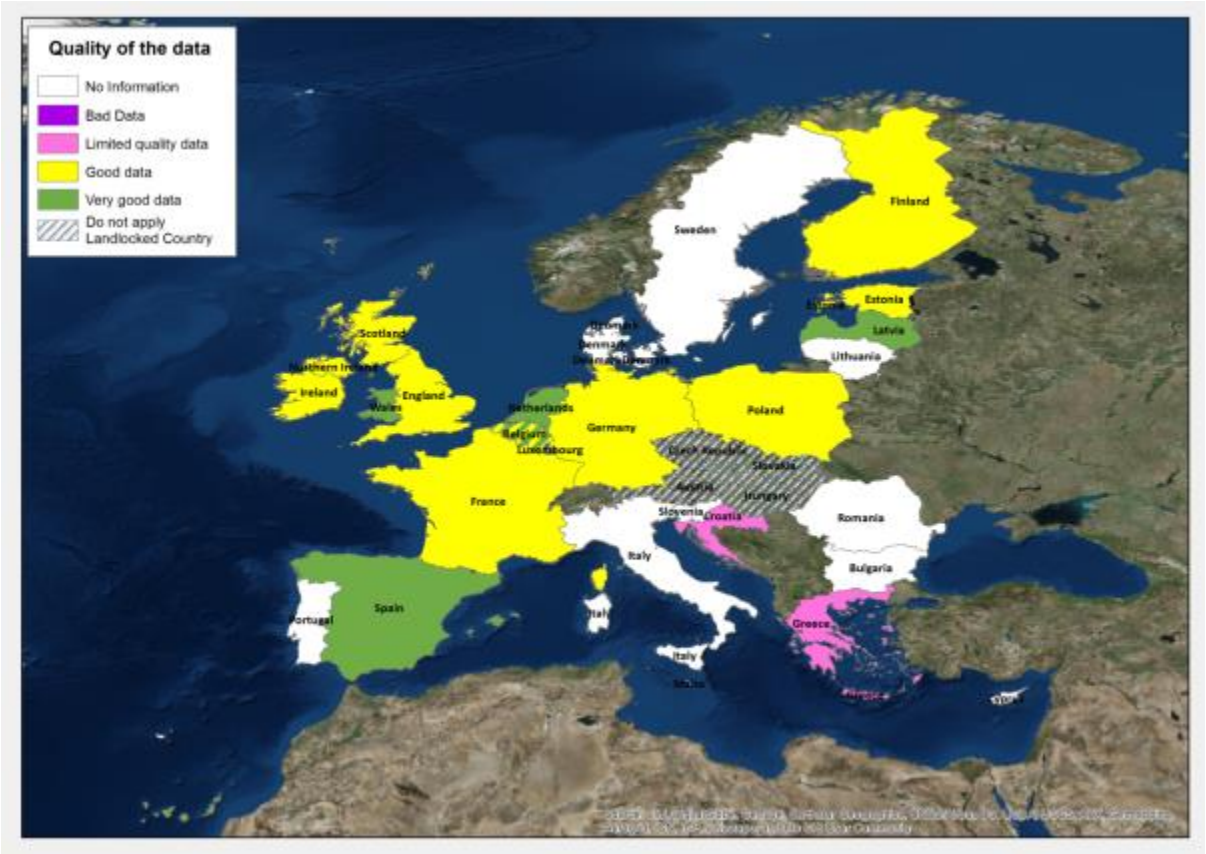
The responses to the following questions were intended to give a perspective on the status of Member States with regard to risk management plans and the effectiveness of measures addressing coastal flooding.

2.2.2 Results

Context for Coastal Flood Mapping

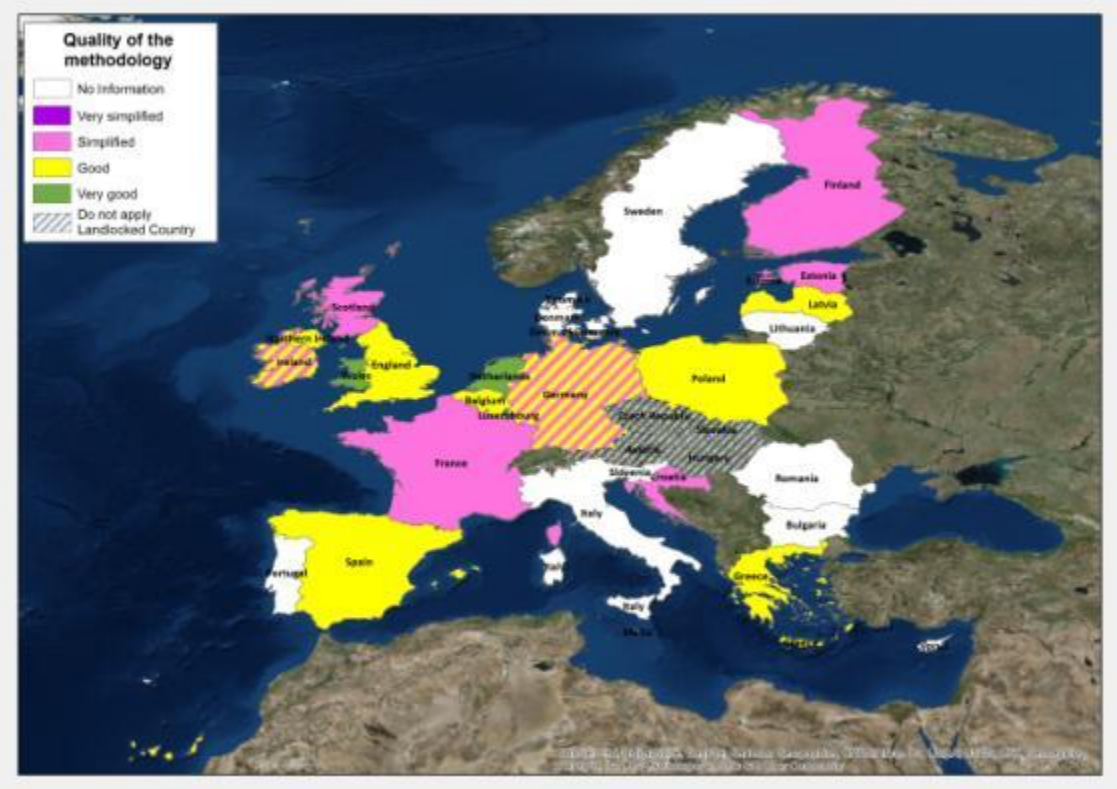
The first set of questions was related to the data and methodologies used for coastal flood mapping. When asked for the quality of the data, good results came up as the graphic and map below show.



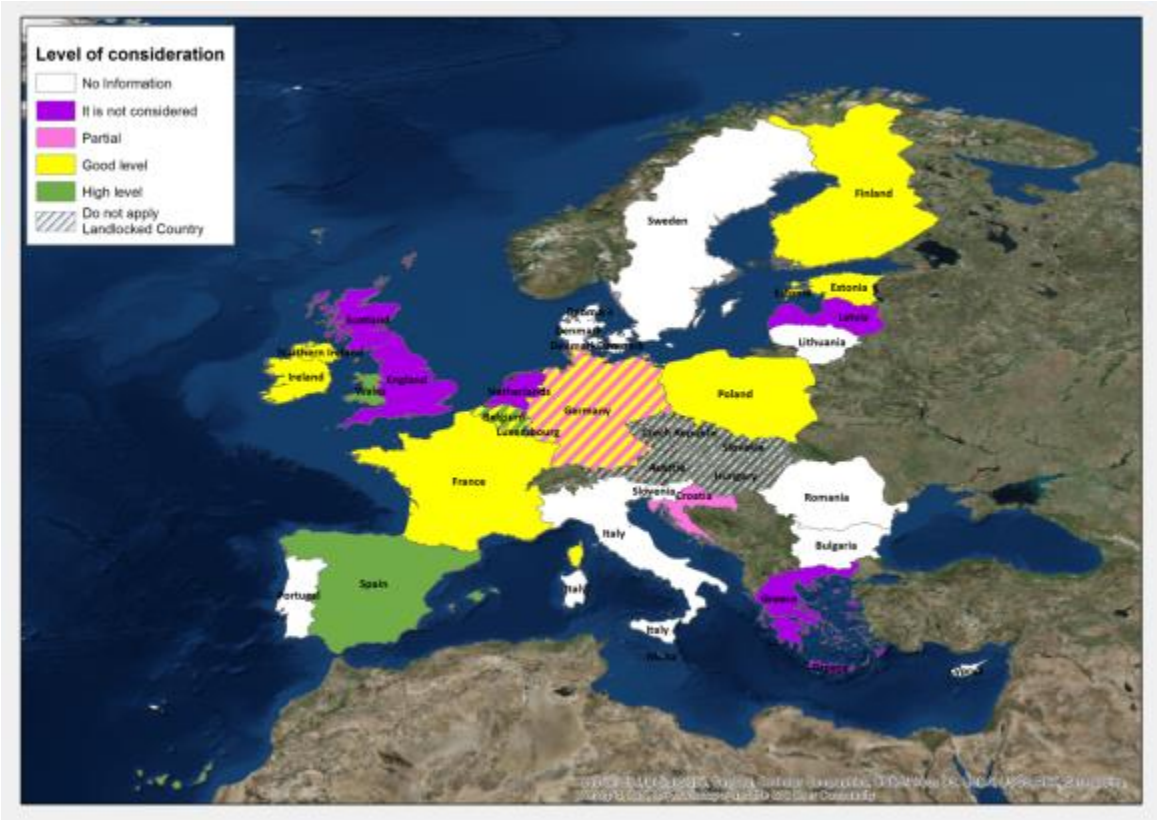


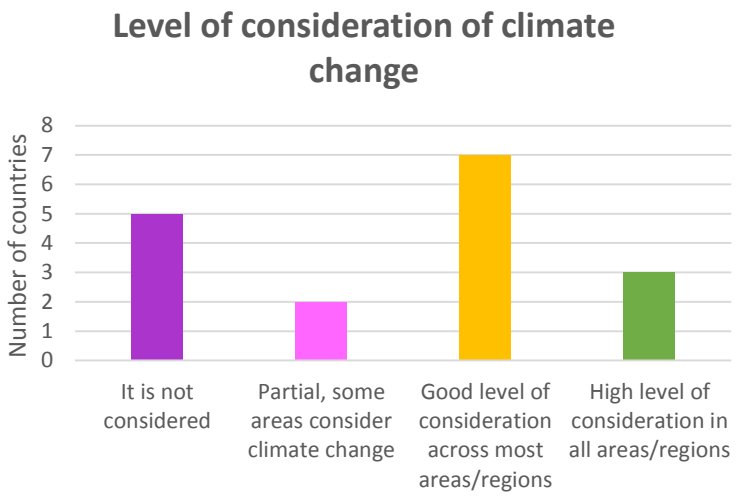
Results show a general satisfaction with the available data to face flood calculations with all Member States having at least good data. However, it is necessary to stand out that some Member States pointed that data is better and larger for some types of variables (datasets from tidal posts) than for others, such as biological parameters or bathymetries.

Then, asked for the quality of the methodologies used for coastal flood mapping, the general trend is to use either simplify or just good methodologies for calculating and mapping coastal flooding, there are very few Member States that actually use very good quality methodologies.



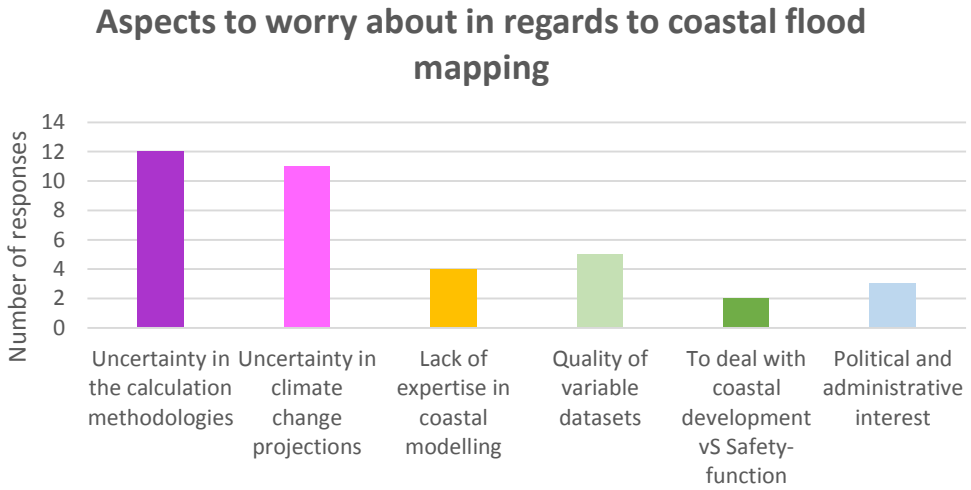
Participants were also asked for the level of consideration of climate change in coastal flood mapping, resulting in a poor consideration in a significant number of Member States. There is still a need to introduce climate change considerations in coastal flood mapping.





In the same way, results for coastal erosion considerations slightly differs from climate change considerations, providing the evidence of a low level of consideration of these matters

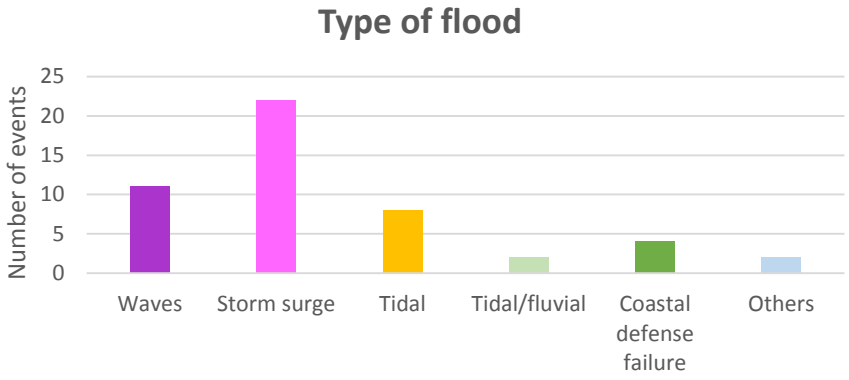
Finally in terms of the aspects that MSs were most worried about relating to coastal flood mapping, most answers focused on the uncertainty in the calculation methodology and climate change.

