

# Introduction

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Europe is vulnerable to most types of natural disasters. Recent events, such as the flooding in France, remind us that loss of lives, impacts on communities and disruption of economic activity continue to pose significant challenges to decision-makers at all levels.

Efforts to increase our current and future resilience are becoming more urgent: climate change, detrimental land-use practices and the increase of assets located in harm's way suggest that the social and economic impact of extreme events will continue to rise.

Responding to these challenges requires collaboration across different stakeholder groups and disciplines, as underlined by the Sendai Framework for Disaster Risk Reduction 2015-2030, which highlights that disaster risk reduction (DRR) needs the engagement of a variety of actors across sectors, partnerships between different stakeholders and across governance levels (UNISDR, 2015).

The ENHANCE project has developed new risk scenarios and hazard information and shared those with multi-sector stakeholders across different case studies, in order to support the development of innovative approaches to DRR. Amongst those, **insurance is one instrument that could benefit from increased collaboration across stakeholders.**

The economic losses of extreme natural disasters can have significant consequences for individual property-owners and businesses, especially when these effects exceed their financial capacity. Disaster insurance is one option to address the financial impacts of a disaster. It

transfers the uncertainty of a loss to an insurer, who in return receives a premium payment from the policyholder. If and how insurance is used in a country is influenced by local traditions, cultural factors, experience with disasters, availability of data, as well as the engagement of public and private sector (Surminski et al., 2015a).

As the current situation in Europe shows, insurance can be provided publicly, privately, through a partnership, be subsidised or mandated – guided either by the principle of solidarity or considered as a risk-based market mechanism. In some countries only public compensation schemes exist, such as in the Netherlands, where the legislation on compensating natural disasters (WTS) can provide partial compensation for damage caused by natural disasters to property-owners and businesses under certain conditions. The system is provided as an ad-hoc compensation system by the government, and it is uncertain whether or not, and how much of the losses will be compensated. A declaration for compensation is based on a political decision. In other countries, such as France, we find public insurance systems. The French CATNAT is funded by insurance customers through a mandatory fee added to their property and casualty insurance. The private insurers are responsible for covering the flood risks, while the main role of the government is to provide re-insurance and establish natural disaster prevention and mitigation plans. The mandatory nature of the insurance results in a high market penetration, with clear rules on compensation (Poussin et al., 2014). In other schemes, such as in the United Kingdom or Germany, the private sector dominates, with the government playing a regulatory role, but not bearing any financial risks. In the United

Kingdom, this takes the form of a public-private partnership, where private insurers have agreed to provide flood cover in exchange for government investment in flood risk reduction. However, this partnership approach is currently being reformed, as highlighted in the ENHANCE analysis of surface water flooding and insurance in London (Surminski and Eldridge 2015; Jenkins et al., 2016).

Disaster losses are highly volatile, and the most common causes of financial problems in these schemes are a lack of risk assessments and insufficient funds, often due to inadequate premium levels (Botzen et al., 2015). This in turn clashes with the requirement of affordability of insurance cover, which often results in subsidisation to make insurance more economical for those at higher risk (Surminski and Eldridge 2015). Rising disaster losses are already putting pressure on all those involved in the provision of disaster insurance (e.g. Paudel et al., 2014), and in extreme cases could lead to private insurers withdrawing from certain regions or hazards, with systems facing

insolvency or requiring a greater public sector involvement (Prudential Regulation Authority, 2015).

Effective disaster risk management can play a significant role for the future affordability and availability of loss compensation mechanisms (Kunreuther, 1996), but it is far from clear how existing and new schemes can foster risk reducing behaviour. Insurance may even increase risky behaviour through moral hazard, particularly if poorly designed and implemented (Ranger et al., 2011). To overcome some of the barriers associated with achieving adaptive responses and risk reduction, insurance partnerships with the public sector are advocated to harness skills and expertise in supporting insurance approaches (see for example KPMG, 2015). This link between insurance and risk behaviour is gaining attention in the discourse on climate change, where insurance is expected to play a vital part in supporting adaptation efforts and increasing climate resilience, as recently noted in the G7 announcement on climate insurance (see for example GIZ, 2015).

