



Integrated Flood Risk Management in India and the South Asia Region:

Lessons from the Rhine and Danube

NFG Policy Paper No. 8/2015 Robert Brears



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Robert Brears

The NFG Policy Papers 7, 8, 9 represent a mini series of papers which constitute a pilot study that aims to bring in an interdisciplinary perspective to the NFG's political science research, by drawing on other disciplines such as geology. These papers look at the EU as a source of models and templates in non-traditional security for the Asia Pacific region, and focus primarily on urban water management and water security. This series will only be published online.

Executive Summary

India and the South Asia region are one of the world's most vulnerable regions to climate change flooding events. With flood risks being transboundary, there is the potential for floods in South Asia to cause widespread instability and state fragility leading to migration and displacement, weak governance and overall geo-political instability in the region. Europe has experience in managing transboundary flood risks, most recently with the implementation of the EU Flood Directive, which calls for transboundary actions to mitigate flood risks. Using existing platforms for cooperation, Europe can transfer knowledge on Integrated Flood Risk Management expertise to India and the wider South Asia region in order to help ensure regional economic and political stability.

Policy Recommendations

- The EU needs to enhance its role as a global non-traditional security actor: Climate change is a threat multiplier that can potentially create or exacerbate geo-political instability in South Asia. To further develop its work in non-traditional security matters, the EU needs to share with India and other areas of South Asia its model of regional integration and cooperation in managing transboundary flood risks.
- The EU should share data: Integrated flood risk management that defines areas of flooding risk is data-intensive and therefore costly. The EU should provide India and other South Asian countries with satellite and geographic information system data so that local, regional and national governments in the region can identify areas with people and infrastructure at increased risk of flooding from climate change.
- The EU needs to increase development assistance: Because integrated flood risk management requires costly measures to reduce flood risks, the EU needs to increase its development assistance in flood risk management so that cities and regions in South Asia can implement structural and non-structural methods to physically reduce flood risks and reverse environmental degradation.
- The EU needs to expand existing regional dialogues to promote integrated flood risk management: The EU should use the full range of existing multilateral and bilateral dialogues available to it and its members to transfer scientific knowledge on integrated flood risk management. These dialogues should also be used to promote transboundary cooperation on flood risk management, with the EU facilitating dialogue between transboundary states in South Asia.

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Integrated Flood Risk Management in India and the South Asia Region: Lessons from the Rhine and Danube

Robert Brears

1. Introduction

South Asia is one of the most vulnerable regions to climate change flood events. According to the Asia Development Bank, if the world follows a ‘business as usual’ approach to climate change mitigation, and so does not change its use of fossil fuels to power the global economy, then India, Bangladesh, Nepal, Sri Lanka, Bhutan and the Maldives could lose around 1.8 per cent of their gross domestic product by 2050, and almost 9 per cent by 2100 (ADB 2014). It is projected that climate change extreme weather events such as flooding will make the losses even greater. India and the rest of the region are already susceptible to flooding events. In June 2013 alone, the North India floods claimed over 5,000 lives, while 100,000 people required rescuing after villages and towns were destroyed from landslides and flooding (Flood List 2013). Over the past decade, Europe has suffered numerous flooding events that have claimed lives, displaced people and damaged infrastructure and property. Between 1998 and 2009, Europe suffered over 213 major flooding events causing 1126 deaths, the displacement of half a million people and at least EUR 52 billion in insured economic losses. With climate change projected to double the frequency of flooding in Europe by 2050, future flood losses could average around EUR 23 billion a year (The Independent 2014).

During the next decade, tensions and conflicts over water are likely to become more frequent, endangering stability and security in many parts of the world. This could potentially have a direct impact on European interests as well as international peace and security. As Europe has a long tradition of cooperation and vast experience and knowledge of managing transboundary rivers, there is the potential for knowledge and expertise in flood risk management to be transferred to South Asia, with the objective of promoting collaboration and encouraging regional and international cooperation.

2. Integrated Flood Management

Traditionally, flood management has focused on draining floodwater as quickly as possible or storing it temporarily, in addition to separating rivers from populated areas through structural measures such as dams and levees. This was often done with no thought to the consequences of upstream and downstream flood risks. Specifically, actions to manage flooding consisted of local flood prevention schemes involving concrete and other engineered defences such as dams, dikes and weirs that had little regard for the health of the surrounding water catchment area. Engineered solutions can have negative effects on water quality and quantity as natural water flow is disrupted. In many regions of the world including Europe and South Asia, the biodiversity of freshwater has suffered due to many rivers, lakes and wetlands being subjected to flood management practices that have included major physical changes such as the straightening of rivers, dredging of rivers and construction of levees. The loss of flood plains takes away key ecosystem services, including water retention and prevention of soil erosion. Intact floodplains also play an important role in alleviating floods by storing water and releasing it slowly back into streams and rivers. Man-made flood defences can also increase the vulnerability of communities to other man-made or natural disasters such as earthquakes.