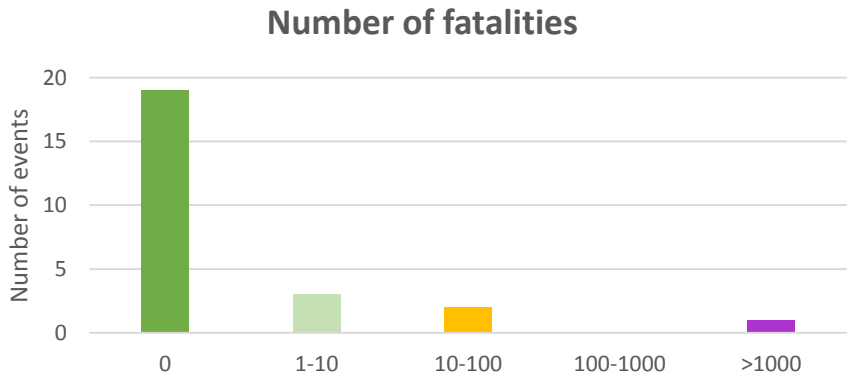


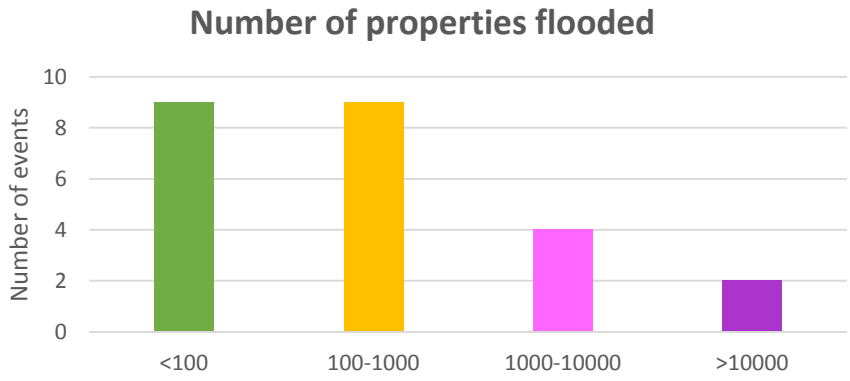
Lessons from Recent Flood Events

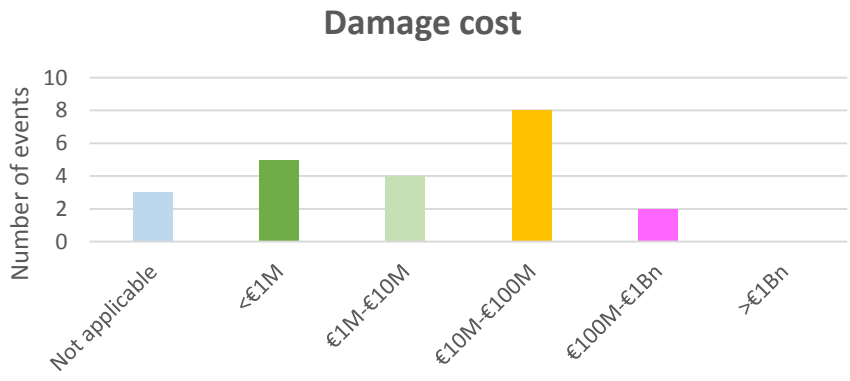
As stated previously, two templates were included in the questionnaire with questions regarding MS´s past flood events. This information is very helpful to get to know the importance of flood events from a physic, economic and social point of view, and it provided a good overview of the lessons learnt after they occur.

It can be concluded that the type of coastal floods that occurred were mostly as a result of storm surge. In most cases the number of fatalities is small, and generally the number of properties flooded was quite “low”. The damage caused by coastal flooding was generally between €1 million and €100 million and the main types of damage reported were residential properties and transportation infrastructure.


Type of flood
Number of events
25
20
15
10
5
0
Waves
Storm surge
Tidal
Tidal/fluvial
Coastal defense failure
Others

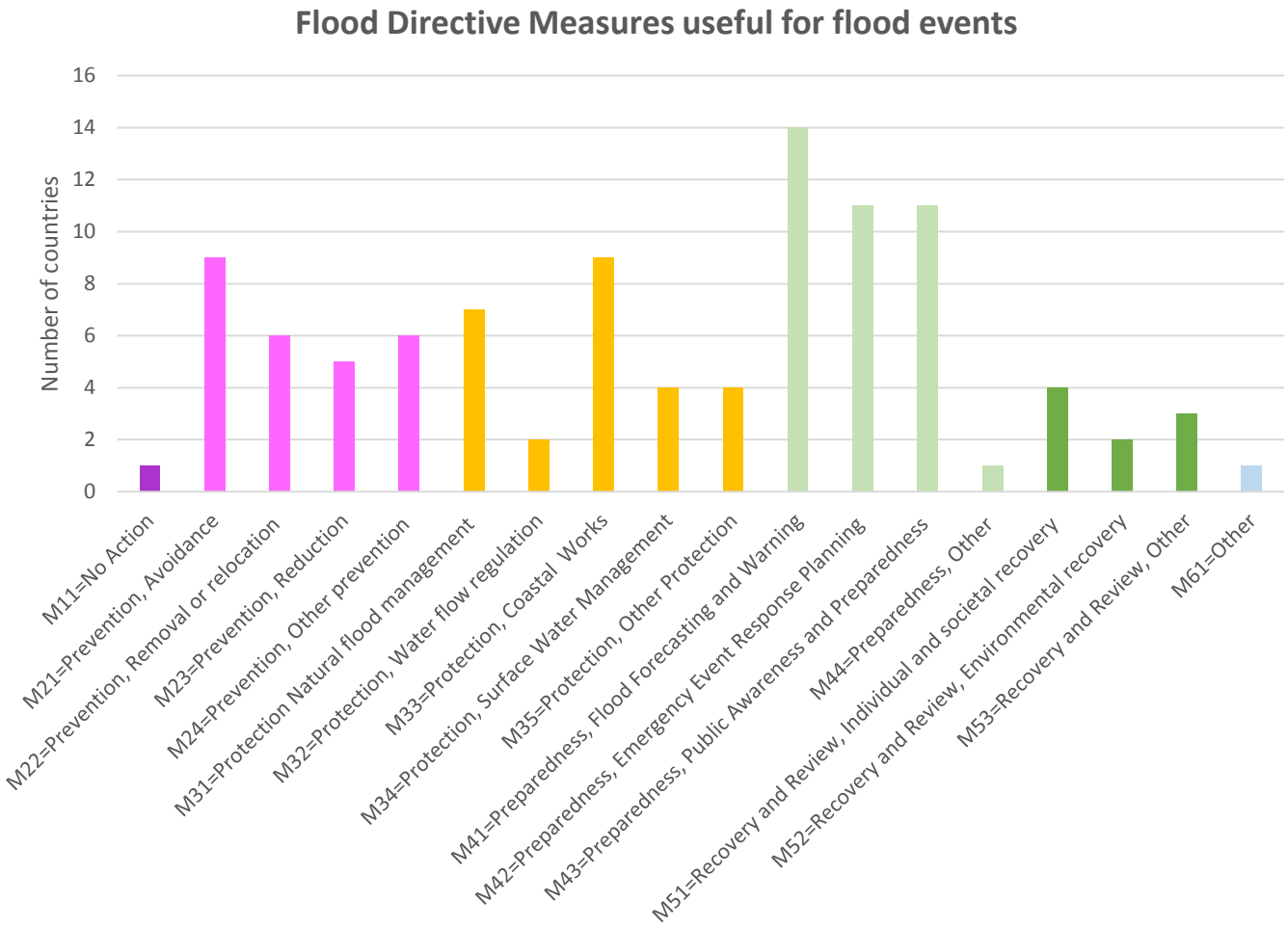

Number of fatalities
Number of events
20
15
10
5
0
0
1-10
10-100
100-1000
>1000


Number of properties flooded
Number of events
10
8
6
4
2
0
<100
100-1000
1000-10000
>10000


Damage cost
Number of events
10
8
6
4
2
0
Not applicable
<€1M
€1M-€10M
€10M-€100M
€100M-€1Bn
>€1Bn

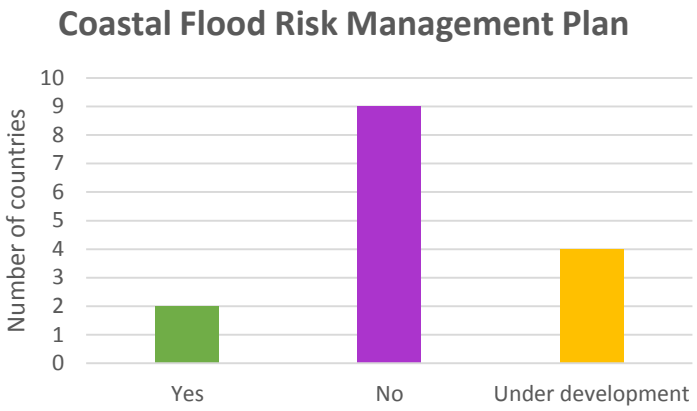
Coastal Flood Risk Management Plans and Measures of the FRMP addressing coastal flooding

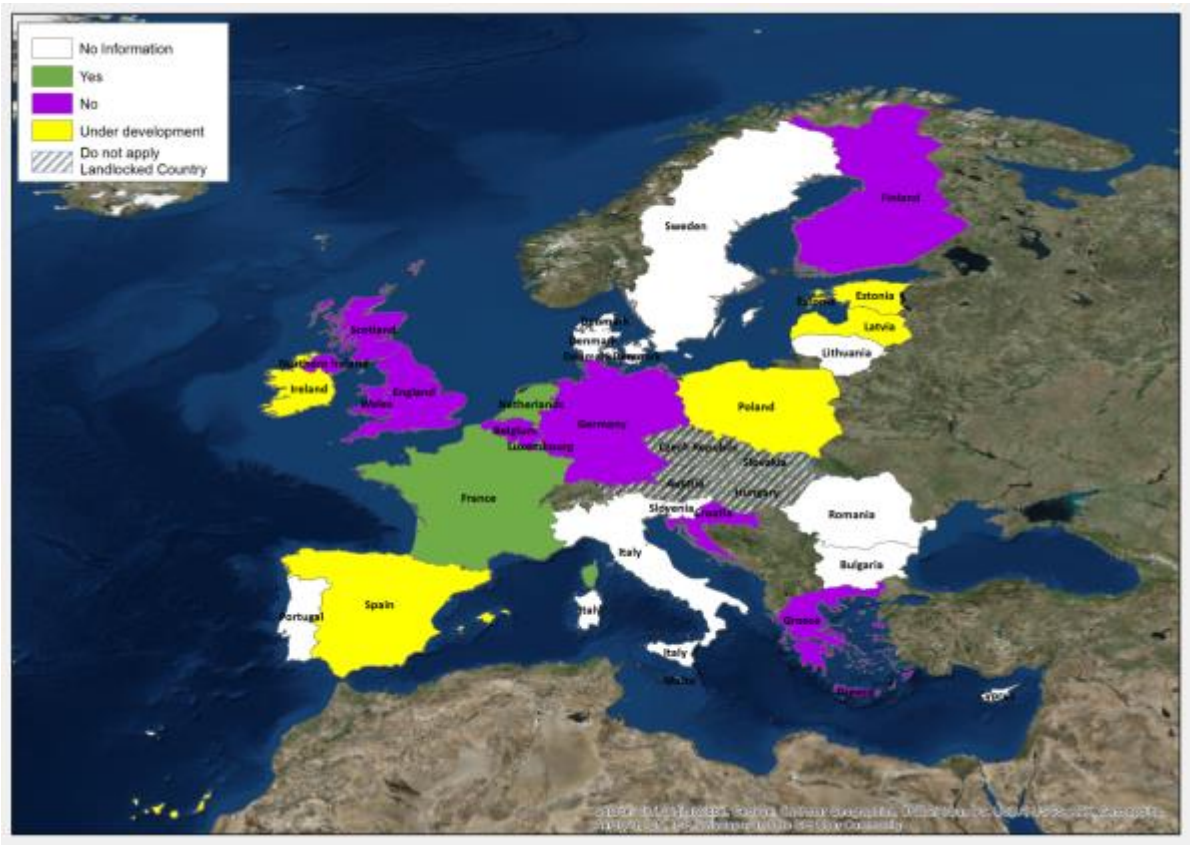
In relation to FD measures that would be most useful for the flood events described. The respondents said that the most useful was flood forecasting and most respondents felt the measures that were mentioned would be useful under climate change. Most MSs anticipated an increased scale of flooding and/or frequency.



Various different actions are being undertaken in different MSs including: improvements in policy; awareness raising; engineering interventions; improvements in flood risk strategies and improvements in flood forecasting and warnings. In terms of improvements in technologies forward by MS that would make a difference for future coastal floods the main ones put forward were: engineering calculations/improvements in modelling and engineering design and construction improvements.

Most MSs do not have a national Coastal Flood Risk Management Plan but most MSs include spatial planning measures in their FRMPs to reduce coastal flood risks.





2.3 Breakout session 1: Methodologies used in coastal Flood Mapping and the consideration of Climate Change in CFR Management

An introduction was given to the break out session. Coastal risk for MSs is a very significant source of flooding. The probability of coastal flooding is likely to increase with climate change. The challenges are:

- Accuracy and assumptions made in models (e.g. joint probability)
- Shared coastline with other MSs

- Climate change and how to include it when mapping coastal floods

The positives of coastal flood risk management are:

- Development control
- Focused protection measures
- Improved emergency response

In the next FD cycle consideration should be given to a refinement of the predicted levels and the revised estimates.

The participants of the workshop were split into three groups to discuss the following issues:

- The main difficulties found when mapping coastal floods
- The way in which climate change is included
- Issues with joint probability of coastal and fluvial flooding
- Main methodologies and recommendations

The following was reported back by the three groups (yellow, blue and orange). The discussion is summarised below.

The main challenges related to coastal mapping were summarised as:

- Defended versus undefended maps and the implications for communication and spatial planning
- Estuary issues and the impacts of waves
- Modelling and uncertainty
- Coastal risk assessments uses different models with different levels of sophistication
- There were issues with calculating join probabilities in different MSs
- Coastal flood risk more complex than fluvial

In terms of climate change the following points were made:

- There is a wide range of approaches in different MSs
- Some MS had taken it into account without carrying out any modelling
- Climate change should be taken into account in terms of vulnerability
- The impacts of climate change are dependent on the geography of the coast

In terms of joint probability the following points were made:

- With high quality data joint probability becomes less of an issue
- Pragmatic approaches are needed

In relation to the methodology the following points were made:

- The difference between coastal and estuary modelling
- Consistency of “principles” of MSs. There is a need to have a discussion over this
- Consistency of mapping resolution
- Accuracy of digital terrain models
- Length of time series of observed data which is usually not long enough communication

In terms of usefulness of the coastal flood maps, they are useful for investment, asset management, emergency planning and spatial planning.

3 Session 2: Flood Risk Management Plans: Coastal and spatial planning

A summary of points from Session 1 was given together with setting the scene for coastal flooding and mapping in Europe. The following key points were made:

- Complexity of problem
- There is often a lack of data
- There is uncertainty in many of the Digital Terrain Models (DTM)
- There is a wide range of dynamics (e.g. estuaries)

It was concluded that there is need for some consistency in the methodologies.

With respect to climate change, all agreed that climate change is relevant; however, there is significant uncertainty in its calculation. There is a need to have climate change included in coastal flood mapping. There is a need for consistency. For example, some maps include flood defences some do not. This makes it difficult to compare coastal maps from difference MSs.

All agreed that coastal flood maps are useful for investment plans and spatial planning. With respect to coastal flooding and spatial planning the maps were useful. The majority of MS coastal flood maps contain spatial planning measures.

The COM said they had difficulty understanding that climate change is included in measures but not in the maps. The conclusions were that climate change needed to be mapped in a different way. It needs to be clear what coastal flood maps show. DE pointed out that if climate change is to be included the "reference year" (e.g. 2050 or 2080, 2100) should be stated to ensure consistency. COM agreed with this. SE said that climate change effects vary with time e.g. there can be a difference between the years 2050 and 2100 maximum can be reached before 2100. NL pointed out that their current flood defences take into account climate change.

3.1 Coastal Flooding Risk Management and successful measures

3.1.1.1 Coastal Flood Risk Management in Schleswig-Holstein. Germany

Jacubus Hofstede (JH) presented on coastal flood risk management in Schleswig-Holstein. Germany is a federal state. It has 16 states, five of which are coastal. Around 2.5 million people live in the coastal lowlands. The coastal states implement flood risk management measures. The state schemes all apply uniform safety standards, there is no consideration of risk.

Schleswig-Holstein is the most northern state in Germany and is populated by around 350,000 people. There are €48 billion of assets at risk from extreme coastal surge. There are around 525 km of primary sea walls and numerous structures (e.g. sluices, barrages). The budget for coastal risk management is €60 to €70 million per year. In 1962 coastal floods caused fatalities which led to masterplan. As part of the coastal management masterplan, safety checks are undertaken for flood defences, around 90 km need to be strengthened. This work acted as a main input to the FRMP.

Regarding the challenge of climate change, sea level rise will be 0.5 to 1.0 m by 2100. Taking into account storm wind setup, the storm surge levels could increase by 0.5 m to 1.5 m leading to increasing hydrostatic forces. There are large uncertainties about the exact magnitudes of these. The key messages are to have "low regrets" measures which have flexibility.

