

Belgium

Belgium faces risks regarding coastal, pluvial and fluvial flooding. While Belgium initially could be said to have a dominant focus on flood defense, in recent years diversification towards flood risk and flood risk prevention (at the level of the regions) and also to preparation and recovery (mainly at the federal level) has taken place. Besides the ongoing diversification of strategies, Belgium's complex institutional setting as a federal state implies that the country has recently put much energy into creating bridging mechanisms between the numerous arrangements and actors (ibid).

Flood risk management in Belgium and, in particular, Flanders is part of integrated water management, based on an integrated Water Act (Flemish Government 2003). Legislation is characterized by general principles such as that water constitutes an element to be taken into account in spatial planning, that water should preferably be kept, stored and finally drained and that water should be given as much space as possible. Since recently, a general regime has existed that ensures that no building activities should take place in flood-prone areas without taking mitigation or compensation measures (Mees *et al.* 2016). Flanders also has a water assessment which relates to plans, programs, and licenses not only with regard to building activities but also to environmental licenses (De Smedt 2004). The system requires that potentially harmful effects on water management should be assessed and if these effects are present, a license should contain provisions to address these negative effects by means of mitigation or compensation measures to be taken. After modifications of the instrument in 2010 and 2013, advice by water authorities has now become mandatory and its scope has been broadened even further to leave more room for water (Mees *et al.* 2016).

A new instrument that bridges several strategies is the so called 'signal areas' which are areas where a contradiction may occur between the interests of the water system and the spatial development perspectives. These areas may play an important role in flood risk management, for example, as they can act as a "sponge" as a result of their natural characteristics. It is a general instrument to protect the available room for water. The consequences of delineating signal areas can be different dependent on what level of flood risks has been assessed. In some cases building activities remain possible but under restrictions while in other cases spatial destinations should be changed. In signal areas the water assessment is more intense and includes more mitigation requirements as well as the obligation to inform property owners and tenants about the flood risks. The relationship between flood risk management and spatial planning is further accompanied by the possibility for expropriation, and by the possibility that a property owner may, in certain cases, demand that the government acquires the property, for example, when the owner is confronted with a delineation of a retention area. Another bridging mechanism can be found in building requirements which aim to avoid rainwater nuisance by requiring a minimum storage capacity of 5,000 liters per property for (uni)family homes unless a green roof has been provided for (Rainwater Regulations 2014; Mees *et al.* 2016). In Belgium, the link between prevention and recovery is made by the inclusion of flood damage in the general fire insurance. This might offer promising opportunities to reinforce the flood risk prevention strategy.

England

Flood risk governance in England can be characterized by a comparatively balanced consideration of flood risks, with similar importance attributed to fluvial, coastal and latterly pluvial flooding (Alexander *et al.* 2016; Hegger *et al.* 2013). This has contributed to a diverse approach to FRM with England having the most diversified set of measures for flood risk management and related governance arrangements among the six countries examined. All strategies distinguished in this paper are in place and most of them have been present for many years. In England, as all five strategies already exist, diversification entails broadening within strategies through the application of new measures and the involvement of new actors and rules. These have led, however, to a degree of fragmentation and although there have been strong efforts to align and bridge between strategies, considerable further effort is still required (Alexander *et al.* 2016). Despite all strategies being present in most situations, the balance between strategies may vary locally depending upon the type and level of flood risk as well as management priorities.

Contrary to Belgium, France and The Netherlands, in England there are no safety standards that formalize the relationship between the several strategies and flood risk management and the financing of defense is primarily based on cost-benefit analysis (Hegger *et al.* 2013). For the preventive strategy, spatial planning is the most important and takes place at the local level; with both application of decision-making and strategic planning (which indicates which areas should be considered for new development) being undertaken by Local Planning Authorities (LPA). English spatial planning legislation is highly fragmented in itself but is based on the premise that spatial planning is mainly a local concern. Flood risks are an important planning consideration which can justify the refusal of planning permission and in practice do so. LPAs are required to produce a Strategic Flood Risk Assessment which is used to inform Local Plans about flood risk concerns when prioritizing areas for future (re)development. The Sequential Test, similar in type to the Dutch and Belgian water assessment, is an instrument that aims to direct new development towards land with lower flood probabilities and this is used as a measure to test the appropriateness of potential development (Alexander *et al.* 2016). If the Sequential Test is not satisfied, it is possible to apply the Exception Test, which permits development in flood risk areas when the safety of a development can be assured and that the “development provides wider sustainability benefits...that outweigh flood risk” (Department of Communities and Local Government 2012; 24). Therefore, the aim is not to preclude all development in flood risk areas, but ensure that development is appropriate, that mitigation measures will be taken and that evacuation is properly addressed and organized (Alexander *et al.* 2016).