Integrated Flood Management means that land and water resources in river basins are developed in order to maximize the efficient use of floodplains and to minimize loss of life and damage to property. Integrated Flood Management is about working with nature and improving the ecosystem and its services, such as restoring a river's natural ability to store and slow down floodwaters. This can be achieved through restoring natural features of river basins, including flood plains and wetlands. For example, wetlands provide a buffer from flooding as they can store water in their soil or retain it as surface water, slowing down the rate of flooding (European Commission 2011).

3. Integrated Flood Risk Management

Flood risk management requires the coordination of numerous activities including the planning of developments, land management, flood warning, community involvement and physical structures to increase resilience of communities and reduce flood risk. Because actions in one part of a river can have consequences elsewhere, flood management is most effective when it is carried out in an integrated and coordinated way throughout the river basin. In Integrated Flood Risk Management, resilience is the capacity of individuals, communities and societies to survive, adapt and grow in the face of shocks. In the context of climate change, resilience is not only about reducing the risk of disaster but also about ensuring 'failure' does not result in catastrophic consequences to life and infrastructure. Adaptive management is an important concept in building resilience (Royal Society 2014). According to the

Intergovernmental Panel on Climate Change, adaptive management is a process of iteratively planning, implementing and modifying strategies for managing natural resources in the face of uncertainty and change. Adaptive management involves adjusting approaches in response to observations of their effect and changes in the system brought on by resulting feedback effects. Resilience-building is an ongoing process involving the use of new information and evaluations of existing measures to regularly update resilience planning and decision-making. In the context of managing climate change extreme weather events, including flooding, adaptive management involves identifying and prioritizing the risks and opportunities associated with extreme weather, implementing measures to address them, establishing monitoring arrangements, regularly assessing the effectiveness of interventions, and evaluating the processes and adjusting measures as a result. However, full knowledge of the risks and consequences of extreme weather events is often partial and incomplete, for instance it is almost impossible to predict future flooding events with precision and accuracy. By recognizing this uncertainty, an adaptive management approach enables decisions to be made and actions taken in the absence of complete information. The result are policies that embed flexibility. Acting under uncertainty and accepting some risk of failure is frequently necessary in pursuing opportunities to increase resilience. With climate change the risk of inaction is the greatest risk (Royal Society 2014).

The Intergovernmental Panel on Climate Change defines risks as the potential for consequences where something of value is at stake and where the outcome is uncertain. Risk is often represented as a probability of a hazardous event occurring. A common way of estimating risk is to measure the exposure (presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure or economic, social or cultural assets in places and settings that could be adversely affected) and vulnerability (propensity or predisposition to be adversely affected, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt) of people, combined with the severity and likelihood of a hazard, where hazard is defined as a physical event that may cause loss of life, injury or other health impacts, as well as damage to property, infrastructure, livelihoods, service provision, ecosystems and environmental services. As such, reducing risk (the combination of hazard, exposure and vulnerability) is a core component of enhancing resilience. With a focus on flooding, flood risk is determined by the occurrence of flooding which may impact exposed populations and assets (for example, houses located near flood-plains), while vulnerability is the characteristic of the population or asset making it particularly susceptible to damaging effects (for example, fragility of housing constructing, poorly planned development, poverty, environmental degradation and climate change) (Royal Society 2014).

4. Why Europe should cooperate with South Asia on Integrated Flood Risk Management

The European Commission's 2014 communication, 'The Post 2015 Hyogo Framework for Action: Managing Risks to achieve Resilience' states that current policy responses are insufficient at effectively addressing existing risks of natural disasters, including flooding. This is because the effects of a changing climate and continued environmental degradation will lead to more intense and frequent flooding, and climate change is a threat multiplier for instability, conflict and state fragility leading to migration and displacement, weak governance and geo-political instability. Conflicts and fragility also further affect global vulnerability to disasters as a result of economies being increasingly globalized and structured around complex global supply chains. For example, the 2011 floods in Thailand led to an economic shock that rippled out to economies and businesses on the other side of the world.