With regards to climate change and safety measures, an example was given of the strengthening of a flood defence in the town of Bűsum. There is a safety margin for sea level rise of 0.5 m. The outer dike slope has been flattened to strengthen it and allow it to be increased in height in the future.

An example was given of spatial planning, this involved raising houses above flood water levels and installing shelter rooms in them. In areas at risk, houses can be built if a minimum building elevation for new receptors is the local water design level.

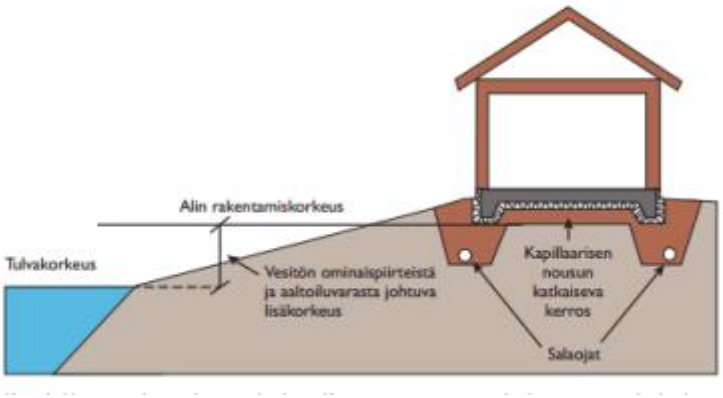
European Water Association (EWA) asked what the much constriction were in terms of space for raising dikes? JH said that this is a challenge; however, 90% of state dikes have agricultural land

behind them. IE asked what actual safety factor was? JH said that the increase in dike levels includes coastal surge and sea level rise.

3.1.1.2 Recommendations for minimum building elevations on Finnish coast

Antti Parjanne (AP) said that with respect to coastal flood risk in Finland there are four APSFRs at risk of coastal flooding out of a total of 21. There are approximately 25,000 people at risk from coastal floods. The effect of sea level rise is 3 mm per annum. Coastal floods may intensify owing to an increase in wind. Post-glacial land uplift of 4 to 10 mm per year counteracts sea level rise in Finland to a certain degree. The sea level for maximum and minimum levels taking into account land uplift were provided.

With respect to land use legislation, national guidelines indicate that flood hazard must be taken into account. Municipalities are responsible for land use planning and building permits. Local consultations are important. There is guidance for determining the lowest building elevations in coastal areas. The aim is to ensure that buildings do not incur damage from floods more frequent than the 1 in 100 to 1 in 200 year events.



Picture 3: Finland guidelines

For inland watercourses there are recommendations based on flood levels for the 1 in 100 year event plus an additional elevation based on the: building type, characteristics of the watercourse, climate change and effects of wave conditions. For coastal areas the recommendations are based on a flood level of 1 in 250 years for the year 2100 plus an additional elevation based on the building type and effects of wave conditions. Some buildings where the risk is lower can be built in high probability areas.

Recommendations for coastal areas take into account latest knowledge. There are no sufficiently accurate estimates of climate change exist past the year 2100. To conclude AP said that:

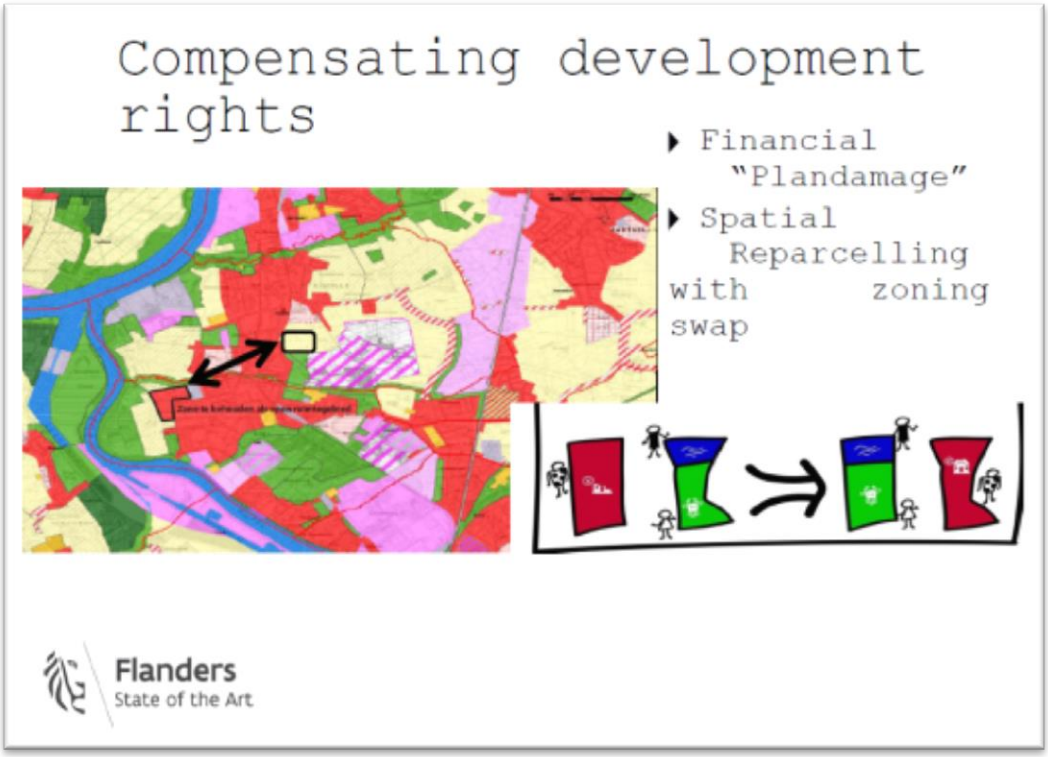
- They should prepare for the worst case scenario in 2200 or then plan flood risk management in shorter timeframes and make sure that they are adaptable;
- Spatial planning is the most cost effective measure to manage coastal flood risk in Finland.

It was asked if the cost of relocation been estimated? AP said that it had but that it was too costly.

3.1.1.3 Spatial planning and flood risk management in Flanders: Case Signal Areas in Flanders.

Robin de Smedt (RdS) said that Flanders is densely populated and heavily urbanised and this is increasing. The spatial policy plan challenges are from expansion to smart transformation of urban areas. A zoning plan has been established which also gives building rights. A red zone has been defined. A scheme has been designed for high probability areas (1 in 10 years) it is not possible to build there. There are opportunities which include the establishment of a green-blue network to increase flood resilience.

Compensating building rights in red zones known as "plan damage". There is a method of spatial re-parcelling with zone swapping. There is an integrated governance approach between different national, regional and local levels.



Picture 4: Slide from Robin de Smelt's presentation (Case Signal Areas in Flanders). The spatial reparcelling, with zoning swap helps prevent increases in the risk of flooding.

It was asked if there is any conflict between “holding the line” and meeting the needs of the Habitats Directive (e.g. where there is a need to maintain room for the mud flats)? RO indicated that there could be an improvement in communication between biodiversity and flood risk management experts. RdS said that there has been a natural coastal squeeze; however, this is a “natural development”. NL said that there was a need to take into account the size of the grains for Habitats Directive; this means the size of the sand needs to be correct.

3.2 Spatial Planning in Flood prone areas: Main conclusions of the previous workshops.

These are the main conclusions of the workshops on Land use planning and water management with a focus on flood risk management, held in Norway in 2007, and Flood management in local planning, held in Austria and Slovenia in 2008.

Mark Adamson gave the background to a workshop held in Oslo in January/February 2007 with 40 delegates from 17 MSs. This was an exploratory workshop via an exchange forum held before WG F was set up. There was an information exchange between land use planning water resource management and flood risk management. The recommendations were that there was a need for further exchange. There were recommendations to set up an exchange forum on land use planning (EXCLUP), but this proposal was superseded by the establishment of WG F and the associated workshops.

Clemens Neuhold then presented the results from the Austria and Slovenia workshop held in 2008. There were about 60 participants from 18 MS. 90% of the respondents to the questionnaire felt that there were gaps between land use planning and flood risk management in local planning in their country. The reasons given were:

- Different legal bases and different competencies (36%)
- No consideration of flood risk in local planning (flood studies are not taken into account) (21%)
- Different planning standards (21%)
- Funding (15%)
- Flood risk is played down by demands for development and due to a weak legal basis (7%)

With respect to the workshop conclusions, the results were:

- Information, communication and participation are required for successful flood risk management
- Raising public awareness of flood risk
- Closer collaboration between flood management and land use planning is necessary
- Funds for the implementation of measures are frequently lacking
- Technical issues generally handled well
- Before the FD was implemented it was felt that necessary legal instruments were often missing
- Considerable differences in the level of implementation

3.3 Summary of questionnaire responses: Spatial Planning in flood prone areas in Europe.

The analysis of this questionnaire has been very useful, and it shows how the MSs are implementing the coordination between these policies. The analysis has 5 main points, starting from the status of the implementation, to the main challenges for the future. Finally, 20 member states have sent the completed questionnaire, a lot of them with many references, hyperlinks and very useful information. The report has been produced with 24 questionnaires, due to the fact that there are four questionnaires from each United Kingdom nations.

The main objectives of the questionnaire were:

1. To know what the current status of the land use policy and flood risk management in Europe is, when it began, and the improvement achieved since 2007, when the last workshops took place and the Floods Directive was adopted.
2. To share experiences about the different mapping guidelines that already exist, the acts, rules, bans, recommendations about land use policy and flood prone areas.
3. The third one is to do a quick overview about the main measures that each Member State is including in FRMP concerning this matter, for example, the improvement of the receptors, the removal or relocation of the most dangerous elements located in the floodplains.
4. To check the green approach in the LUP and FRM, the climate change consideration and the main challenges for the future.

Picture 5: Member states who have sent the completed questionnaire (in green)

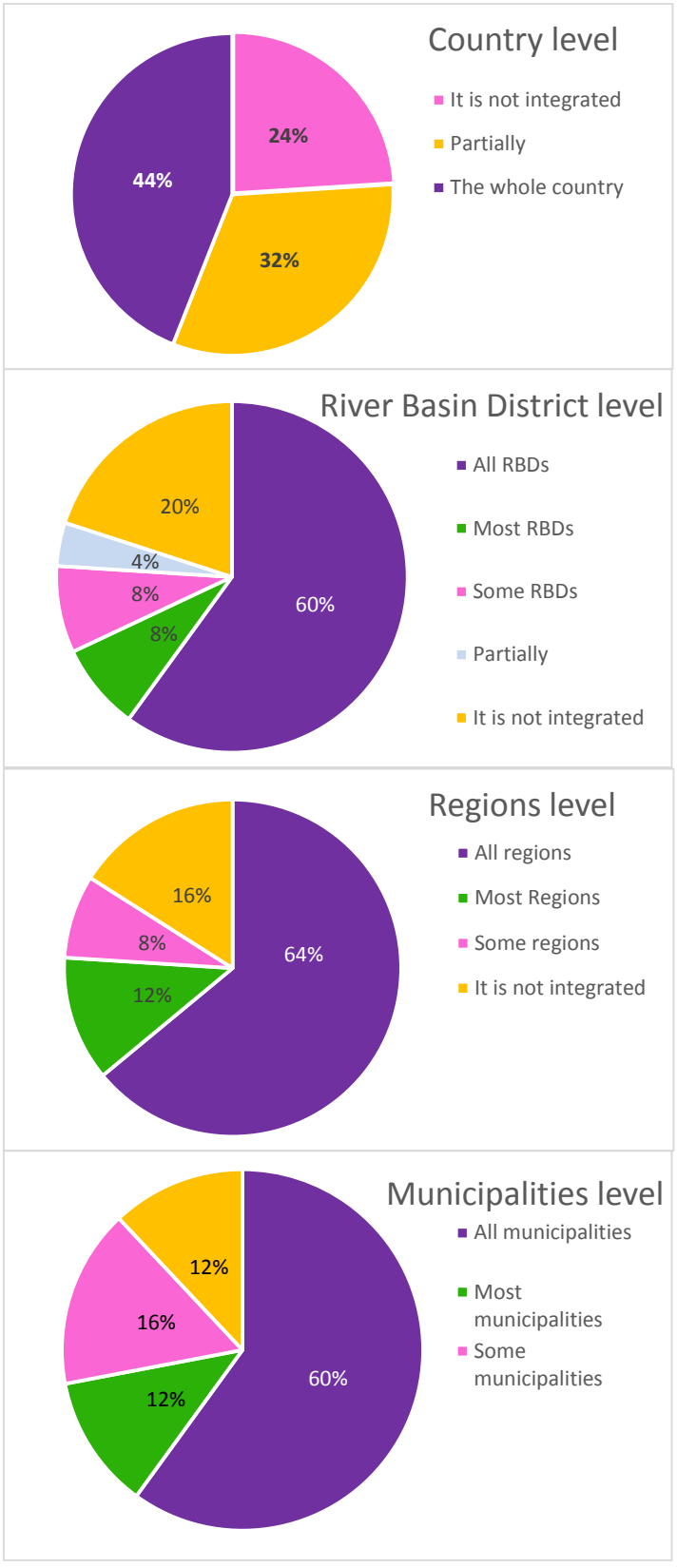
3.3.1 Situation of the land use policy (LUP) regarding the Flood Risk Management (FRM).

The responses to the following questions in this section were intended to give a high-level perspective on the status of spatial planning in the Member States with regard to the implementation of the Floods Directive and the new approach that has been carried out in Flood Management Risk due to this directive.

3.3.1.1 Integration level.

The first groups of questions are related to the level of integration of land use policy and flood risk management. Graphs below show the answers of each MS regarding the current status of the integration level of the LUP and FRM.

As a broad conclusion, it should be noted that in general, the most usual scheme in MS is that there is a regulatory framework at national level, which is mainly developed at regional or federal level, with a further application at the municipal level. It seems that there is still a significant percentage of MS that don´t have integrated flood risk and land use planning.

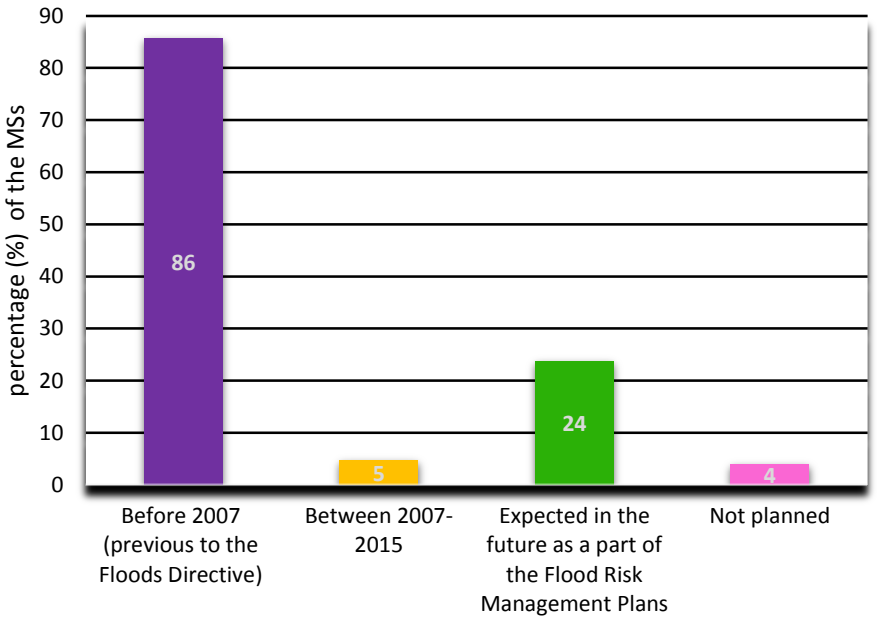


Picture 6: Status of the different integration level of the LUP-FRM policies in the MSs

3.3.1.2 Dates of the integration.

Another question was on when this integration occurred, and if, in general, it has influenced the adoption of the floods directive. The following graph reveals the results of the question, which show if general integration already existed before the adoption of the floods directive, and in other cases, it will be implemented during the first cycle of flood risk management plans.