**This chapter presents insights from the ENHANCE case studies on the use of disaster insurance in Europe, and presents lessons on how to use multi-sector partnerships (MSPs) to improve the risk reduction component of insurance. Across these case studies the research focused on two key aspects:**

- 1) assessing existing insurance offerings;
- 2) designing new insurance schemes so that the strengthen and incentivise DRR

A range of different methodologies were applied, reflecting on data availability, stakeholder input and the characteristics of the particular cases. As outlined by Surminski and Hudson (2015), these methods included stress testing; investigation of flood insurance and moral hazard; estimation of effectiveness of household-level flood risk mitigation measures; assessment of risk based insurance pricing incentives for flood risk mitigation; analysis through a Risk Reduction Framework; and investigation of the design principles of insurance.

The application of these methods and the level of analysis varies across the cases – for a summary see Surminski and Hudson, 2015. Below we highlight three key findings from our analysis: (1) the role that risk assessment can play in supporting MSPs, (2) the use of insurance to incentivise risk reduction, and (3) insights on multi-sector collaboration.

<sup>(3)</sup> The G7 Climate Risk Insurance Initiative policy initiative, also known as InsuResilience was launched at the G7 summit in Germany in June, 2015, as part of the G7 Climate Change Commitments. It is a 5-year project funded by the G7 members to implement direct (such as microinsurance) and indirect extreme weather insurance (such as sovereign risk transfer) for an additional 400 million people in developing countries.

# The ENHANCE insurance case studies

In the wake of recent natural disasters, we witness growing interest in the use of insurance as an economic disaster risk management tool from policy makers, practitioners and academics (Surminski, 2014). At a European level, The European Commission Green Paper on the Insurance of Natural and Man-made Disasters (EC, 2013) questioned the appropriateness and availability of current insurance options in the context of rising risk, and asked if and how the provision of insurance could be reformed. These questions have been further examined during the ENHANCE project, with a key focus on the prevention role of insurance, and how this could be enhanced and strengthened through MSPs. To investigate this, we chose **six regional case studies, which are deliberately diverse** (Figure 5.1; Table 5.1).

Table 5.1 shows the different insurance cases and a short description of current insurance schemes. In the United

Kingdom case we have two very distinctive features: an evolving public-private relationship and a temporal consideration of affordability – with Flood Re proposed as a temporary measure to ease the transition to risk-based pricing. In Italy the intention is to show the role of insurance within a mix of policy instruments that jointly lead to a more efficient management of water resources and risk. In Portugal the novel aspect is the integration of public funds and private insurance, as well as the inclusion of Forest Intervention Zones to assist small landowners to gain access to insurance. The Netherlands case focuses on the quantification of flood risk in a participatory way, engaging the different stakeholders to better understand risks, which eventually might lead to new insurance solutions. The Romanian and EUSF cases consider the re-orientation of the EUSF from a post-disaster to a pre-disaster instrument, with a focus on how best to align this public form of compensation with existing and proposed insurance schemes.

**Figure 5.1.**  
ENHANCE case studies with insurance focus.



**Table 5.1.**

ENHANCE Insurance case studies (Source: Surminski et al., 2015a).

<p>Multi-hazard risk assessment in Po River basin (Italy)</p> 	<p>Flooding and drought pose two major concerns in the Po River Basin. Whereas state-subsidised agricultural yield insurance is in place, flood insurance uptake remains low and disaster losses are typically compensated by the state. The role of agricultural insurance in wide-reaching water management reform is analysed and the opportunities are shown for disaster risk reduction through cooperative agreements and partnerships.</p>
<p>Flood risk and climate change implications for Multi-Sector Partnerships (United Kingdom)</p> 	<p>Insurance is provided by private insurers. To address concerns about affordability of insurance a new pooled approach (Flood Re) has been introduced, funded through a levy on all home insurance policies. The design and implementation of Flood Re highlights the challenges of addressing affordability in times of rising risks. Risk reduction and prevention elements are not integral to the new system.</p>
<p>Insurance and forest fire resilience in Chamusca (Portugal)</p> 	<p>Forest insurance is mandatory yet insurance products are scarce in delivering insurance solutions. The case study explores the options for introducing a new forest fire insurance scheme, with a view on risk reduction elements.</p>
<p>Flood risk management for critical infrastruc- ture (The Netherlands)</p> 	<p>Provision of flood risk management in a high risk area presents several challenges for effective application and an innovative multi stakeholder approach aims to deliver a reduction in societal risk.</p>
<p>Reforming natural hazard insurance (Romania)</p> 	<p>Mandatory natural hazard insurance is required under law for residential properties in Romania yet includes no risk reduction elements. The case study investigates the recent changes to the insurance system.</p>
<p>Reforming the European Union Solidarity Fund in support of insurance</p> 	<p>Using a supranational fund such as the European Union Solidarity Fund could provide a link to potential ex-ante capitalisation of disaster funding for risk reduction action. The case study focuses on the options for aligning the EUSF with insurance solutions.</p>

