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# "NAture Insurance value: Assessment and Demonstration"

NAIAD

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**INDEX**

1. General context: NAIAD objectives ..... 6
2. Task 8.1. Mapping of EU policies, legal and regulatory frameworks for insurance capacity of ecosystems ..... 7
2.1 Objectives ..... 7
3. NAIAD's approach of the insurance value of ecosystems (IVE) ..... 8
3.1 Flood insurance and DRR in EU ..... 10
3.2 Insurance structures and implications for IVE ..... 12
3.3 Ecosystems and insurance – what's the connection? ..... 14
4. Synergies of policies from global to EU level ..... 15
4.1 Timeline of the development of climate change adaption (CCA), disaster risk management (DRM) and Nature-based solution (NBS) concepts: ..... 15
15
4.2 Barriers and gaps to the insurance value of ecosystem implementation ..... 19
4.2.1 ISSUE: Lack of targeted legislation on NBS or IVE but an abundance of possibly relevant ones ..... 21
4.2.2 ISSUE: Quality of data, and disclosure of insurance risk related data in competitive markets ..... 21
4.2.3 ISSUE: Estimating overall damage, i.e., not only to some assets ..... 22
4.2.4 ISSUE: Climate change impacts on hazard risk increases uncertainty ..... 23
4.2.5 ISSUE: Clarifying who should pay for DRR, ecosystem protection and who benefits ..... 23
5. Conclusion ..... 24
6. References ..... 25
7. Appendix: Mapping of policies, agents and capacities of EU member States ..... 29
7.1 ISSUE: List of most relevant policy questions ..... 30
7.1.1 Denmark ..... 30
7.1.2 France ..... 31
7.1.4 Germany ..... 33
7.1.5 Italy ..... 33
7.1.6 The Netherlands ..... 34
7.1.7 Poland ..... 35
7.1.8 Romania ..... 36
7.1.9 Slovenia ..... 37
7.1.11 Spain ..... 38
7.1.12 Sweden ..... 39
7.1.13 United Kingdom ..... 39
7.2 AGENTS: List the most relevant stakeholders and potential 'agents of change' ..... 40
7.2.1 Denmark ..... 40
7.2.2 France ..... 41
7.2.3 Germany ..... 42
7.2.4 Italy ..... 43
7.2.5 The Netherlands ..... 44
7.2.6 Poland ..... 45
7.2.7 Romania ..... 46
7.2.8 Slovenia ..... 47
7.2.9 Spain ..... 49
7.2.10 Sweden ..... 50
7.2.11 United Kingdom ..... 51

7.4 ACTIONS: Evaluate differences in the capacity to implement insurance value of ecosystems between member states ..... 53
7.4.1 Denmark ..... 53
7.4.2 France ..... 54
7.4.3 Germany ..... 55
7.4.5 Italy ..... 56
7.4.6 The Netherlands ..... 56
7.4.7 Poland ..... 57
7.4.8 Romania ..... 57
7.4.9 Slovenia ..... 58
7.4.10 Spain ..... 59
7.4.11 Sweden ..... 60
7.4.12 United Kingdom ..... 60

## EXECUTIVE SUMMARY

This policy brief maps existing policies, agents and capacities of EU member states and reviews international drivers in the context of integrating insurance value into conventional insurance frameworks and risk modelling. The analysis was broad, spanning from the EU Water Framework Directive, EU Biodiversity Strategy, Floods Directive, to IUCN's push on NBS and the subsequent anchoring in the Paris Agreement and the New Urban Agenda. The review demonstrates that within the EU and internationally, it is widely recognised that there is a role for NBS in terms of risk reduction and the capacity of an ecosystem to sustain risk reduction. From here the IVE logic is that insurance value assessments could feed back into regulations for investment in the maintenance or NBS that produce an equivalent return in measured 'insurance value'. The link between insurance and the NBS, where valid, is in a return loop as a potential source of capital, or justification of capital expenditure on NBS to provide risk mitigation. However, it is relatively rare that insurers themselves make direct investments in risk mitigation measures, instead they are more likely to advocate for higher standards or public investment in DRR.

Some of the complexities around the broader aim include the range of stakeholders involved, their appetite for risk, the solvency of the insurance industry, connection with insurance premiums, and issues around availability and use of data, both from risks generally and specifically related to climate change. From the data perspective, there are insufficient data to underpin the assessments and an unwillingness to share data due to intellectual property issues. From the incentive's perspective, the incentive signals are not supporting the implementation of ex ante measures or preventative measures.

In parallel is also recognised that NBS have the potential to provide additional benefits (co-benefits), the market and potential willingness to pay for co-benefits remain less obvious. However, situating IVE as one benefit among several co-benefits delivered from an NBS could be a supplementary driver to support wider adoption of NBS. It is clear that a range of policy questions remain and that the agents of change need to be further specified to enhance the integration of ecosystems and natural capital into EU policies and frameworks. However, there are a milieu of policy opportunities to support integration. This sets a context from which to explore in the subsequent policy briefs how, within current policy frameworks, or to advance through new policies, institutions or financing mechanisms, becomes the driving question once IVE has been successfully demonstrated and assessed.

**Keywords:** natural hazard, insurance, risk reduction, European regulation, protective ecosystems.

## 1. GENERAL CONTEXT: NAIAD OBJECTIVES

NAIAD (Nature Insurance Value: Assessment and Demonstration) is a new H2020 European project (started in December 2016) dedicated, to assess Nature Insurance Value. The *H2020* **NAIAD** project aims to operationalize the contribution of ecosystems to society's resilience concerning water risks, and giving particular attention to extreme-water-related disasters in Europe and beyond. The goal is to develop a methodology based on gathering existing knowledge and developing new knowledge and methods (operational objective), to characterize the resilience of ecosystems including uncertainty in assessment to inform decision processes on mitigating risks. In relation with other partners, the proposed holistic approach will integrate social, economic, environmental issues in spatial evaluation of the protective role of ecosystems that consider the effectiveness to reduce risks, their vulnerability and long term sustainability.