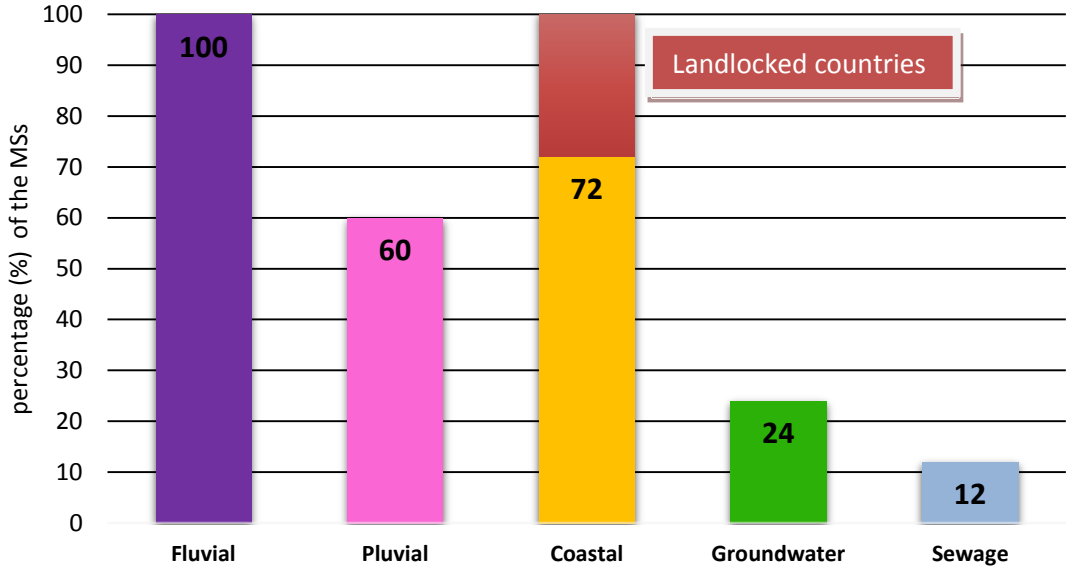
Just a few countries where this integration did not exist before 2007 have developed new legislation instruments since 2007. However, this integration will be improved with the implementation of FRMPs.



Picture 7: Starting date of integration in percentage of the MSs

3.3.1.3 *Types of flood included.*

This policy includes, in most cases, fluvial and coastal flooding. Only one country with sea has not included the type of coastal flooding. Pluvial flooding is taken into account in about 60 % of the countries, in a particular way that will be explained in the following points. Groundwater, sewage floods and "other types of flooding" are included in a few countries.

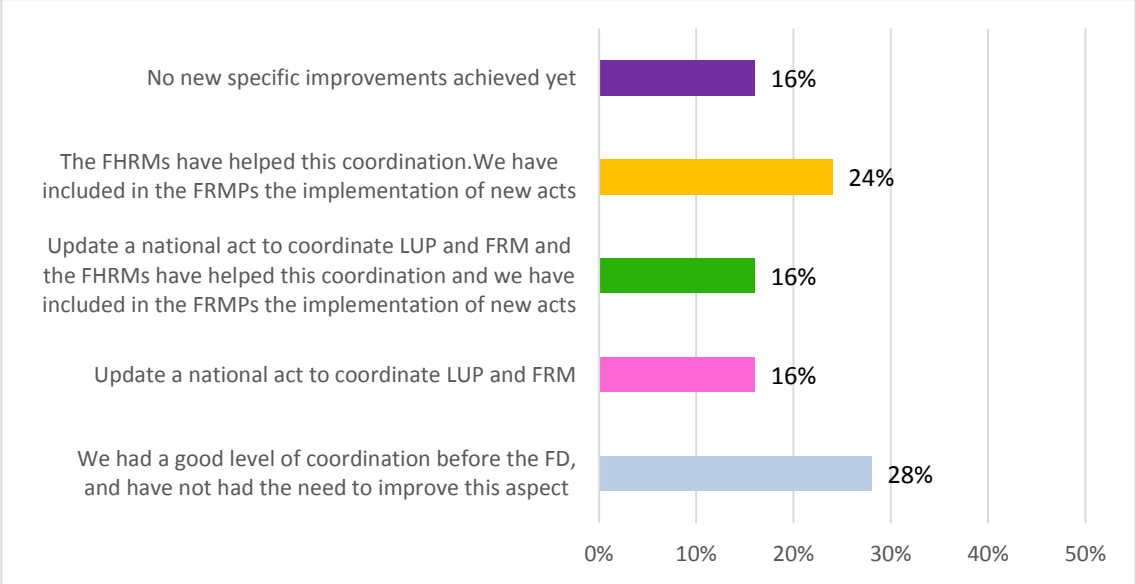


Picture 8: Types of flooding included in the LUP-FRM policies.

3.3.1.4 *Main improvements achieved in land use planning (LUP) since 2007.*

Since 2007, the different countries and regions have worked in several actions and including new measures. At this moment, 29 % of the member states have a good level of coordination, they even had it before 2007, and they don`t need to improve on this aspect.

19 % of the member states in the last few years have updated a national law to coordinate LUP and FRM, and 14 % have already done it, but are going to develop more acts (regional in several cases) in the FRMP implementation. Also, almost 30 % of the member states include the improvement of new acts, rules and recommendations in the FRMP. Only 10 % of the countries have not made new improvements yet.



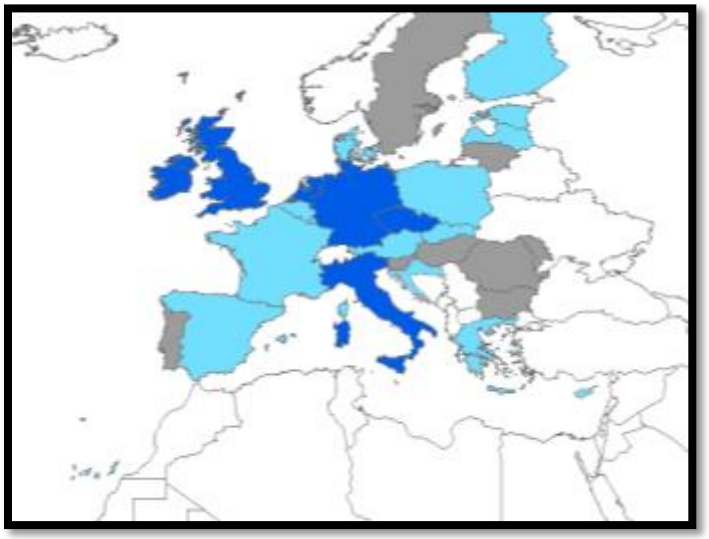
Picture 9: Improvements achieved since 2007.

3.3.1.5 Conclusion: levels of coordination.

In the map below, the MSs shown in dark blue are the ones which have indicated that the already have a good level of integration. These MSs are Ireland, United Kingdom, The Netherlands, Germany and Czech Republic.

These countries are good examples to help the countries in light blue, where the policy is integrated at different levels, and these countries are going to develop several rules and documents in the future.

To illustrate this information, point 3.5 of this report summarizes 3 examples of good regulations (UK-England, Austria- Styria and Germany).



Picture 10: Dark blue: MSs which have indicated that they have a good level of integration.

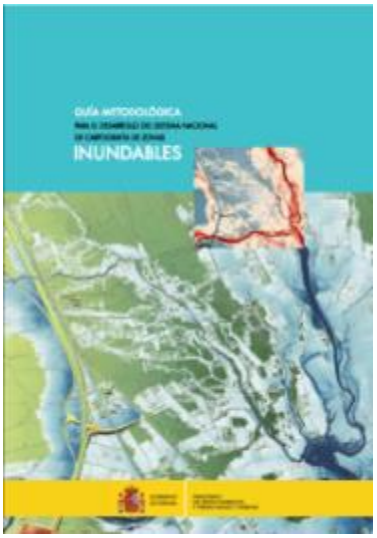
3.3.2 Rules and guidelines for land use planning in flood prone areas.

In this chapter, the questionnaire tried to show how the different MSs define their rules, guidelines about LUP and FRM and how they implement different policies to coordinate spatial planning with environmental issues, (ecological status of water bodies, Nature 2000 network, green approach, etc) and climate change.

3.3.2.1 Procedure for defining flood prone areas.

It is very important to compare how the different MS define the flood prone areas, methodologies, procedures and who is in charge of elaborating these maps.

Most of the countries (90%) have prepared official guidelines to define the technical procedure to calculate flood prone areas.



Picture 11: Spanish guide to calculate fluvial flood prone areas.
http://www.magrama.gob.es/es/agua/publicaciones/guia_metodologica_ZI.aspx

LUP and FRM integration is needed in every city, not only in the APSFR places. For this reason, the questionnaire asked if each country had defined flood prone areas in places that are not APSFR. The answer was that only 60 % of the member states have defined flood prone areas in places that are not APSFR. This means that Europe still needs to mate a lot of effort to continue defining the flood prone areas beyond the APSFR.

Usually, the different authorities: national, regional, local and public research centres, are in charge of elaborating these maps. However, it is possible that the flood prone areas have to be calculate by the urban developer if there are no public studies available. Below are some examples.

In France, the State's decentralised departments are in charge of these definitions: they collect all the data available (local studies, topography, protection systems …), and a simplified mapping of the risk is made. There are rules regarding whether or not construction is to be and there can be conditions if constructions are allowed (single storey houses forbidden …). They are also in charge of that task in a more detailed manner at the municipality level with specific studies (modelling if necessary).

In the Slovak Republic, State authority can determine territory as flood prone areas (inundation area) on the basis of expert judgement of the water body administration authority or records which indicate the real floodway.

In Poland, flood prone areas are determined by national law of 21 December 2012 on drafting flood hazard maps and flood risk maps, defining special flood hazard areas, in which are also included:

- areas located in the direct vicinity of the sea (ie . the technical zone),
- areas situated between dike (or high bank) and river,
- areas situated on river islands and sandbanks
- areas indicated by the director of regional water management authority according to local act
- areas indicated by the director of regional water management authority by studies of flood protection

In Ireland, the definition of the Flood Zones applies to all watercourses. It is important that this is the case, as the focus of the Guidelines on planning and flood risk is often on areas where there is currently very low / no risk, but where future development might otherwise occur.

If the analysis and flood mapping required to define the flood zones has not been completed by the OPW (National Lead Agency for FRM) under the 'CFRAM' Programme (through which the FD is being implemented), then the responsibility for flood mapping and defining the locations and extents of the Floods Zones is for:

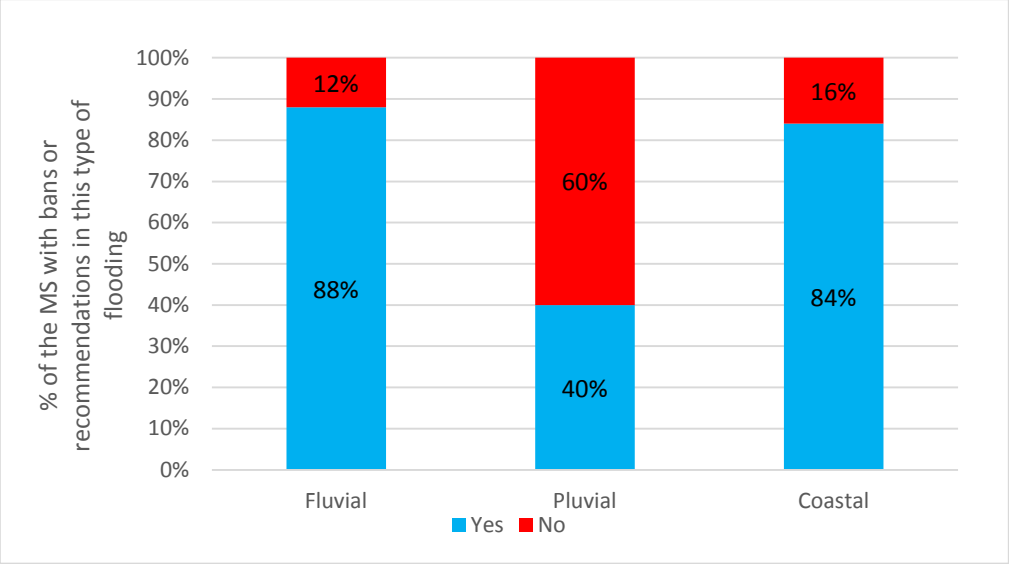
- Local Authorities for forward planning, e.g., preparation of development plans
- Developers for the preparation of planning applications

3.3.2.2 Main characteristics of the rules.

The main characteristics of the rules existing in the different MS can be summarized in the following aspects:

- Type of flooding considered.
- Bans included or not.
- Recommendations included or not.
- Main return periods considered.

In this graph we can see the different bans that we can find in the rules and laws reported by the member states.



Picture 12: Bans according to the type of flooding: Fluvial and coastal flooding almost always have different bans or recommendations.

Almost all the regulations include different bans for fluvial and coastal flooding. Pluvial flooding has a different approach: the building codes usually establish different rain scenarios for designing sewer systems, and the buildings have to be designed to not flood when the rain scenarios have been exceeded.

In the table below, it is possible to see how there is a wide range of return period associated with these bans. In fluvial flooding, these return periods range from 5 years to 1,000 years. However, the most frequent is 100 years, included in 60% of the questionnaires.

Return period	Fluvial flooding	Pluvial flooding	Coastal flooding
5	9.5 %	11 %	13.3 %
10	23.8 %	11 %	
20	9.5 %	-	6.7 %
25	4.8 %	-	-
30	4.8 %	-	-
50	9.5 %	-	-
floodway	9.5 %	-	-
100	57.1 %	11 %	26.7 %
200	9.5 %	22 %	33.3 %
250	-	-	4.0 %
500	14.3 %	-	-
1000	23.8 %	-	26.7 %

Picture 13: Percentage of MS that consider this return period in the bans or recommendations in their LUP-FRM policies

In coastal flooding there is a wide range too, but this type of flooding also has other approach. Generally speaking, the most used return period is 200 years (used, for example, in the 4 UK nations). That means that we can affirm that the some policies try to be more restrictive with coastal flooding, due to the difficulty in fighting against the sea, coastal erosion and climate change. In pluvial flooding, the return periods are lower, and not too many member states have defined them as we saw before.

To illustrate this information, point 3.5 of this report reproduces 3 examples of regulations (UK-England, Austria- Styria and Germany).

3.3.2.3 Consideration in the FRMPs possible measures aiming to improve the receptors adaptation in flood prone areas (houses, farms, industries, etc.)

One of the most important questions is what we can do with all the inhabitants who live in the flood prone areas. In Spain, for example, almost 3,000,000 people live in the flood prone areas associated with APSFRs. One of the main goals for these houses or receptors is to improve their adaptation and increase their resilience.

In this case, the question 2.4.c was about whether the MSs look at the improvement of these elements, and 86 % of the MS answered with an affirmative answer.

In Germany, the LAWA Catalogue of Measures ("LAWA-Maßnahmenkatalog") contains, among others, the following measures referring to the above-mentioned receptors:

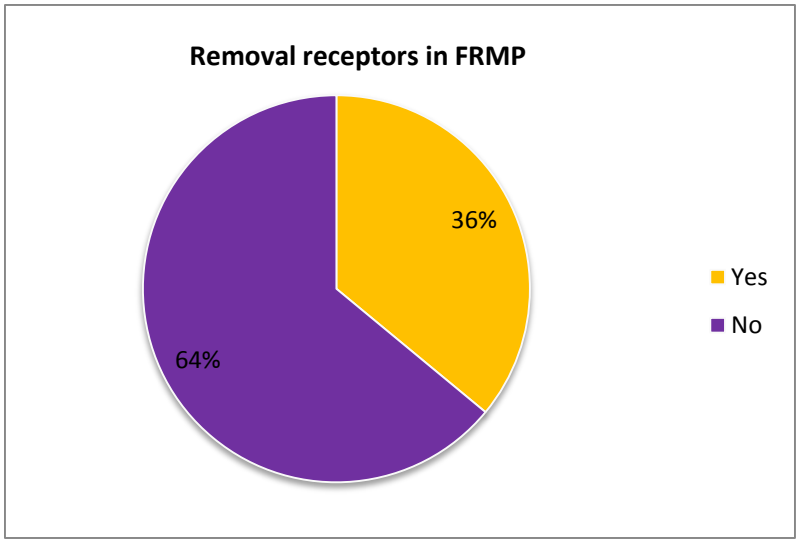
- 306: flood-adapted construction and upgrading
- 307: physical protective measures for buildings and infrastructure

On the other hand, almost 50% of the countries have already published a guideline for defining the technical aspects of this adaptation. One of them is the French Guideline, where it is possible to find a lot of adaptations for the different types of elements affected.