FRM strategies in England are bridged by common actors (notably the Environment Agency) who have key responsibilities in all strategies apart from recovery. There is also a long-held and increasing focus on community-level management including awareness-raising which enables individuals to better understand flood risk, adopt any appropriate

(defense and mitigation) measures at an individual or community scale and take preparation actions for future floods.

France

France is facing all types of flood risks: fluvial, pluvial, coastal and flash floods. The country suffered from serious localized floods in the last few years. In France, all strategies are present, but they do not appear very well aligned. However, at a discourse level, prevention plays a very important role in reconfiguring and ‘embracing’ all other approaches to flooding. A typical example of this is provided by the Action Program for Flood Prevention (PAPI). Prevention is considered the main strategy in terms of social and political legitimacy, but defense dominates in implementation practice (Larrue *et al.* 2016).

Since the 1980s more attention was given to decentralized actors as France has been a strongly centralized state. Since the 1930s, there have been legal possibilities to keep areas free from urban development as part of the prevention strategy. A Flood risk Prevention Plan (PPRi) is formulated by state services in areas under flood risk. There is no integrated flood risk management based on one integrated water act. However, there are plans at basin level (SDAGE and SAGE, “Schéma d'Aménagement et de Gestion des Eaux” and “Schéma Directeur d'Aménagement et de Gestion des Eaux“, local water management plans and water management master plans respectively); and a water act at national level which, however, only partially include floods as these are mainly considered through the Natural Risk Act. This might make the coordination between strategies more difficult. Authorities in the field of spatial planning should take some general principles based on national legislation into account, and on PPRi in localities where they exist, although they have a large amount of policy discretion. One of these principles is the obligation that spatial plans should try to reduce the risk of natural disasters, including floods. Furthermore, there is a coordination mechanism between water plans and spatial plans. Another mechanism is the link made theoretically between recovery and prevention strategy: the CatNat system through the National Fund for the Prevention of Major Natural Risks called the Barnier Fund helps to implement prevention devices, and must be related to risk plans. However this relationship is not effective in reality. Another bridging mechanism is related to the fact that when granting licenses in the field of spatial planning, water plans as well as PPRis should be taken into account. A more informal bridging mechanism provides that risk management plans should take land use into account, but there is no formal legal regulation of this mechanism. The most important authority for flood risk management, at local level, is the municipality as it has a general obligation to take care of the safety of its citizens. This means that applications for licenses for developments that may increase flood risks may be refused. There is neither specific legislation that deals with flood risks in relation to spatial planning nor legislation that addresses flood risk mitigation measures. Local guidelines are being developed to fill this gap.

The Netherlands

The Netherlands are faced with risks related to coastal, pluvial and fluvial flooding (Hegger *et al.* 2013). In The Netherlands, the flood defense strategy with probability-reducing measures, such as the construction and maintenance of dikes, is historically predominant, although The Netherlands also have a tradition of specific mitigation measures (Hegger *et al.* 2014, Kaufmann *et al.* 2016). In the last 20 years, consequence-reducing strategies, most notably flood risk mitigation, have become more popular again, even though they are nowadays mostly applied in exceptional cases where the flood defense approach is not seen as efficient or feasible (Van Buuren *et al.* 2014). Flood risk prevention through pro-active spatial planning is hard to realize in a densely populated country where it is difficult to find space for natural solutions, and gets therefore less attention (Hegger *et al.* 2014a), although there are formal rules against building in unembanked areas that are not protected by the primary dikes (Hegger *et al.* 2014, Kaufmann *et al.* 2016).