Europe has a long tradition of cooperation – and thus vast experience and knowledge – of managing transboundary rivers in a sustainable manner. This is hardly surprising given that 60 % of the EU's territory lies in transboundary river basins (EU Council 2013). In 2000, the EU's Water Framework Directive (WFD) established a legal basis to protect and restore clean water across the EU and ensure its long-term, sustainable use. The WFD called for all Member States to establish River Basin Management Plans (RBMPs) by 2009, with the aim of achieving good status in river basins by 2015, or by 2027 at the latest. The WFD states that waters in the Union are under increasing pressure from a continuous growth in demand for good quality water for all purposes. To reduce this pressure the WFD states that common principles are needed in order to coordinate Member States' efforts to improve the protection of Union waters in terms of quantity and quality, to promote sustainable water use, to contribute to the control of transboundary water problems, to protect aquatic ecosystems, and terrestrial ecosystems and wetlands directly dependent on them, and to safeguard and develop the potential uses of Union waters. To do this the WFD is intended to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. This is in order to prevent further deterioration and to protect and enhance the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly dependent on the aquatic ecosystems. This is to be achieved through promoting sustainable water use based on a long-term protection of available water resources; ensuring the progressive reduction of pollution of groundwater and preventing its further pollution; and contributing to mitigating the effects of floods as well as droughts.

5. EU policy on Integrated Flood Risk Management

In 2007, the EU's Flood Directive entered into force requiring Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and the humans and assets at risk in these areas, and to take adequate and coordinated measures to reduce any flood risks. The aim of the Directive is to reduce the adverse consequences to human health, economic activity, the environment and cultural heritage associated with floods. A requirement of the Directive was that by 2011 each Member State should have identified areas subject to potential significant flood risks, by 2013 have mapped these flood hazards and flood risks, and by 2015 have used this information to develop Flood Risk Management Plans (FRMP) which were to be subject to review every six years.

While the Flood Directive provides Member States with the decision-making ability on the types of measures used in managing floods, the objective of the Directive is to promote cooperation in the development and implementation of transboundary FRMPs. This comes under the Directive's principle of solidarity, which states that flood protection measures should not compromise the ability of other upstream or downstream regions or Member States to achieve the level of protection they consider appropriate. Regarding the types of measures taken to protect lives and infrastructure from floods, the Directive recommends that taking both structural and non-structural measures can reduce the likelihood of floods and/or the impact of floods in a specific location.

Enhancing the EU's resilience to natural hazards, as well as its capacity to anticipate, prepare and respond to risks, especially transboundary risks, is also one of the objectives of the Europe 2020 strategy to generate competitive, sustainable and inclusive growth. Competitiveness and sustainability depend on effective disaster risk management, which helps avoid losses and strengthens resilience to increasing global shocks and threats (European Commission 2014).

6. Case study: Integrated Flood Risk Management in the Rhine River basin

One of the causes of increased flood threats in the Rhine river basin stems from more than 85 % of the Rhine's natural flood plains having been cut off as a result of straightening, correction and embankment. This development has been in tandem with rapid sealing of soil and soil compaction, which accelerates flood waves. At the same time, population density has increased with intensive land-use on natural floodplains, increasing the vulnerability of people and infrastructure to flooding.

In 1998, the International Commission for the Protection of the Rhine (ICPR) implemented the Action Plan on Floods, which aims to protect humans and their assets against floods, while improving the ecology of the Rhine and its flood plains. Specifically, the Action Plan aims to reduce flood damage risks to humans and infrastructure by 25 % by 2020. In 2001, the ICPR adopted Rhine 2020, a program for the sustainable development of the Rhine that seeks to improve its ecosystem. The Action Plan on Floods was incorporated into Rhine 2020, with one of the goals being the improvement of flood prevention and protection. Specifically, Rhine 2020 aims to reduce, in the Rhine's lowlands, risks of flood damage by 25 per cent by 2020 compared to 1995, and reduce, downstream of Baden-Baden, extreme flood peaks by up to 70cm compared to 1995 levels. Regarding structural goals along the Rhine itself and in the Rhine basin, the Rhine 2020 strategy aims to increase water retention facilities and maintain and strengthen dikes. Non-structural goals include increasing water retention along the Rhine by reactivating inundation areas and improving the flood warning systems. In the Rhine basin, non-structural goals include increasing water retention by re-naturing streams, reactivating inundation areas, initiating afforestation projects, and reducing the amount of sealed surfaces.