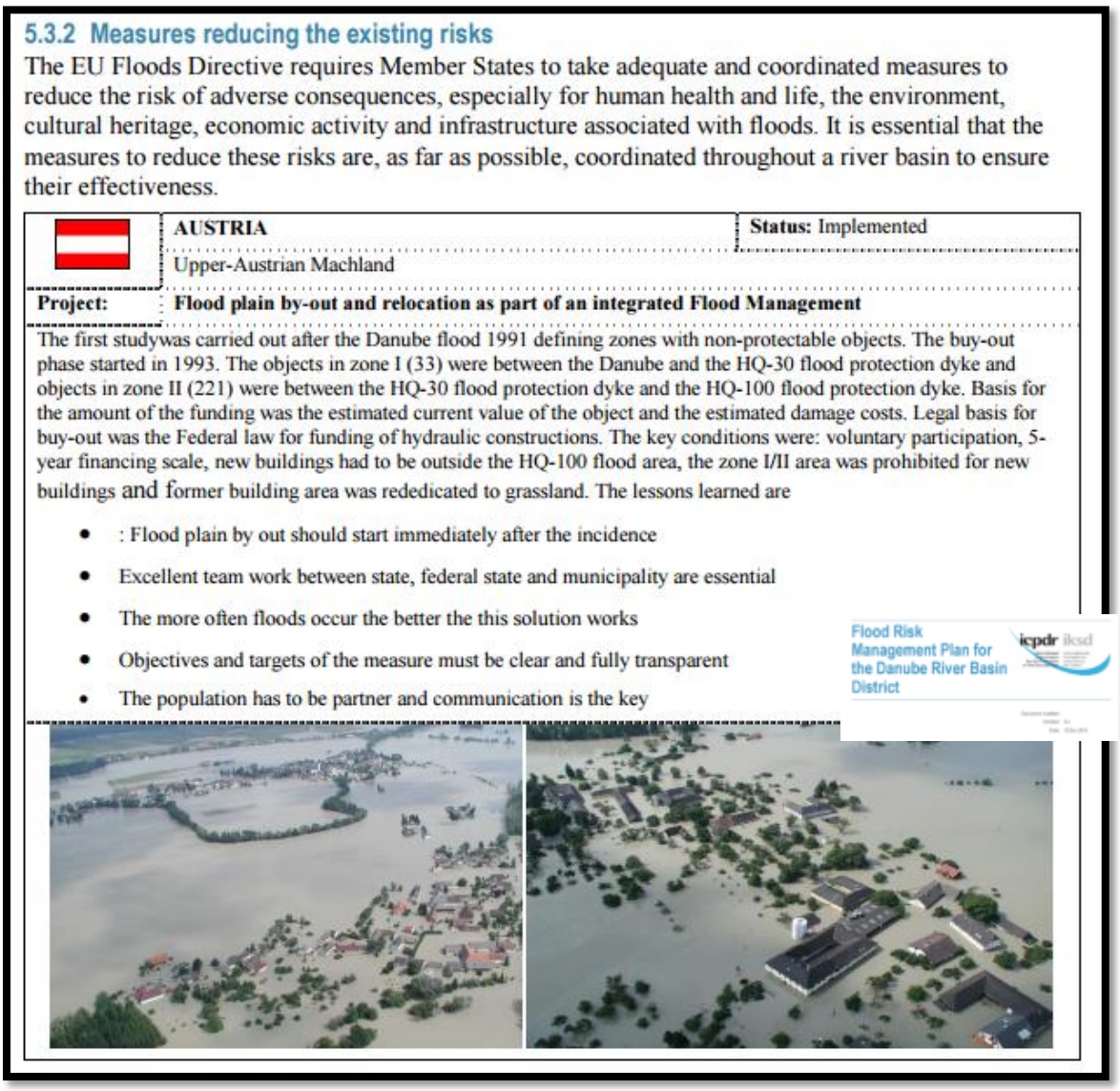
Picture 14: Example of existing guidelines: excellent [French Guide]

3.3.2.4 *Consideration in the FRMPs of possible measures aiming at removal or relocation of elements at risk in the flood prone areas.*

Generally speaking, it is not common for the different countries to develop projects for the relocation of cities at risk. Austria can be a good example, where reasonable removal and relocation have been developed, always negotiated with inhabitants.



Picture 15: Percentage of the MS that includes removal of the receptors as a measure in their FRMP.



5.3.2 Measures reducing the existing risks

The EU Floods Directive requires Member States to take adequate and coordinated measures to reduce the risk of adverse consequences, especially for human health and life, the environment, cultural heritage, economic activity and infrastructure associated with floods. It is essential that the measures to reduce these risks are, as far as possible, coordinated throughout a river basin to ensure their effectiveness.

AUSTRIA — **Status:** Implemented

Upper-Austrian Machland

Project: **Flood plain by-out and relocation as part of an integrated Flood Management**

The first studywas carried out after the Danube flood 1991 defining zones with non-protectable objects. The buy-out phase started in 1993. The objects in zone I (33) were between the Danube and the HQ-30 flood protection dyke and objects in zone II (221) were between the HQ-30 flood protection dyke and the HQ-100 flood protection dyke. Basis for the amount of the funding was the estimated current value of the object and the estimated damage costs. Legal basis for buy-out was the Federal law for funding of hydraulic constructions. The key conditions were: voluntary participation, 5-year financing scale, new buildings had to be outside the HQ-100 flood area, the zone I/II area was prohibited for new buildings and former building area was rededicated to grassland. The lessons learned are

- : Flood plain by out should start immediately after the incidence
- Excellent team work between state, federal state and municipality are essential
- The more often floods occur the better the this solution works
- Objectives and targets of the measure must be clear and fully transparent
- The population has to be partner and communication is the key

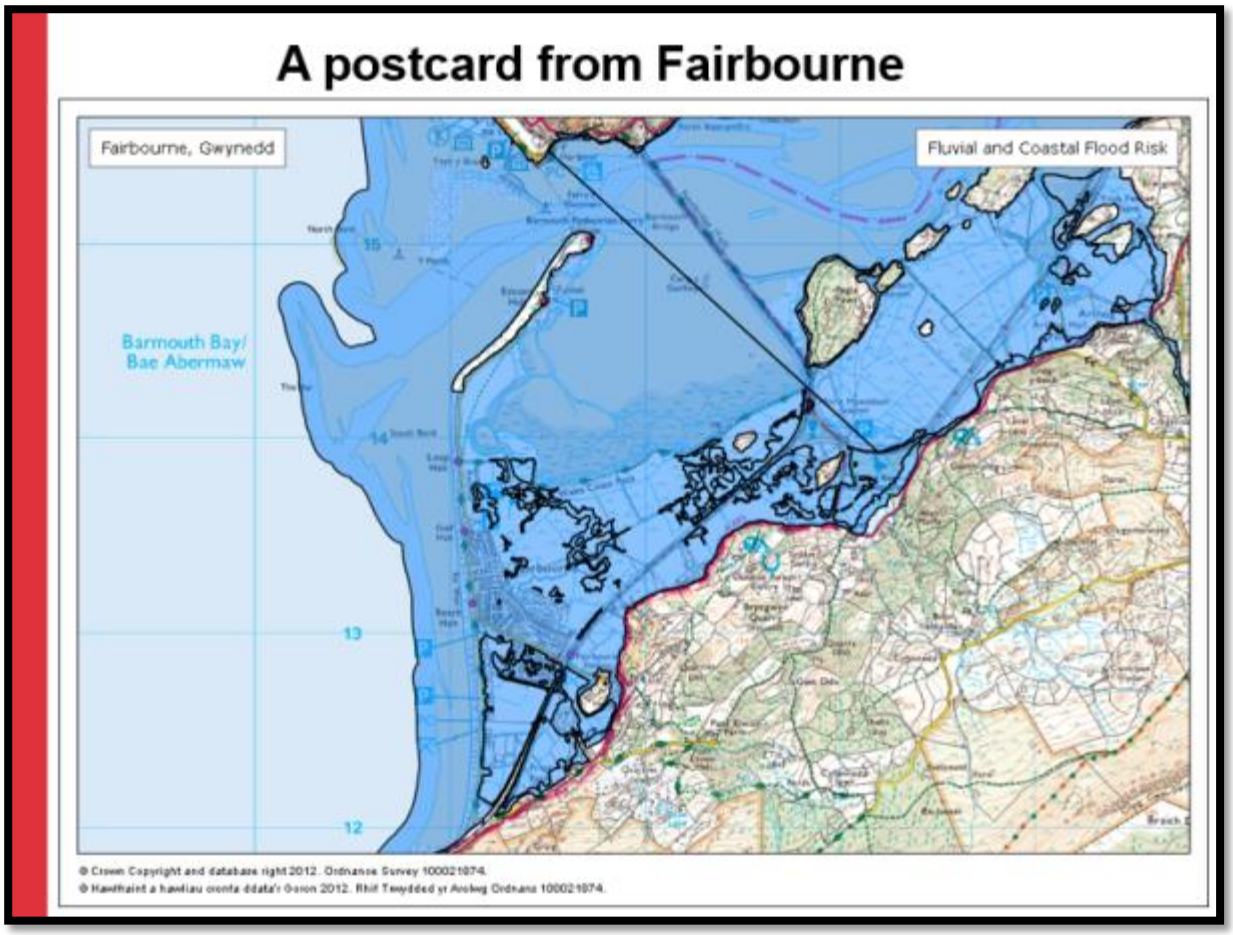
Flood Risk Management Plan for the Danube River Basin District

icpdr ikscd

Picture 16: Example: Relocation in Austria. Flood Risk Management Plan for the Danube River Basin District.

In the Netherlands, removal or relocation is not a general policy, though in exceptional programmes it will be considered. Specifically; part of the Second Delta Programme is the long term flood management of the major rivers. This is being carried out in the Room for the River programme (which will be completed in 2016). The Room for the River Programme includes more than 30 measures that increase the discharge capacity of the major rivers. For these measures, approximately 150 families were moved (and their houses demolished) and 50 farms were relocated. This has been a major operation and should make further relocations unlikely.

On the other hand, Wales showed a good example of a city (Fairbourne) with a lot of coastal flooding problems (presentation item 2.4.2.1), founded in 1896 as a tourist resort with only around 500 homes, where Wales' s society have to weigh up their future. For the moment the Welsh Government continue to defend the city from flooding, but it is also searching how to relocate town, and the social impact.



Picture 17: Slide from James Morris (UK-Wales) presentation: Fairbourne: the sea level rise and topography mean their future is uncertain.

3.3.2.5 Green approach in land use planning, for instance allocating areas for natural retention.

The Green approach, in coordination with the water framework directive and Habitats Directive, is really included in the 90% of the answers of the questionnaires. The Netherlands, for example, for local spatial planning in urban areas, with small scale measures for water sensitive urban design (e.g. retention areas in parks, playgrounds or parking areas) are carried out. On a national scale the Room for the River programme has measures that combine flood protection and nature development (e.g. measures in Deventer, Noordwaart, Munnikenland).

In Germany, the LAWA Catalogue of Measures ("LAWA-Maßnahmenkatalog",) contains, among others, the following measures:

- 310: flood-reducing agricultural and forestry practices
- 311: fostering the natural development of watercourses, floodplain renaturalisation and activation of former wetlands
- 312: reduction of soil sealing
- 313: rainwater management
- 314: restoration of natural retention areas

Most of these measures apply also in land use planning.

In Spain, as a very good example, in the Ebro River Basin District, Navarra Region, in the north of Spain, we can find a real example as the coordination between Flood risk management, ecological status and the Habitats Directive have a common space the LIFE + Mink Territory Project (http://www.territoriovison.eu/). This Project was finalist of the European Riverprize 2016.

Until the twentieth century, the Aragon river, with its tributary Arga, was a meandering river that generated many complex oxbow lakes. However, flood risk in the basin led to the introduction of multiple defensive structures and intensive river dredging in an attempt to mitigate flood effects. Unfortunately, these activities caused a significant reduction in natural habitats along the river and, consequently, biodiversity plummeted. Together with the Spanish Ministry of Agriculture, Food & Environment and the European Commission, the Regional Government of Navarra—through several LIFE projects and community partners—has spent more than a decade working to reverse these impacts and restore habitat for local flora and fauna. The project has been accompanied by a process of social participation in a territory where the high presence of flood risk led to popular support for defence mechanisms.

For example, in the Marcilla municipality (Aragon river) between February and December 2014, on-ground works were undertaken over 32 hectares and 2.5 kilometres of river. 985 metres of riprap were eliminated, 1,342 metres of dikes were removed, 200,000 cubic meters of gravel and silt were reintroduced to the river bed, the original shape of the river was restored, and wetlands were reconstructed. Today, the Aragon River is home to a typical Mediterranean river forest as well as species like the European mink, considered one of the planet's most threatened mammals.

Picture 18: Different images of flood plain restoration in Marcilla (Aragon River). Mink territory LIFE + project © GANASA © Eduardo Berián (LIFE09 NAT/ES/531).

We can find other examples in Slovak the Republic, where on the basis of the flood risk maps represented by natural floodway, the water management authority set territories of flood prone areas (inundation area) and areas determined by natural transformation of flood wave i.e. areas for natural retention of water. Consequently such areas have to include spatial plans on the level of municipalities and districts. In Austria, for example, in their funding system these measures take priority.

In England, the National Planning Policy Framework sets out the need for local authorities and developers to reduce the causes of flooding. Guidance is provided.

http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/

An example of the 'green approach' would be the flood alleviation solution implemented for the town of Banbury, Oxfordshire, England, where the creation of upstream flood storage on the River Cherwell has enabled growth to take place and has reduced flood risk to the town.

The scheme comprises ~3 million cubic metres of flood storage – constructed in an agricultural area. This provides a significant increase in standards of flood protection (100 year CC flow was reduced to 20 year equivalent), enabling land in the town to be released for development.

Flow control is achieved by using a passive design, with no operator intervention, power supply or moving parts. Flows passed downriver are controlled to about 38m^3/s (within a range of ±10%). The peak of flood measured at Banbury gauging station in 1998 was about 90m^3/s, corresponding to a return period of about 100 years.

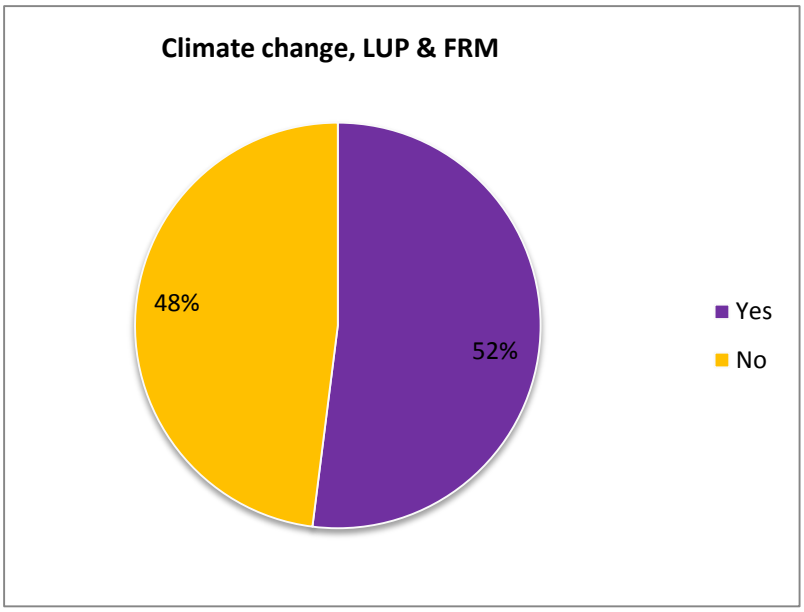
With the benefit of the storage scheme, the peak flood through Banbury will be attenuated by between about 50% and 60% for floods with return periods of 50 to 200 years. The scheme includes spillways with an aggregate discharge capacity of about 400m^3/s.