# The importance of risk assessment and data gathering

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In-depth assessments of natural disaster risks are a vital part of the ENHANCE project, as outlined in the recent ENHANCE policy brief on risk assessment (Botzen et al., 2015). Such assessments are important for guiding the development of risk transfer schemes. Particularly for the cases of flooding in Rotterdam and wildfire in Portugal the role of risk data and analysis is evident. In both examples risk data is used to trigger a debate about designing relevant insurance solutions. Another example of such a study is the EU-wide assessment of river flood risk which has been undertaken to estimate current and future risk levels (Jongman et al., 2014). The basic method is a probabilistic catastrophe model of about 1,000 large river basins in the EU. Model results show that current average annual flood risk is about €5 billion which may increase up to €24 billion by 2050 because of socio-economic development and climate change. These results have been used for a stress test of the EUSF and its ability to provide financial aid to the

governments of EU countries hit by a natural disaster. An implication of the increased flood risk is that claims to the EUSF are expected to increase substantially in the future (See Box 2.1, Chapter 2). The model results show that by 2050 the fund's insolvency probability may be 80% higher than under its current structure, and that in addition the magnitude of uninsured flood losses may increase.

New risk data plays also a key role in the ENHANCE assessment of London's surface water risk and the implications for flood insurance. Through the application of qualitative analysis (Surminski and Eldrige, 2014) and a novel agent-based model (ABM), the investigation benefits from the incorporation of a surface water flood event dataset, for present and future climate scenarios, developed by combining probabilistic precipitation projections with broad scale surface water flood modelling and mapping (Jenkins et al., 2016; Jenkins et al., 2015b).

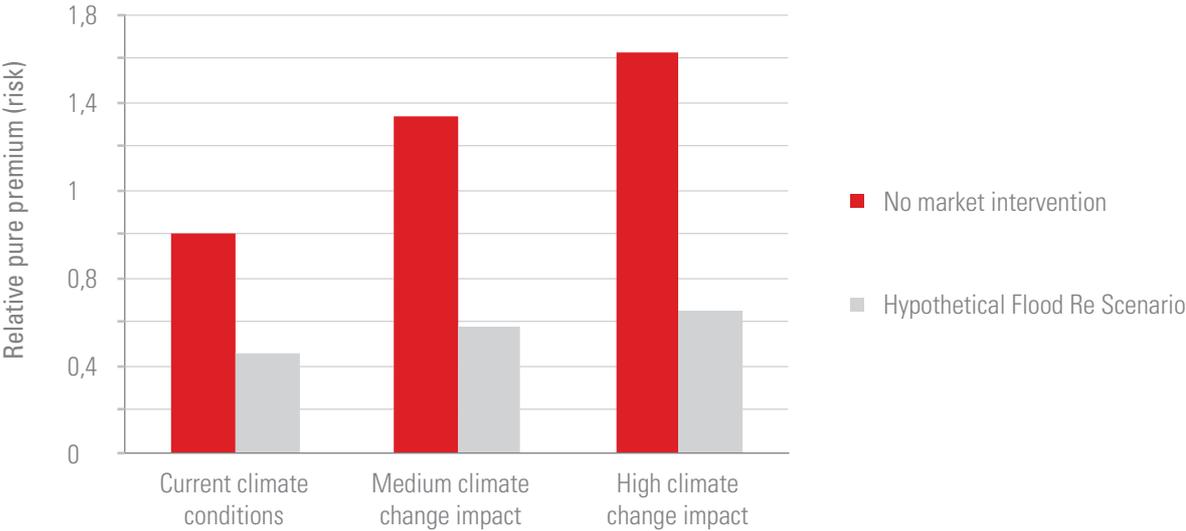
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## Figure 5.2.

The Pricing Implication of Climate Change (Source: Based on Jenkins et.al. (2016), cited in Prudential Regulation Authority and Bank of England. The impact of climate change on the United Kingdom insurance sector, 2015).

The case study analysis finds that more frequent and severe flooding as a result of climate change is a barrier to continued provision of affordable flood insurance. The results from Jenkins et al. (2016), highlighted by the Bank of England (2015), show that climate change and socio-economic risk drivers are expected to widen the gap between 'affordable' flood insurance premiums and premiums that reflect the technical price of flood insurance (see Figure 5.2 below).