7. Case study: Integrated Flood Risk Management in the Danube River basin

Projections from hydrological and climatic modeling of the Danube River basin show that both the probability and the extent of extreme rain events during winter is expected to increase as a result of climate change. To increase resilience to flooding, in 2002 the International Commission for the Protection of the Danube River (ICPDR) published the 'Action Programme for Sustainable Flood Prevention in the Danube River Basin (Action Programme)'. Its overall goal is to achieve a long-term, sustainable approach for managing the risks of floods in order to protect human life and property, while encouraging conservation and improvement of water-related ecosystems.

The Action Programme sets out five main principles. First, a shift is required from defensive action against hazards to management of the risk and living with floods. In managing these risks, human interference in the processes of nature should be reversed, compensated for and in the future prevented. Second, a flood strategy should include the entire Danube basin area and promote the coordinated development, management and conservation of water, land and related resources with the development of basin and sub-basin-wide flood action plans, based on an integrated approach, taking into account the Water Framework Directive. Third, joint action of government, municipalities and stakeholders towards developing flood risk management strategies that involve timely and reliable flood risk warning and forecasting systems, ongoing training and raising public awareness about flooding and the need to coexist with this phenomena. Fourth, reduction of flood risks via restoring the river's natural wetlands and floodplains to alleviate flooding risks, structural measures (defence structures) to protect human health and safety and of

goods and property mainly in urban areas, and reduction of hazards, for instance, human use of floodplains should be adapted to existing hazards and measures taken to reduce the risk of flooding. Fifth, solidarity is essential in managing flood risks, as one region should not pass on water management problems to another region.

Overall, the concepts the EU can export from the Rhine River and Danube River basins to South Asia is the need to simultaneously reduce flooding risks to life and economic assets while restoring natural ecosystems. Specifically, flood managers can maintain and strengthen flood stop-banks while increasing artificial water storage areas. Meanwhile, on the environmental front, flood managers can restore waterways to natural conditions by reducing sealed surfaces which enhances the health of aquatic ecosystems, reactivate natural floodplains and restore these floodplains to natural conditions through afforestation projects with trees slowing down floodwaters and forests overall absorbing excess floodwater. In addition, solidarity is required in managing transboundary flood risks, as negative actions from one region can adversely impact another region, which in turn impacts regional stability.

The EU can export to India, the wider South Asia region, and beyond to the wider Asia-Pacific, the scientific and political aspects of the EU's Flood Directive and best practices of integrated flood risk management, to ensure flood risks in South Asia are managed in a transboundary, integrated manner. Scientifically, the Flood Directive emphasizes the need to assess all waterways for flood risks and map the extent that human life and economic assets are exposed to flood risks. Politically, the Flood Directive ensures cooperation on managing flood risks by requiring the implementation of transboundary flood risk management plans. The benefits of exporting this model to the region is that it can reduce loss of life and economic output from flood risks, ensure natural ecosystems remain healthy and increase the resilience of the populations to flood risks, which overall reduces geo-political instability in the region. In addition, Europe can export this model to the wider Asia-Pacific region to promote cooperative rules-based regional integration (ASEM 2014). The EU can promote and export the scientific and political aspects of the integrated flood risk model to the South Asia region on several levels: at the level of the EU's engagement with South Asian states, region to region dialogues, or between EU Member States and South Asian states.

The benefits of applying European transboundary integrated flood risk management models to the South Asia region is that politically, integrated flood risk management plans reduce instability from floods at both the intra and inter-state level, as the majority of the region's river basins cross political boundaries. At the intra-state level, this reduces the possibility of conflict in one political administration leading to enhanced flood risks in downstream areas. At the inter-state level, integrated flood risk management plans reduce the potential for flood risks to lead to tensions and even conflict between nation-states that share transboundary water resources. In particular, integrated flood risk management plans promote cooperation in managing flood risks, which in turn avoids upstream states releasing floodwater suddenly, impacting hydropower, agricultural or industrial infrastructure, or upstream states failing to provide early warning to downstream states of predicted flood events. However, there are political costs of implementing

the European integrated flood risk management model in South Asia. For instance, many underprivileged people will be displaced from floodplains to make way for afforestation projects. With property rights not being as developed in South Asia as they are in Europe, and the region having numerous ethnic minorities, there is the potential for displacement of people to lead to ethnic tensions and even conflict.