Finally, Natural England's Green Infrastructure Guidance show different examples in relation to green infrastructure planning and delivery, which is increasingly recognised as an essential part of sustainable spatial planning. This is due in no small part to the role of green infrastructure as a 'life support system', able to deliver multiple environmental functions, and to play a key part in adapting to and mitigating climate change.

Picture 19: Green Infrastructure Guidance. England. http://publications.naturalengland.org.uk/publication/35033

3.3.2.6 Recommendations for climate change related to land use planning in flood prone areas.

Climate change is one of the main challenges for the future. More of the 52 % of the countries have answered that their land urban planning take into account the climate change.



Picture 20: Climate change consideration in LUP and FRM.

In some cases, including flood risk in a national strategy for adaptation to climate change, like Luxembourg, or in other cases, like France, where at municipalities' level, land use planning made by State's department take into account the sea-level rise for coastal risk assessment through 2 levels modeled :

- The first one based on a 100-year event + 20 cm for climate change
- The second based on the same event + 60 cm for climate change

First scenario determines buildable lands and the seconds gives the prescriptions for future constructions and extensions.

Regarding fluvial flooding, the Scottish Planning Policy recommends that a precautionary approach is applied in land use planning. It also sets out that climate change should be taken into account. Current guidance is to include an increase of +20% on peak flows nationally to accommodate future climate changes; note that this is currently under review with especial consideration of a more flexible and regional approach to climate change.

Picture 21: Scottish Planning Policy web site.

The German Strategy for Adaptation to Climate Change Summary contains, among others, some general recommendations on how to deal with flood risks in land use planning.

As a result of a "Modellvorhaben der Raumordnung" (MORO – "Model Projects of Spatial Planning") research project, in 2013 the Federal Ministry of Transport, Construction and Urban Development (Bundesministerium für Verkehr, Bau und Stadtentwicklung) issued a handbook: "Methodenhandbuch zur regionalen Klimafolgenbewertung in der räumlichen Planung" ("Handbook of Methods on Assessment of Regional Climate Change in Spatial Planning") with a lot of references to flood risks (www.klimastadtraum.de). For spatial planning policy at federal level and especially MORO, now the Federal Ministry of Transport and Digital Infrastructure is responsible. In continuing the above-mentioned handbook, additional recommendations are under preparation, full title: "Klimawandelgerechter Regionalplan" ("Climate change proof regional plan").

Picture 22: German Strategy for Adaptation to Climate Change and Climate change Handbook of Methods on Assessment of Regional Climate Change in Spatial Planning in Germany. www.klimastadtraum.de

For Germany, climate change is one of the main challenge for the future, because areas likely to become flood prone areas in the future must be identified and building even now restricted in these areas. The main challenges will be to identify these areas in the face of the existing uncertainties and to convince local actors to take them into consideration in their land use plans.

3.3.3 Main challenges for the future about land use planning and flood risk.

Large range of challenges have been identified in the questionnaire for the future, here we can find the main points:

- The adaptation of the land use planning to the objectives and to the programme of measures of the FRMP. Design well new regulations (GR, BE,PO, ES,CZ)
- How can we maintain major towns in areas that are flood prone or will become flood-prone with sea-level rise? (UK-Wales)
- How do we reconcile the uncertainties in climate change projections with the economic justification for flood risk mitigation measures? (UK-England, UK- Scotland, FR, DE, IE,ES)
- Leave enough space to the water courses. Rising land prices across. This will lead to increased pressure on the floodplain (UK-England, UK-North Ireland, DE, IE, LV, LU)
- Critical infrastructure: avoid new and remove existing if possible. (DE)
- Uncertainty: Decision makers are not concerned about potential damages. Convincing and communicating. (FI, FR, DE,ES)
- To achieve lasting awareness (AT,LV,PO, UK-North Ireland)
- Resources: Need to investment in hydraulic modeling, data.(England, ES)
- Financial compensations for property owners at areas determined to water retention (SK)
- More green approach in land use planning (LV,PO,ES, UK-North Ireland)

3.3.4 Best practices that MS want to share with other countries.

The spatial planning questionnaire finished with the possibility to identify examples of good practices that each MS want to underline and to share with the other countries. These good practices are identified in this chapter, with the hyperlinks provided for each MS.

3.3.4.1 Belgium

Flanders have developed a procedure for flood-prone areas assigned for building, to determine whether a change in land destination or adaptive measures are necessary (signal-areas), as this report show in the item 3.1.1.3, Robin de Smedt presentation in the workshop.

3.3.4.2 Finland

As we have seen in 3.1.1.2 item, Antti Parjanne showed the main aspects of this guide: Guidance for lowest permissible building elevations in shore areas

3.3.4.3 Wales (UK)

In Wales exists a Technical Advice Note 15 (TAN 15) which seeks to define flood prone areas within the planning process. TAN 15 provides advice on:

- development advice maps
- nature of development or land use
- justifying the location of built development
- assessing flooding consequences
- surface water run-off from new development
- action through Development Plans
- development control.

The development advice map under TAN 15 contains 3 zones: A,B and C (which contains subdivisions C1 & C2). Zone C is used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences. C1 is used to indicate that development can take place subject to application of a justification test, including acceptability of consequences. C2 is used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences.

http://gov.wales/topics/planning/policy/tans/tan15/?lang=en

Natural Resources Wales (NRW) are the independent environmental body for Wales and have responsibility for the mapping of flood risk areas for main rivers, coastal, pluvial and reservoirs. The Wales flood map can be found here:

https://naturalresources.wales/our-evidence-and-reports/maps/flood-risk-map/?lang=en

Wales also underline the following guide, where recommend searching by 'Rainscape Llanelli' for an excellent example:

Better use of Sustainable Drainage Systems in existing areas as well as in new developments

3.3.4.4 Ireland.

Ireland want to share the policy of land prone to fluvial or coastal flooding are defined by flood zones:

- Flood Zone A: Within 1% Annual Exceedance Probability (AEP) (or the 100-yr) fluvial flood extent and/or the 0.5% AEP (200-yr) coastal / tidal flood extent

- Flood Zone B: Outside of Flood Zone A, but within the 0.1% (1000-yr) fluvial or coastal / tidal flood extent
- Flood Zone C: Outside of Flood Zone B, but potentially prone to flooding from other sources

http://www.opw.ie/en/floodriskmanagement/floodriskpolicyfunctions/otherbodiesthatdealwithfloodriskmatters/

More information it is possible to find at:

Irish Guidelines on the Planning System and Flood Risk Management

3.3.4.5 Netherlands.

The Room for the River programme includes nice example were flood safety measures are combined with other uses (farming, nature, urban development).

https://www.ruimtevoorderivier.nl/english/

Specific cities have innovative examples of how water sensitive urban design. See:

- For examples from Rotterdam: http://www.rotterdam.nl/waterloket
- For examples from Dordrecht: https://cms.dordrecht.nl/inwoners/natuur-en-milieu/dordrecht-en-water

3.3.4.6 Germany.

The LAWA Catalogue of Measures is a tool to structure and optimize the application of both the WFD and the FD and the links between them. Link

In Saxony, areas where important run-offs are likely to occur as a result of intense rainfall or snowmelt (so-called Water Generation Areas - Hochwasserentstehungsgebiete) are being determined.

Such areas can be found mainly in up-hill regions, especially in the Oar Mountains close to the Czech Border. In these areas, natural water retention capacities have to be preserved or restored, especially by measures of reforestation and restoring soils. In these areas, new building areas, new buildings > 1.000 m^2, new roads, deforestation and transforming grassland into fields is not allowed. Exemptions are possible, if it is proven that there is no negative effect on the natural water retention capacities in the area or compensation measures are taken.

3.3.4.7 England (UK).

The Thames Gateway is a regeneration area which includes brownfield development land which stretches 70 km east from inner east London and straddles both sides of the River Thames and the Thames Estuary.

The Thames Gateway is contingent upon ensuring that impacts of climate change are taken into account for the following factors:

- Maintenance on the proposed crest levels for the River Thames flood defences, which were defined as part of the Thames Estuary 2100 strategy
- Setting finished floor levels and safe refuge levels in new development sufficiently high enough (i.e. above the modelled breach flood level of the Thames defences)
- Achieving Greenfield (i.e. pre-development) rates of surface water runoff

What sets this development apart from other similar ventures is the application of the managed adaptive approach towards climate change. Developers must demonstrate the ability to raise the crest level of the tidal defences to the future level with the development in place and without undue cost and difficulty. Certain developers take the option to undertake the raising of flood defences during construction of the development to avoid potential future changes to landscaping in the future, or where the raised defence level works with their current landscape proposals. The alternative option is to enable developers to demonstrate how flood defence crest levels can be raised to the appropriate climate change level in the future, providing information spatially as to how this can be achieved. The funding mechanisms and associated legal agreements to gain commitment to future increases are agreed between the local planning authority and the developer/ residents. Royal Arsenal, at Woolwich is an example of a site where this approach has been successful.

3.4 Examples of spatial planning policies and flood risk management.

With all the information collected, this item shows a summary of three different spatial planning policies with a good level of integration between spatial planning and flood prone areas.

3.4.1 United Kingdom: England

England is one of the countries that already has a good level of integration related to the land use policy (LUP). Flood risk management and appropriate development is enacted through the National Planning Policy Framework (NPPF). The National Planning Policy Framework was published on 27 March 2012 and sets out the Government's planning policies for England and how these are expected to be applied.

Development flood risk management policy is integrated into their National Planning Policy Framework. England has had solid development and flood risk policy for nearly fifteen years. They admit that because of this no major national updates on spatial planning (i.e. Town & Country) have taken place that integrates Land use Planning and Flood Risk Management as a result of the EU Floods Directive.

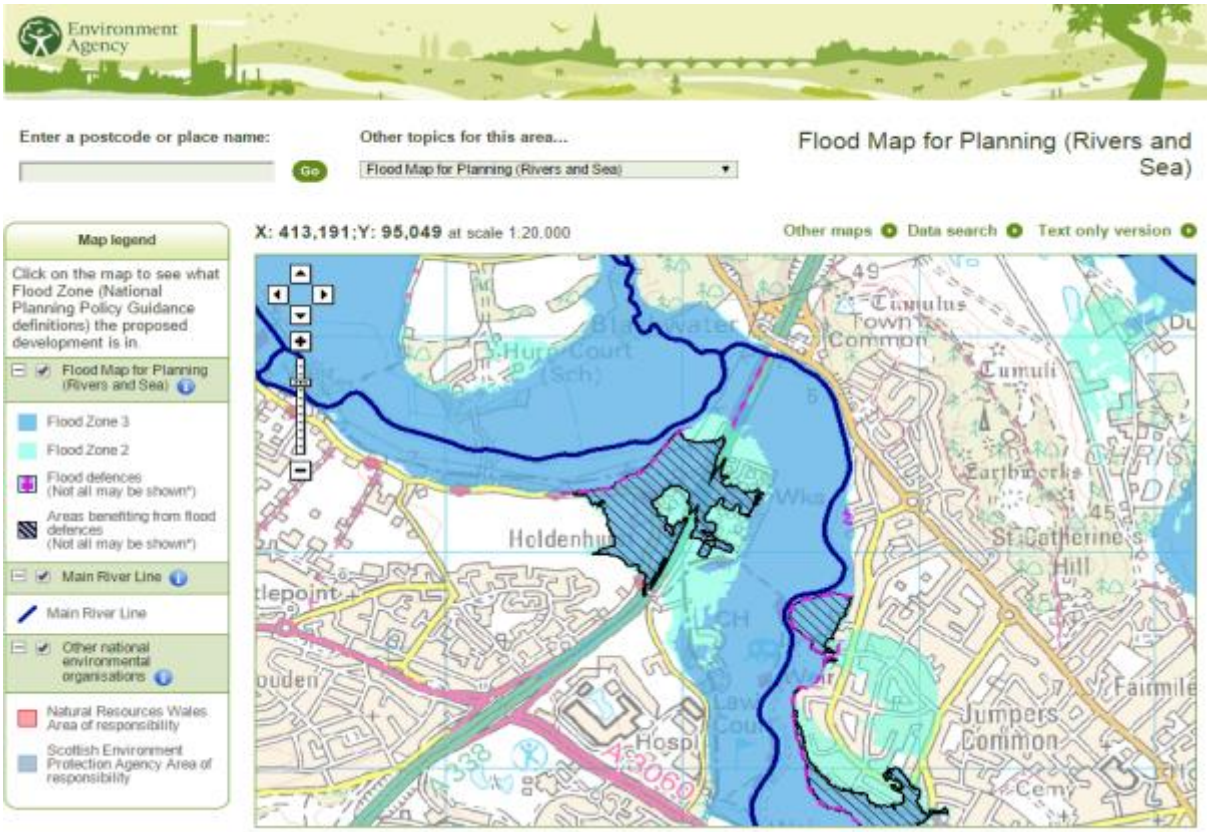
The NPPF claims that decision-takers at every level should seek to approve applications for sustainable development where possible. Local planning authorities should work proactively with applicants to secure developments that improve the economic, social and environmental conditions of the area.

The NPPF recommends a sequential based approach towards development planning in flood risk areas. Development which is most vulnerable to flooding should be preferentially located to areas with lowest probability of flooding, also known as Zones 1. This policy establishes four different zones in order to achieve these goals taking into account such probabilities:

1. Zone 1 land has a less than 1 in 1,000 annual probability of flooding.
2. Zone 2 is defined as land that has an annual probability of flooding between 100 and 1,000 years of return period (200 years in coastal flooding).
3. Zone 3 is the area which has an annual probability of flooding greater than 100 years of return period. It is divided in two groups, the first one, 3a, is the "normal" land in this area, and the second one, is the zone named 3b, that comprises land where water has to flow or be stored in times of flood.

For each zone, the national policy defines the land uses allowed and the limitations.

1. There are not any limitations for zone 1.
2. In zone 2, there is just one limitation in the case of existing a developer interested in including an element classified as "highly vulnerable" (for example, caravans, mobile homes and park homes) in the area. In these cases, an exception test is required.
3. In the zone 3, land which might be flooded with a return period less than 100 years, just the less vulnerable elements can be located, such as land and buildings used for agriculture and forestry and buildings used for shops; restaurants, etc… In the zone 3b, only the water compatible elements can be located, such as ship building, nature conservation and biodiversity, outdoor sports and recreation….



Picture 23: In this image, it can be appreciated how different zones are defined along the main river depending on the probability of these areas to be flooded annually. Source: Environment Agency.

3.4.2 Austria: Styria

Austria is another Member State whose policy has integrated the main ideas on the status of spatial planning that the implementation of the Floods Directive has approached. From a legal point of view land use policy (LUP) is integrated in Flood Risk Management (FRM). But as a federal state, Austria has 9 different policies on land use / spatial planning. This sometimes can lead to difficult decisions. When it comes to zoning, the municipality is responsible dealing with a lot of pressure from the inhabitants.

Here we have the example of one of the nine different policies Austria has. This is Styria, a state located in the southeast of Austria. They have drawn up a Programme for Flood-Safe Development in Settlement Area.