The ENHANCE analysis underlines the importance of reducing flood risk through a range of flood risk management measures: Flood Re is designed as a temporary instrument to provide a buffer against high technical flood risk prices, before an anticipated move to a risk-based pricing system in 25 years. However, unless the underlying flood risk is reduced, the gap between the subsidised price of coverage and the technical risk price will grow over time, which would make a move to risk-based pricing unlikely.



# The use of insurance to incentivise risk reduction

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While stakeholders have only limited control over the occurrence of a natural disaster, their actions determine the extent of losses during and after the event. An ENHANCE study for Germany applied Propensity Score Matching techniques to estimate the flood damage savings of such DRR actions by households. The results show that DRR measures lowered damage during floods between €6,700 and €14,000 per flood event (Hudson et al., 2014). Another study also shows that flood damage mitigation measures implemented by households in France substantially saved damage during a variety of different flood events, and that these measures can be cost-effective (Poussin et al., 2015). However, households commonly do not invest in DRR measures, even when they are cost-effective. They insufficiently prepare for natural disasters, for example, because they underestimate low-probability natural disaster risk and the benefits of DRR.

Few studies have empirically examined the relationship between natural disaster insurance coverage and risk mitigation activities of individuals (Botzen, 2013). An ENHANCE study examined how the implementation of a variety of household flood risk mitigation measures differs between individuals with, and without, flood insurance coverage in Germany (Hudson et al., 2014). The results show that individuals with flood insurance coverage in Germany are significantly more likely to have employed mobile flood barriers that keep flood water out of their home, while other risk reducing measures were often implemented by insured and non-insured individuals equally. These findings suggest that the moral hazard effect of insurance coverage is absent since households with flood insurance prepare more for floods. Additional anal-

ysis indicates that the better flood preparedness of the insured is related with activities of seeking information about flood risk, which can signal that the individuals who purchase flood insurance are more careful.

Another ENHANCE study examined whether financial incentives offered by risk-based pricing of insurance in Germany and France can stimulate policyholder adaptation to flood risk (Hudson et al., 2016). This risk-based pricing implies that households receive a premium discount when they take measures that reduce flood risk. The effectiveness of such incentives is analysed using an integrated model of household level mitigation behaviour and public-private flood insurance. The results indicate that insurance based incentives are able to promote adaptation by correcting for individual misperceptions of flood risk and related benefits of DRR. The incentives could reduce residential flood risk by 12% in Germany and 24% in France by 2040. The higher level of flood risk in France results in a strong present incentive to reduce risk. Rapid growth of flood risks in Germany results in more effective incentives in later periods. An overall drawback of risk-based pricing is that flood insurance becomes potentially unaffordable for households who face a high risk. The study shows that such concerns for affordability can be overcome by providing insurance vouchers that help low-income households pay for flood insurance coverage. This voucher system that overcomes affordability concerns with risk-based flood insurance has a lower cost by 2040 than the benefits it brings of additional risk reduction. A main policy recommendation that follows from this study is that strengthening the link between insurance and DRR is worthwhile, but second-

any policies may be needed to compensate additional costs for low-income households.

The effectiveness of risk-based flood insurance in stimulating risk reduction is also shown by an agent-based model (ABM) analysis for the ENHANCE case study Rotterdam (Haer et al., 2016). This ABM simulates the interaction between stakeholders like insurers and households, and allows for the modelling of complex decision-making when faced by real-world constraints, such as limited information availability (bounded rationality). The analyses of individual flood preparedness under a variety of behavioural theories simulated by the ABM show that the effectiveness of risk based premium in stimulating investments in DRR heavily depends on household behaviour. For example, incentivising DRR is most effective in situations when many households underestimate the flood risk that they face, because they have not been flooded for a long time and flood risk awareness of the community has faded (Haer et al., 2016).

Linking insurance to effective adaptation and flood risk management is also an issue in the discussion around

Flood Re the United Kingdom. Effective adaptation is crucial to ensure the affordability and availability of flood insurance. However, these issues were not fully taken into account in the design of Flood Re. The ENHANCE analysis suggests that the efforts to reform the insurance arrangements have been predominantly focused on dealing with the current affordability of insurance, without considering the importance of managing and reducing the underlying risks. Flood Re does not have any direct levers to influence flood resilience, and it is unclear how it can impact the behaviour of those groups that will determine future risk levels: homeowners, national and local governments, developers and insurance companies. The failure to build incentives to increase resilience into the design of Flood Re is a missed opportunity (Surminski and Eldridge, 2015). It could even have a detrimental effect on overall flood risk management. The scheme's existence may reduce the urgency for Government to prevent and reduce risks and might also reduce incentives for home- and business-owners to invest in resilience measures i.e. it can create moral hazard (Surminski, 2014).