In The Netherlands, flood risk management is part of integrated water management, based on an integrated Water Act (Van Rijswijk and Havekes 2012). Flood risk policy is characterized by general principles such as that water should be leading in spatial planning, that water should preferably be retained, stored and finally drained and that water should be given as much space as possible. The flood defense strategy can be seen as well-developed and also highly institutionalized and legally embedded. Safety standards prescribing the necessary strength of flood defenses have been laid down in the Water Act. The legal embedding of flood defense reflects the idea that water management should follow land use. In recent times, there is more attention for also considering the effects of land use on water management (*ibid.*). In the past 20 years following the (near) floods of 1993 and 1995, several initiatives have been taken and policy documents developed to give spatial planning a stronger role in FRM, including the prohibition of building in the winter bed of rivers; the establishment of a formal ‘Room for the River’ policy program as well as the establishment of a so-called ‘water assessment’, an obligatory procedural instrument that enables water managers to advise spatial planners on the effects of new developments on water management, including flood safety (*ibid.* and also Correljé *et al.* 2010; Hegger *et al.* 2014; Kaufmann *et al.* 2016). Experience in practice, however, shows that the effectiveness of the instrument is highly dependent on informal cooperation and willingness to seriously examine flood risks in the field of spatial planning. The same goes for measures in the field of risk mitigation. While the Water Act has a general provision that obliges municipalities and water managers to cooperate in the field of urban water management, for the moment there are no sanctions if this cooperation is insufficient. Formal flood recovery mechanisms are hardly present in The Netherlands (Kaufmann *et al.* 2016; Van Rijswijk and Havekes 2012).

Poland

In Poland, the structural defense sub-arrangement, focusing on technical infrastructure, dominates (Matczak *et al.* 2016). However, other sub-arrangements, such as prevention and preparation, are gaining momentum. Dramatic experiences such as the flood events of 1997 and 2010 brought different ways of thinking on how to deal with flood risks,

amongst others in terms of how to organize crisis management and how to prevent environmental harm by constructing flood defenses.

Poland has had several large, destructive, pluvial, fluvial and flash floods in the last decades. The relationship between water management and spatial planning has been dominated by the centralized approach (heritage of the communist system in 1944-1989) in which safety was strongly related to military. After the floods of 1997 a program started with the help from the World Bank and later also the European Union which as a novelty included creating more room for rivers in order to decrease flood risk (Matczak *et al.* 2016). Significant improvements in terms of flood preparation were also made. However, in Poland it is difficult to create societal support for more far-reaching restrictions on spatial development, as they may hamper further economic development that is very much needed in this country with emerging economy. Fragmentation of powers on the national, provincial and municipal levels hampers effective coordination between spatial planning and flood risk management. Spatial planning is mainly a municipal competence, while legislation in the field of water management lies at the national level and planning of defenses is taken care of at the provincial level. Because the shift of powers in the field of spatial planning to the municipal authorities was not accompanied by the necessary shift of financial resources, local authorities still do not pay enough attention to taking the effects of flood risks into account and they have no formal obligations to do so. Besides that, the enforcement of spatial plans is insufficient which leads to further ongoing developments in flood prone areas (*ibid.*).

Sweden

Sweden faces risks regarding fluvial, pluvial and coastal flooding, however risks vary significantly in time and space and the experience of severe floods is limited. Flood risk management in Sweden can be considered diversified; all strategies are implemented to some extent, flood preparation and recovery are however most developed. Due to the variability and unpredictability of flood risks, temporary defenses are more common than permanent defense structures. Flood prevention and mitigation are emerging, these strategies have recently been explicitly incorporated in legislation but this has not necessarily been translated to common practice yet (Ek *et al.* 2016).

There is no distinct national flood policy domain in Sweden as in the other STAR-FLOOD countries, instead actors, rules, resources and discourses related to flood risks are scattered over other policy fields such as e.g. risk and safety and spatial planning. Moreover, flood risk management is highly decentralized; while the national level decides on the legal framework governing flood risk management, the municipal level carries the main responsibility for initiating, financing and implementing different flood risk management strategies. Coordination and bridging is thus likely to be most important at the local level. In spite of the dispersion of flood risk governance across other policy areas, the need for coordination and bridging is, to some extent, reduced by the decentralization of Swedish flood risk management. Building regulations are one example of a legal bridging mechanism between prevention and defense and/or mitigation; these nationally set guidelines come into place and are required for building

permits (granted by the municipality) when new developments are planned in a flood prone area (Ek *et al.* 2016).

Flood risk management is not much linked with water management. Water operations are regulated in the Environmental Code (which covers permanent defense and some of the mitigation measures) and other rules related to flood risks (governing prevention and other mitigation measures) are found in the Planning and Building Act. These two laws are applied in parallel. Sweden chooses an approach that refers to general principles – amongst others in its spatial planning legislation – which have to be taken into account by all authorities in all relevant policy fields. Most important is to take care of a prudent and rational use of natural resources. These general principles have effect as well in planning as in the granting of environmental permits (e.g. for defense).