The purpose of this Development Programme is to minimize the risk in case of flood events or events occurring in torrent and avalanche catchment areas by taking appropriate spatial planning measures. The Programme considers that the interface between water management and spatial planning is crucial in the effort to minimize damage caused by flood events. While Water Management provides detailed fundamentals on the event to be expected, Spatial Planning is able to minimize the hazard and damage potential by assigning appropriate land use to appropriate locations.

It is possible to distinguish between four different zones in order to achieve this:

1. "Floods with a one-hundred-year return period (HQ 100)" refer to an event which is likely to occur or to be exceeded, on average, once within a period of 100 years as predicted by the Bundeswasserbauverwaltung (Federal Water Engineering Administration) on the basis of discharge analyses conducted over an infinite, hypothetical series of years of observation.
2. "Priority zones for settlement development", are those priority zones for industry and commerce and development sites for industry and commerce are identified in the Regional Development Plans.
3. "Red hazard zones", are those areas which are so severely endangered by torrents or avalanches that their permanent use for settlement and transport purposes is not possible at all or would require disproportionally high investments, given the expected impact or frequency of the design event.
4. "Yellow hazard zones" refer to all other areas which are endangered by torrents or avalanches and whose permanent use for settlement and transport purposes is restricted by these hazards.
5. "Blue restricted zones" designate areas which are needed by the responsible agencies to carry out technical or forest-biological measures as well as activities required to ensure the sustained effectiveness of these measures, or which call for a special type of management to safeguard a protective function or the success of a defense structure.

To minimize the risk associated with flood events the spatial conditions for water retention in the flood catchment and discharge areas shall be preserved or improved. To this end uninterrupted open spaces shall be maintained in these areas to keep the hazard and risk potential as low as possible in case of flood events.

There are limitations from any use of open space which may increase the hazard potential and obstruct discharge (e.g. landfill areas) as well as from any new construction pursuant in some of the most hazardous areas.

In conclusion, they claim that compatible uses of open space in areas subject to flooding shall be pooled and recognize that buildings and installations within flood discharge areas enhance the damage potential so that there must be some restrictions when it comes to construction actions. The key is also to minimize flood damage through early warning as well as rescue actions and defence measures are crucial to protect human lives and movable property.

3.4.3 Germany

Germany is the third Member State considered as a potential example. This country has a legal framework related to spatial and land use planning on federal level. These are the Federal Act on Spatial Planning (Raumordnungsgesetz) and the Federal Building Code (Baugesetzbuch).

Currently, there is no formal federal development plan, but a policy paper agreed by the State governments and the Federal Ministry of Transport and Digital Infrastructure. The title of this policy

paper is: “Leitbilder und Handlungsstrategien für die Raumentwicklung in Deutschland” (“General Principles and Action Strategies for the Spatial Development in Germany”), which is being under revision. In the draft version it is requested the implementation of FRM at two levels:

a. State Development Plan (Landesentwicklungsplan) for the whole area of the Federal State.
b. Regional Plans (Regionalpläne) for particular areas (regions) within a Federal State.

When it comes to municipal level, there are also two tiers:

a. Land Use Plan (Flächennutzungsplan) at municipal level covering the entire area of a municipality.
b. Local Plan (Bebauungsplan) also at municipal level, but more detailed and covering a certain area.

It is compulsory to deal with flood risks in spatial and land use planning and this had been included in the respective legal acts (Federal Spatial Planning Act / Raumordnungsgesetz and Federal Building Code / Baugesetzbuch) even before 2007. After 2007, only one new obligation with direct reference to the FD was introduced to the Federal Building Code: APSFR have to be marked in Land Use Plans and Building Plans.

According to the Federal Water Act (Wasserhaushaltsgesetz), the competent authorities have to determine flood prone areas, where building and some other activities are not allowed (exemptions are possible on certain conditions). Nowadays there are no official guidelines to determine such areas at the federal level, but some Federal States have published recommendations. Pursuant to the law flood prone areas have to be determined within the APSFR at least for a return period of 100 years or in areas necessary for water retention.

In according with the Federal Building Code (Baugesetzbuch) municipalities have to deal with flood risks in their land use plans and determinate areas where building is restricted due to relevant flood risks.

In flood prone areas it is forbidden by law to develop new building areas. Exceptions are possible, if there are no other possibilities for development in the municipality and if possible adverse effects on the flood situation and an increase of the flood risk are prevented by appropriate measures.

Germany proposes that the areas likely to become flood prone areas in the future must be identified and building must be restricted in these areas. The main challenges will be to identify these areas in the face of the existing uncertainties and to convince local actors to take them into consideration in their land use plans. It is also important to avoid new critical infrastructure in flood prone areas and remove existing critical infrastructure from them, if possible.

3.5 Breakout session 2: key aspects and recommendations on streamlining between spatial planning and flood prone areas in the FRMPs

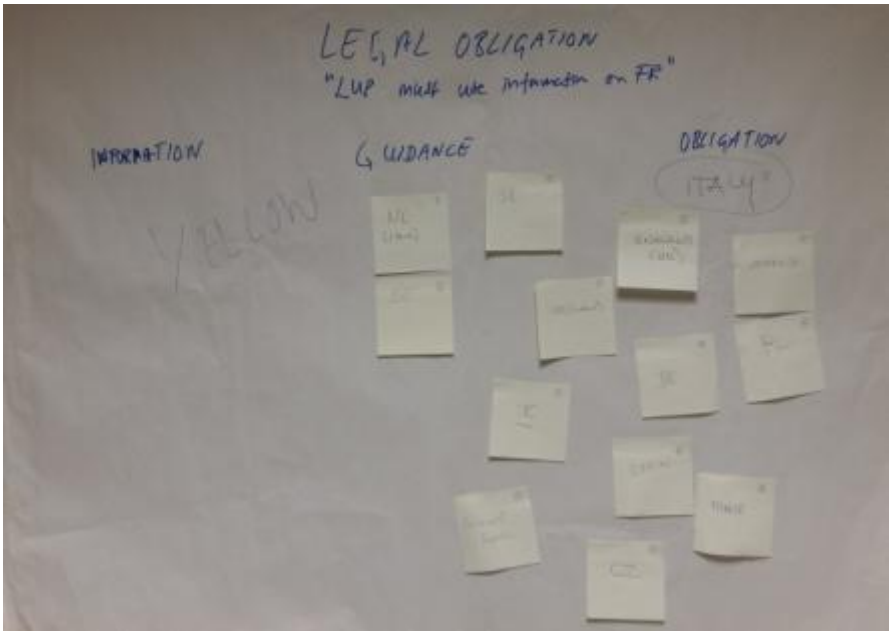
Questions for discussion were:

1. What are the current developments in spatial planning in each MS?
2. Have you endorsed any legislation to prevent coastal/fluvial flooding?
3. In which ways do you consider the FD is enhancing the link between spatial planning and flood risk management?
4. What are the recommendations and lessons learnt and what are the knowledge gaps for Working Group F?

A summary of the feedback from the breakout groups was that:

- The FD had helped to accelerate and influence spatial planning
- Maps in particular have helped to coordinate planning
- FD has helped to look more holistically (e.g. emergency planning)

Different MSs have moved between guidance and legislation. Some MSs have strict prohibition as to what can be built in flood ways. Behind flood defences advice is generally given. It was felt beneficial that there was flexibility, and to be between guidance and legislation. The overwhelming response is that LUP should be obliged to use information about Flood Risk, while other countries think it should serve as a guide. No country believes that maps should be only used as a source of information for the citizens.



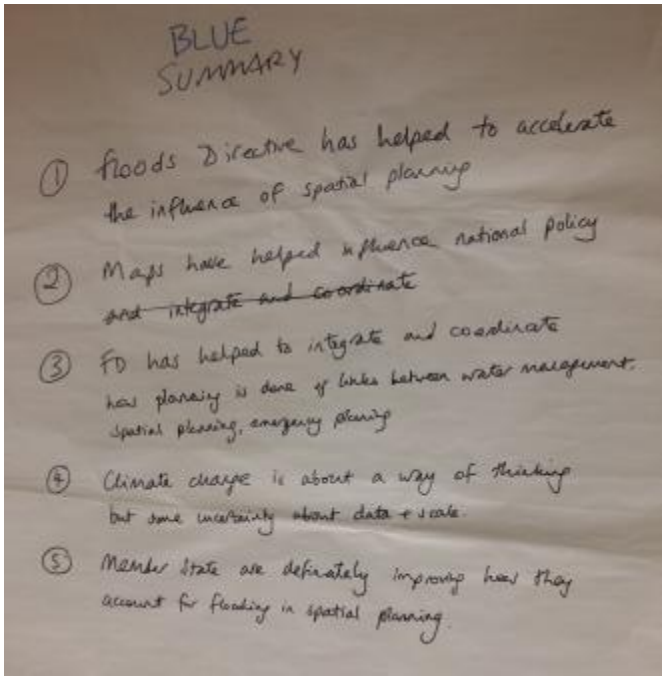
Picture 24: Panel of legal obligation (LUP and FRM). Yellow team. Most of the countries have as an obligation, the coordination between these policies.

Some countries liked the fact that there should be a mix between obligation and guidance. COM agreed with this. Fourteen MSs in the group have moved more towards guidance than legislation. All MSs have (or will have) guidelines to account for flood risk in spatial planning. Changes to this legislation include simplification and incorporation of flexibility in flood risk zones in specific conditions. There is incorporation of the possibility to allow development in flood risk areas when it is demonstrated that flood risk is not increased. There is a need for feedback about local planning decisions to corresponding authorities dealing with FRMPs.

With governance arrangement in MSs (e.g. federal ones) there needs to be national guidance. The benefits and effectiveness of the FD in assisting spatial planning in certain MSs (e.g. DE, UK, NL) was queried. Other MSs saw a clear benefit. All MSs saw flood maps as being advantageous.

Climate change is a "journey" which is now taken into consideration more than in 2007. It is generally taken into account at a policy level. MSs have seen an improvement in how they take into account flooding in spatial planning. Most member countries that responded to this question concluded that climate change influences their decisions, but not in a compulsory way, and it does not impact at all levels (national, regional, local). For example, Northern Ireland and Denmark, meanwhile, do take into account, while other MSs will take it into account in the future pending further evidence. Other countries will remain on the sidelines for now.

There was a need to give consideration to the INSPIRE Directive of how much effect this will have on producing flood maps. Pluvial flooding, and how it is mapped, is of interest particularly taking into account climate change. There is a need to explore how MSs define flood zones in relation to planning. There is potential for follow-up questions from the questionnaire.



Picture 25: an example of one of the team's summaries.

Future workshops

Suggestions were made for future workshops which could cover:

- Looking at how to improve resilience/reduce risk for different areas (i.e. differentiate between urban and rural) that require development but are located in flood risk zones.
- How to incorporate feedback and incorporate the spatial planning decisions information in the updated FRMP and with relevant authorities.
- How to include risks to transport, energy and other critical infrastructure.

4 Workshop Summary and Conclusions

The main conclusions of the workshop can be summarized in the following key points.

Key point 1: The complexity of problem of the coastal flooding.

Coastal flood mapping is a complex problem where many different variables and dynamics are involved. This finally turns into many uncertainties within the models used and the methodologies for calculations, resulting in a wide range of approaches. Hence, some consistency of principles and methodologies is needed. Main issues:

I. Lack of data.
II. Uncertainty in the calculation of Joint Probability.
III. Accuracy of digital elevation models (DEM).
IV. Wide range of dynamics (estuaries).
V. Model sophistication / Model uncertainties.

Key point 2: Climate change consideration in coastal flooding.

It is accepted that climate change should be included in the map calculations but it is not clear what climate change scenario is to be used. Climate change is usually considered in Flood Risk Management measures, but the inclusion in coastal flood mapping must be improved. Main issues:

I. Climate change is relevant in Flood mapping and Flood Risk Management.
II. Several different available scenarios but, which one should be used?
III. Climate change also affects vulnerability and land use, and this is not included.

Key point 3: Need for consistency of the flood hazards maps.

There is a need for consistency as maps are consistent within a Member State but risk results cannot be compared among state members. Main issues:

I. Some maps include defences, others do not.
II. Resolution of data and maps are different depending on State Member.
III. Modeling approaches are different.

Key point 4: Coastal flooding and spatial planning.

It is agreed that spatial planning is a very useful tool for reducing flood impacts, and it is being used by most Member States. Main issues:

I. Coastal flood maps are needed for a proper spatial planning.

II. A proper spatial planning is needed for reducing coastal flood risk.

Key point 5: Usefulness of outcomes in coastal flooding.

Coastal Flood Maps are very useful for defence investment plans, development plans, emergency response, etc. However, there is a need for a clearer explanation to the public so that they could understand what these maps are made for.

Key point 6: Spatial planning is the essential key for not increase the risk of flooding.

Since 2007, several member states has improved their acts and rules, for increasing the coordination between Spatial planning and flood risk management, but in the most of the countries, it is necessary to improve them, because there are still some gaps. The FRMPs include measures to improve this coordination, being one of the group of measures more important.

Key point 7: Components of a complete regulation.

Thanks to this workshop, the recommendations for design a good regulation could be the followings:

- The level should be a country and/or regional/federal level more than municipality level.
- The rule should include graduated bans for each different scenarios for fluvial and coastal flooding, according with the risk of the different land uses.
- The rule should include some exceptions, well defined, because, in some cases, it can be inevitable occupy the flood prone areas-
- For pluvial flooding, the rule should define criteria (e.g. return period) for design drainage and sewage systems, and criteria for designing buildings and infrastructures when this return period will be exceeded.
- This regulation should be applied in the whole territory, beyond the APSFRs, for this reason, it is necessary define flood prone areas in each new settlement.

Key point 8: Green approach and climate change in spatial planning.

Green approach is being considered in the different member states, nevertheless, it is necessary to increase this implementation. Climate change is beginning to be considered, in some cases as a recommendation. Due to the uncertainty, it is necessary to developing new studies and a general strategy. A good strategy is to define how must be designed or adapted the receptors in the current flood prone areas, or future with climate change consideration.

5 Annex I – Workshop agenda

WGF18 WORKSHOP PROGRAMME

Coastal flooding and spatial planning
21st and 22nd October

Wednesday 21st October

12:00- 13:00 Lunch buffet

Session 1: **Setting the Scene: Coastal flooding in Europe and Coastal Flood Mapping**
Chairperson: Ana García, SPAIN

13:00 - 13:30 **Registration**

13:30 - 13:45 Welcome and Introduction: Ioannis Kavvadas / Ana García

13:45 - 14:00 Coastal flooding in Europe and the Floods Directive. (COM)
15 mins presentation

14:00 - 15:30 Presentations on Flood Events and Lessons Learnt in relation to coastal flooding in different MS. Coastal Flooding Risk (CFR) Mapping (as a second topic to include presentations on).