There are many economic benefits of applying Europe's integrated flood risk management model to the South Asia region. Economically, water is a vital resource in the production of economic goods and services. In South Asia, many industrial sectors, including food, pharmaceuticals and textiles, rely on large volumes of water for production of food, medicines and clothing. They are therefore exposed to the risk of floods which damage critical infrastructure and contain excessive amounts of chemicals and sediments which make water unsuitable for industrial use. As such, floods have the ability to impact the revenue generation of businesses. At the aggregate level, floods can have a negative impact on exports of goods and services, which in turn affects overall employment and income levels. Meanwhile, water is essential in the production of energy and floods can damage energy infrastructure, further reducing economic output. Therefore, the implementation of integrated flood risk management models that incorporate both structural and non-structural means enhances the resilience of economies in the region to flood risks. However, it is economically very costly to implement integrated flood risk management plans, as it involves the mapping and analyzing of areas at risk of flooding, high maintenance costs of developing structural measures such as dikes, high costs of restoring waterways and floodplains to their natural states and compensation costs of relocating people away from areas of high flood risks. With the region a developing one, it is unlikely the national governments will have the fiscal ability to implement these projects without development assistance.

8. Platforms to share Integrated Flood Risk Management from Europe to South Asia

There are several examples of current platforms that can be used to transfer integrated flood risk management knowledge and best-practice from Europe – including the experiences in the Rhine River and Danube River basins – to India and other nations in South Asia. These platforms, and how they can be used to facilitate this transfer, include:

- India-EU water innovation platform: The aim of the platform is to facilitate the setting up of joint India-EU research and/or innovation projects in the water sector. The platform supports the implementation of the 'Water for Life' vision document created in 2013 by a group of senior officials from India and Europe. The focus of this platform is to improve drinking water quality, wastewater treatment and urban water management. This platform can be enhanced by including joint projects on integrated flood risks management as flooding risks pose threats to drinking water quality and can damage water infrastructure,

- such as wastewater treatment plants and threaten urban areas.
- ASEM: The ASEM forum enables the exchange of best practices between Europe and Asia in water resources management. In the third ASEM Sustainable Development Dialogue (which was held in 2014) the Chair's statement identified flood management as a key challenge. Finding sustainable solutions to floods is important for the socio-economic development of transboundary regions in both Europe and Asia. In particular, a network of experts on flood management is to be created by the two regions, with the aim of sharing best practices and expertise, complemented by a communication mechanism to consolidate basin-wide water cooperation and ensure sharing of best practices.
- Indo-German Environmental Partnership: The partnership supports the Indian Government's efforts to meet the numerous environmental challenges associated with rapid economic and population growth and urbanization. The partnership's main aim is to ensure more efficient use of resources and better climate protection measures, and thus to promote sustainable development. This programme could be enhanced to include support for the Indian government's implementation of integrated flood risk management projects, as these projects protect rapidly urbanizing regions from flooding risks while reducing environmental degradation through the restoration of natural ecosystems in waterways, including in urban areas and afforestation of floodplains by cities.

9. Conclusions

South Asia is one of the most vulnerable regions to climate change flood events. According to the Asia Development Bank, India, Bangladesh, Nepal, Sri Lanka, Bhutan and the Maldives could lose almost 10% of their gross domestic product by 2100 if no action is taken on climate change. This could endanger stability and security in the region, potentially having a direct impact on European interests as well as international peace and security. As Europe has vast experience of managing transboundary rivers, it should transfer knowledge and expertise in flood risk management to South Asia for the following reasons:

Policy recommendations:

- The EU needs to enhance its role as a global non-traditional security actor: Climate change is a threat multiplier that can potentially create or exacerbate geo-political instability in South Asia. To further develop its work in non-traditional security matters, the EU needs to share with India and other areas of South Asia its model of regional integration and cooperation in managing transboundary flood risks.
- The EU should share data: Integrated flood risk management that defines areas of flooding risk is data-intensive and therefore costly. The EU should provide India and other South Asian countries with satellite and geographic information system data so that local, regional and national governments in the region can identify areas with people and infrastructure at increased risk of flooding from climate change.

- The EU needs to increase development assistance: Because integrated flood risk management requires costly measures to reduce flood risks, the EU needs to increase its development assistance in flood risk management so that cities and regions in South Asia can implement structural and non-structural methods to physically reduce flood risks and reverse environmental degradation.
- The EU needs to expand existing regional dialogues to promote integrated flood risk management: The EU should use the full range of existing multilateral and bilateral dialogues available to it and its members to transfer scientific knowledge on integrated flood risk management. These dialogues should also be used to promote transboundary cooperation on flood risk management, with the EU facilitating dialogue between transboundary states in South Asia.

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