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Flood in York, UK, 2006. Copyright: UNISDR.



# The role of multi-sector collaboration for enhancing insurance partnerships for catastrophic natural disasters in Europe

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Despite broad agreement for closer collaboration between public and private actors in response to rising risk levels, many challenges remain for translating this into innovative solutions. Public-Private Partnerships (PPP) in disaster insurance can serve as role models for a joint bearing of responsibilities and efficient risk-sharing, promote insurance coverage and penetration, and guarantee a strong financial backing in view of uncertain tail distributions of risk. Johansen (2006) summarised the principles and pre-conditions of successful PPPs as (1) being shaped through constructive dialogues (between public and private entities) and conscious of mutual principles and limitations, (2) safeguarding competitive environment; and (3) respecting, if not exploiting, risk-differentiated prices as incentive and reward for individual or collective risk prevention and protection. Ideally, private insurers (should) 'have the opportunity to carry on using their *savoir-faire* in an environment of mutual understanding' (ibid).

All ENHANCE case studies exemplify that public and private stakeholders have very different constellations and problem definitions. Therefore, stakeholder engagement is important in order to discover current barriers, perceived or otherwise, that are inhibiting innovative solutions or the development of new partnerships. For example, it may be that the level of risk itself is inhibiting the partnership or that the stakeholders do not have a suitable platform upon which to engage.

The ENHANCE assessment of flood insurance in particular highlights this need for more effective collaboration between stakeholders. The patchwork of flood insurance provision across Europe has fuelled the debate about the

role that insurance can play and how other stakeholders such as homeowners or governments can respond to growing flood losses. This discourse over the future of insurance has mainly focused on insurance as a compensation mechanism, and less on the possibilities of increasing resilience and promoting risk reduction. Through the ENHANCE project, we show that this is an area that would require further action and increased multi-sector collaboration (Surminski et al., 2015). Acknowledging the significant challenges that insurers and risk managers face (e.g. Paudel et al., 2015), our analysis supports a move towards insurance and risk management partnerships that do not focus exclusively on compensating and transferring the financial losses but rather combine this with risks reduction.

To investigate this further the ENHANCE project convened a workshop with academics, (re)insurance industry, and policymakers, to discuss the role of such insurance partnerships. Focussing on the EU Green Paper and the role of public policy the workshop concluded that there is not a single partnership model that can be homogeneously applied across Europe (Surminski et al., 2015). The discussion also underlined the importance of design and structure of any partnerships between insurers, governments, and policyholders. Spreading and exchanging knowledge were commonly referred to as key outcomes of improved collaboration. For instance, academics can contribute advanced risk models and forecasts, which would allow insurers to better price and prepare for risk, and which would pinpoint government to spot hotspots of unaffordability or areas that require investments in protection infrastructure. In turn, households could be made aware of the relative benefits of risk reduction measures to better manage the re-

sidual risks. Creating such virtuous cycles are possible, but require transparency, trust and engagement from all sides.

Our regional case study investigations provide further insights into if and how multi-sector collaboration can help utilising insurance for resilience. We note that across all our cases the provision of insurance is influenced by public policy: Directly through regulation such as mandating cover or instigating the development of new schemes. And indirectly by providing the enabling infrastructure and environment, for example through a broad risk reduction framework, including building codes and better flood risk data provisions. Overall, a stronger policy approach to disaster risk management (planning, defence, resilience measures, data etc.) would make the MSPs more viable (Surminski et al., 2015).

Another key aspect is how insurance targets and engages with those who can take action. The London ABM model investigates the roles and behaviour of different stakeholders and explore how they could support surface water flood risk reduction under future climate change (Jenkins et al., 2016). The model simulations show that the highest resilience results can be achieved by combining of resilience activities from insurers, government, and property developers. This is particularly relevant when future climate change is considered. This underlines the importance of including multiple actors in the MSP, and allowing a flexible framework that can be modified over time as different risk thresholds are passed (Jenkins et al., 2016).

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