1. A 10 min, 5 mins Q&A (NL, 50 years of coastal protection. Lessons learnt)
2. B 10 min, 5 mins Q&A (IE, John Martin, Assessing tidal flood risk in Ireland)
3. C 10 min, 5 mins Q&A (Christian Stocker, Basque Country, Spain. Lessons learnt on CFR Management)
4. D 10 min, 5 mins Q&A (James Morris, Wales, Response to 2013/14 coastal storms and lessons learnt.
5. E 10 min, 5 mins Q&A (Greece) Assessment of flood risks from the sea

General Discussion (15 min)

15:30 - 16:00 **Coffee Break**

16:00 - 16:15 Summary of Questionnaires in relation to Coastal flooding: Raul Medina. University of Cantabria (Spain)

16:15 - 16:30 "Assessing the impacts of climate change on coastal flood risk in Europe" JRC Peter Salomon

16:30 - 16:45 Introduction to break out sessions: Methodologies used in CFR Mapping
Facilitator 1 (Jonathan McKee)

16:45 - 18:00 Break out session: Methodologies used in coastal Flood Mapping and the consideration of Climate Change in CFR Management. (Facilitator 1 J. McKee, Facilitator 2 Eva Baron and Facilitator 3 John Martin)

Break out sessions answering questions such as (3 groups):

- Main difficulties found when mapping
- In which way have you included CC?
- Any issues with the joint probability of coastal and fluvial flooding
- Main methodologies and recommendations
- Usefulness of the studies outcomes

18:00 -18:30 Feedback and Discussion. Conclusions and recommendations for second cycle. Chairperson 1 and Facilitators

Roger Orpin to take notes of the first session

18:15 **End of Session 1**

Thursday 22nd October

Session 2: **Flood Risk Management Plans: Coastal and spatial planning**
Chairperson: Conchita Marcuello

09:00 - 09:15 Summary Points from Session 1 and Introduction to Session 2 Spain (DG Coastal)

09:15 - 10:15 CFR Management and successful measures

1. A 10 min, 5 mins Q&A (CFRM with regarding adaptation to CC, Jacobus Hofstede, DE)
2. B 10 min, 5 mins Q&A ("Recommendations for minimum building elevations on the Finnish coast" Antti Parjanne FI)
3. C 10 min, 5 mins Q&A (project "signal areas" spatial planning to reduce flood effects, Robin de Smedt BE)

General Discussion (15 min)

10:15 - 10:45 **Coffee Break**

10:45 - 12:45 Spatial Planning in Flood prone areas:

10:45 -11:00. Outcomes from previous workshops. Clemens/Mark

11:00 -11:15 Setting the scene: Summary of Questionnaire: Spatial Planning in flood prone areas in Europe. Sánchez ES

11:15 -11:20. Introduction to break out sessions: key aspects and recommendations on SP and FRMPs. Facilitator 4 (Mark Adamson)

11:20 - 12:30. Break out session: key aspects and recommendations on streamlining between spatial planning and flood prone areas in the FRMPs. (Facilitator 4, Facilitator 5 Barbro Näslund Landenmark and Facilitator 6 James Morris)

Break out sessions answering questions such as (3 groups):

- Recent developments on Spatial planning in each MS/RBD.
- Have you endorsed any legislation to protect from coastal/fluvial flooding
- In which way do you consider the FD is enhancing the link between SP and floods risk management
- Recommendations and lessons learnt

12:30 -12:45 Feedback and Discussion. Conclusions and recommendations for second cycle. Chairperson 2 and Facilitators

12:45 - 13.00 Workshop wrap up
Jorge Ureta

13:00 End of Workshop

13:05 Lunch

6 Annex II – List of Participants

LAST NAME	FIRST NAME	Member State / Stakeholder / NGO
Acebo	Isabel	Spain
Adamson	Mark	Ireland
Åkesson	Daniel	Sweden
Aparicio Martín	Monica	Spain
Arciniegas	Brenda Lizeth	Spain
Aristeidou	Kostas	Cyprus
Babic	Marijan	Croatia
Baron	Eva	Netherlands
Basin	Bérangère	France
Bauduceau	Nicolas	French local authorities
Bernal	Lucia	European Commission
Biondic	Danko	Croatia
Blackwell	Iain	European Water Association
Brask	Joel	Sweden
Brezina	Petr	Czech Republic
Brooks	Wendy	UK-England
Čadek	Peter	Slovak Republic
Coleto	Carmen	Spain
De Smedt	Robin	Belgium
Dudenas	Gediminas	Lithuania
Englebert	Benjamin	Belgium
Fernandez	Pedro	Spain
Flikweert	Jaap	United Kingdom and The Netherlands
Galazka	Aleksandra	Poland
García	José	Spain
Garcia -Fletcher	Ana	Spain
Gkini	María	Greece
Gombás	Károly	Hungary
Grzadka	Grzegorz	Poland
Hiiob	Mariina	Estonia
Hofstede	Jacobus	Germany
Horlait	Jean-Charles	Belgium
Jakopic	Bojan	Slovenia
Jendrike	Harald	Germany
Kavvadas	Ioannis	European Commission
Keskisarja	Ville	Finland
Leclerc	Boris	France
Loureiro	María	Spain
Lumbroso	Darren	HR Wallingford
Marcuello	Conchita	Spain
Martin	John	Ireland
Massabò	Marco	Italy and SEE Europe
Mckee	Jonathan	UK-Northern Ireland

McLaughlin	Mark	UK-Scotland
Morris	James	UK-Wales
Näslund-Landenmark	Barbro	Sweden
Negru	Simona-Olimpia	Romania
Neuhold	Clemens	Austria
Norbiato	Daniele	Italy
Orpin	Roger	UK-England
Panagopoulos	Panos	Greece
Parjanne	Antti	Finland
Pinto López	Elena	Spain
Piontkowitz	Thorsten	Denmark
Quirós Fernández	Javier	Spain
Radulescu	Daniela	Romania
Rindasu-Beuran	Ionel-Sorin	Romania
Ruza	Javier	Spain
Salamon	Peter	European Commission
Sánchez Martínez	Francisco Javier	Spain
Santos	Rubén	Spain
Santos-Olmo	Jessica	Spain
Schwarz	Katharina	Germany
Sereinig	Norbert	Austria
Sokolić	Sandra	Croatia
Stam	Jean-Marie	Netherlands
Stocker	Christian	Spain
Szentivanyi	Arpad	Hungary
Tejkalova	Jana	Czech Republic
Ulm	Reet	Estonia
Urbanowicz	Ewa	Poland
Ureta	Jorge	Spain
Van Keer	Edward	Belgium
Van Os	Hans	JASPERS
Vanneuville	Wouter	European Environment Agency

7 Annex III – Useful links: urban planning and flood risk management.

Austria

Official guidelines to determinate flood prone areas:

http://www.ris.bka.gv.at/Dokumente/Begut/BEGUT_COO_2026_100_2_831651/BEGUT_COO_2026_100_2_831651.pdf

http://www.bmlfuw.gv.at/forst/schutz-naturgefahren/wildbach-lawinen/leistungen/Gefahrenzonenplanung.html

Belgium

Official guidelines to determinate flood prone areas:

Flanders region:

www.watertoets.be

http://www.integraalwaterbeleid.be/nl/publicaties/draaiboek-kaart-overstromingsgevoelige-gebieden

Brussels region:

http://www.environnement.brussels/thematiques/eau/leau-bruxelles/eau-de-pluie-et-inondation/cartes-inondations-pour-la-region
http://www.environnement.brussels/sites/default/files/user_files/fichemethodo_aleainondation_20140116.pdf

Walloon region :

- Application :

http://geoapps.wallonie.be/inondations/#CTX=alea

http://geoapps.wallonie.be/inondations/#BBOX=4496.875158750307,320211.5690881382,56.25374650750018,184008.18415036832#CTX=zi

- Methodology:

http://geoportail.wallonie.be/files/docs/Inondations/AleaEtZi_2013/Note_methodo_carto20131015_Final.pdf

Laws and regulation for land use planning regarding flood risk:

www.watertoets.be

Guidelines defining the adaptation of the receptors or special characteristics for the design of settlements in flood prone areas:

Flanders Region

http://www.integraalwaterbeleid.be/nl/beleidsinstrumenten/watertoets/overstromingsveilig-bouwen-en-wonen

Related to the green approach in the land use planning:

Flanders Region

http://www.rsv.vlaanderen.be/RSV/RuimtelijkStructuurplanVlaanderen/Planningsprocessen/Landbouwnatuurenbos

Finland

Updated Land use and building act and Flood risk management act integrates LUP and FRM, especially responsibilities concerning pluvial flooding. In both acts there are articles **how other planning processes should take FRM into account**.

More information:

Land use and building act: http://www.finlex.fi/en/laki/kaannokset/1999/en19990132 chapt. 17, sect. 11

Flood risk management act: http://www.finlex.fi/en/laki/kaannokset/2010/en20100620

Government Decree on Flood Risk Management:
http://www.finlex.fi/en/laki/kaannokset/2010/en20100659

Official guidelines to determinate flood prone areas:

http://www.ymparisto.fi/en-US/Waters/Floods/Flood_risk_management/Flood_risk_management_planning/Preliminary_flood_risk_assessment

http://www.ymparisto.fi/en-US/Waters/Floods/Flood_risk_management/Flood_risk_management_planning/Flood_mapping

Guidelines defining the adaptation of the receptors or special characteristics for the design of settlements in flood prone areas:

Not really guideline, but one chapter (chapter 10) in Flood preparedness in building –guideline.

https://helda.helsinki.fi/bitstream/handle/10138/135189/YO_2014.pdf?sequence=1 (only documentation page in English)

Best practices shared by this country:

Guidance for lowest permissible building elevations in shore areas:
https://helda.helsinki.fi/bitstream/handle/10138/135189/YO_2014.pdf?sequence=1 , only

documentation page in English. Defined lowest permissible elevation heights soon also in national flood map service.

Germany

Guidelines defining the adaptation of the receptors or special characteristics for the design of settlements in flood prone areas:

http://www.wasserblick.net/servlet/is/146574/ (Link to the LAWA Catalogue of Measures. The other documents are not available in English.)

Recommendations for climate change related to land use planning in flood prone areas:

www.klimastadtraum.de. ("Handbook of Methods on Assessment of Regional Climate Change in Spatial Planning") with a lot of references to flood risks.

German Strategy for Adaptation to Climate Change

Strategy of the State of Sachsen-Anhalt for Adaptation to Climate Change („Strategie des Landes Sachsen-Anhalt zur Anpassung an den Klimawandel")

Best practices shared by this country:

http://www.wasserblick.net/servlet/is/146574/ (see 2.4 and 2.5) is a tool to structure and optimize the application of both the WFD and the FD and the links between them.

Ireland

Official guidelines to determinate flood prone areas and best practises shared by this country:

http://www.opw.ie/en/floodriskmanagement/floodriskpolicyfunctions/otherbodiesthatdealwithfloodriskmatters/

http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,21708,en.pdf

Guidelines defining the adaptation of the receptors or special characteristics for the design of settlements in flood prone areas:

http://www.opw.ie/en/floodriskmanagement/floodriskpolicyfunctions/otherbodiesthatdealwithfloodriskmatters/

http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,21709,en.pdf

Recommendations for climate change related to land use planning in flood prone areas:

http://www.opw.ie/en/climatechange/

http://www.opw.ie/en/media/Draft%20Climate%20Change%20Sectoral%20Adaptation%20Plan.pdf

Latvia

Official guidelines to determinate flood prone areas and best practises shared by this country:

Cabinet Regulation No.406 “Methodology for the Determination of Surface Water Body Protection Zones”:
http://www.vvc.gov.lv/export/sites/default/docs/LRTA/MK_Noteikumi/Cab._Reg._No._406_-_Surface_Water_Body_Protection_Zones.doc

Luxembourg

Official guidelines to determinate flood prone areas:

http://g-o.lu/rqhks

Recommendations for climate change related to land use planning in flood prone areas:

http://www.developpement-durable-infrastructures.public.lu/fr/developpement-durable-infrastructures/partenariat/Paquet_Climat_integral.pdf (National guide for adaptation to climate change)

Netherlands

Official guidelines to determinate flood prone areas:

The FRMP include the use of the so-called “water test”, an instrument which has been developed to weigh water management and spatial planning. The “water test” can be seen on:

http://www.dewatertoets.nl/ *(in Dutch)*

Best practises shared by this country:

The Room for the River programme includes nice example were flood safety measures are combined with other uses (farming, nature, urban development).

https://www.ruimtevoorderivier.nl/english/

Specific cities have innovative examples of how water sensitive urban design. See:

For examples from Rotterdam: http://www.rotterdam.nl/waterloket

For examples from Dordrecht: https://cms.dordrecht.nl/inwoners/natuur-en-milieu/dordrecht-en-water

(both sites in Dutch)

Poland

Official guidelines to determinate flood prone areas:

http://www.isok.gov.pl/pl/mapy-zagrozenia-powodziowego-i-mapy-ryzyka-powodziowego

Flood prone areas are determined by national law – Water act and Regulation of the Minster of Environment, Minister of Transport, Construction and Marine Economy, Minister of Administration and Digitalisation and Minister of Interior of 21 December 2012 on drafting flood hazard maps and flood risk maps (Journal of Laws of 2013, item 104)

England (UK)

Official guidelines to determinate flood prone areas:

National Planning Policy Framework:

https://www.gov.uk/government/publications/national-planning-policy-framework--2 Specifically, Tables 1 to 3, which define the relationship between development vulnerability and the probability of flooding. Table 1 of the NPPF Planning Practice Guidance sets out the definitions of the Flood Zones, from low to high probability of river and sea flooding, and refers to the Environment Agency's Flood Map for Planning (Rivers and Sea) which shows the location of these Flood Zones. Table 3 of the NPPF provides an overview of what development is deemed appropriate for given flood zone classifications.

For England we have not identified APSFRs for rivers and sea. We map and plan for these types of flood risk everywhere.

Areas susceptible to surface water flooding maps – detailing locations that are at significant risk of flooding in high intensity rainfall events. These maps provide an indication of the risk of surface water flooding. Produced by the Environment Agency and available to download free of charge for use by developers and public from our Data Share website

Groundwater flooding data – defined by local area teams – these are not a nationally coordinate dataset but operational teams can draw upon this information resource to inform our responses on planning consultation s under our statutory consulted role.

Guidelines defining the adaptation of the receptors or special characteristics for the design of settlements in flood prone areas:

The Department for Communities and Local Government produced a document recommending appropriate flood resilient construction methods (*Improving the Flood Performance of New Buildings – 2007)* and British Standards International are creating a standard on flood resilient design (*Guide to improving the flood performance of new buildings – flood resistant and resilient construction*).

Related to the green approach in the land use planning:

The NPPF sets out the need for local authorities and developers to reduce the causes of flooding. Guidance is provided.

http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/reducing-the-causes-and-impacts-of-flooding/

Recommendations for climate change related to land use planning in flood prone areas:

Guidance on development lifetime is provided in the NPPF and Climate Change allowances for increases in peak flow, peak rainfall intensity, mean sea level rise, wind speed and wave height are derived by the EA through analysis of UKCiP09 datasets.

Flood & Coastal Risk Guidance for Planners: Climate change allowances for planners. https://www.gov.uk/government/publications/flood-and-coastal-risk-guidance-climate-change-allowances

Northern Ireland (UK)

Official guidelines to determinate flood prone areas:

The main guideline is Planning Policy Statement, PPS 15 'Planning and Flood Risk'. The link http://www.planningni.gov.uk/index/policy/planning_statements/pps15revised-2.htm

Recommendations for climate change related to land use planning in flood prone areas:

Planning Policy Statement, PPS 15 includes guidance on Climate Change adaptation in planning in flood prone areas. http://www.planningni.gov.uk/index/policy/planning_statements/pps15revised-2.htm

Scotland (UK)

Official guidelines to determinate flood prone areas:

Scottish Planning Policy: http://www.gov.scot/Publications/2014/06/5823/0

Recommendations for climate change related to land use planning in flood prone areas:

Scottish Planning Policy can be viewed online here:
http://www.gov.scot/Publications/2014/06/5823/0

Wales (UK)

Official guidelines to determinate flood prone areas:

Natural Resources Wales (NRW) are the independent environmental body for Wales and have responsibility for the mapping of flood risk areas for main rivers, coastal, pluvial and reservoirs. The Wales flood map can be found here:

https://naturalresources.wales/our-evidence-and-reports/maps/flood-risk-map/?lang=en

Policy and guidelines related to new development planning in flood prone areas is contained in Planning Policy Wales and Technical Advice Note (TAN) 15:

http://gov.wales/topics/planning/policy/tans/tan15/?lang=en

http://gov.wales/topics/planning/policy/ppw/?lang=en

Guidelines defining the adaptation of the receptors or special characteristics for the design of settlements in flood prone areas, the main challenges for the future about land use planning and flood risk and best practises shared by this country:

Please see the links for TAN 15 and the NRW flood map above.

8 Annex IV - Questionnaire Responses: Coastal flooding

Link to pdf file.

9 Annex V - Questionnaire Responses: Spatial planning

Link to pdf file.