NAIAD focuses on the insurance value of ecosystems, i.e. "the value of the sustained capacity of ecosystems to maintain their functioning and production of benefits despite any disturbance"[1,2], specifically on benefits regarding water-related disaster mitigation. Ecosystems protect but are also impacted[3] by storms, wildfires, diseases, climate change, etc. Specific management operations might increase their resilience, although possibly involving operation and management costs[4]. NAIAD aims to **bring evidence of the ecosystem protection roles, provide integrated hazard assessment methods, inclusion of social risk perception and preferences, and tailor innovative business models and finance to consider the insurance value of ecosystems (see details in the appendix 1)**.

NAIAD is organized in 10 work packages (WP). The present document is the first deliverable of WP8 called "Policy and mainstreaming".

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[1] "The system itself having the capacity to cope with external disturbances and includes both an estimate of the risk reduction due to the physical presence of an ecosystem (e.g. area of upstream land/number of downstream properties protected) and the capacity to sustain risk reduction (i.e. the resilience of the system)" (EC, 2015). "An ecosystem's ability to maintain its basic functions and controls under disturbances, is often interpreted as insurance: by decreasing the probability of future drops in the provision of ecosystem services, resilience insures risk-averse ecosystem users against potential welfare losses". Baumgärtner and Strunz (2014),

[2] Definition retained by the European Commission in the document: "Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities", 2015

[3] It worth being stressed that storms, wildfires and other "catastrophes" are an integral reset mechanism, a natural ecosystem management measure that enables the transition from one succession stage of an ecosystem to the next or even helps keep an ecosystem healthy by eliminating old, diseased or exotic elements from the system.
From an ecological point of view, they are not catastrophes, but rather mere essential processes that sustain the dynamic equilibrium and diversity of natural ecosystems and consequently their resilience, since natural resilience is drawn from diversity of functions and interactions of abiotic and biotic elements.
When using ecosystems for protection, we rely on specific functions of specific succession stages of that ecosystem and we aim to artificially maintain that succession stage which offers the most protection or the ecosystem services that we require. The disturbance brought by storms, wildfires, diseases and climate change may curtail some key ecosystems services and are consequently perceived as negative from a societal point of view. Further works of NAIAD, for example on forest wildfire will bring elements on the protective service perturbation, best way to deal with them and best ways to manage ecosystems and risks sustainably: Nature-based solutions must integrate these aspect of ecosystem dynamics

[4] Please note that at present there is little data on the differences in terms of O&M costs of nature based solutions as compared to standard (hard) infrastructure.

**WP8 - Policy and mainstreaming [Months: 1-36]**

*Partners involved: SIWI, BRGM, ICATALIST, ERCE PAN, REVIVO, GEOECOMAR, BDG, ISKRIVA, IRSTEA, UNS, DELTARES.*

WP8 will promote knowledge exchange and policy dialogue to support innovation in policy, legal and regulatory frameworks, to enhance their capacity to utilize the insurance capacity of ecosystems in disaster risk management, climate adaptation and ecosystem management. This will be disseminated through a series of publications, policy dialogues and stakeholder consultations with key actors in the public and private sector.

# 2. TASK 8.1. MAPPING OF EU POLICIES, LEGAL AND REGULATORY FRAMEWORKS FOR INSURANCE CAPACITY OF ECOSYSTEMS

## 2.1 OBJECTIVES

WP8 is organized in 4 tasks, the present document is the deliverable for Task 8.1.

**Task 8.1. Mapping of EU policies, legal and regulatory frameworks for insurance capacity of ecosystems (Lead: SIWI, Collaborators: BDG, DELTARES, IRSTEA, REVIVO, ERCE, ICA, BRGM) (Month 1-8)**

Recently conducted policy reviews (in FP7 projects OPENNESS and OPERA, 2015) demonstrate **clear gaps in the integration of ecosystem services and natural capital into EU policy frameworks, particularly at the operational level.** One particular window of opportunity is the review of the river basin management plans and the recently submitted Flood risk management Plans prepared by all EU member states. This task will therefore assess and provide recommendations on concrete actions to be taken and effective entry points to mainstream the insurance value of ecosystems into the current regulatory frameworks. This will follow an issue-agent-action method performed through:

a. ISSUE: **List of most relevant policy questions** that are not well understood that determine effectiveness of applied methods for insurance value of ecosystems and NBS (compiled through desk study, questionnaire, and interviews. Building primarily upon previous studies done in current FP7 Programmes OPENNESS and OPERA);

b. AGENTS: **List the most relevant stakeholders and potential 'agents of change'** from government, business, financial sector and civil society to support uptake of NBS and insurance value of ecosystems at the EU and member state level;

c. ACTIONS: **Evaluate differences in the capacity to implement insurance value of ecosystems between member states** and global leaders outside of the EU to highlight future opportunities for twinning, policy dialogues and knowledge exchange.

This mapping exercise will serve as EU baseline for the institutional and policy analysis to be undertaken in WP3 (Task 3.2), which will undertake a similar exercise at country/DEMO level and produce eight additional reports (chapters) for each DEMO country.

## 3. NAIAD'S APPROACH OF THE INSURANCE VALUE OF ECOSYSTEMS (IVE)

This report outlines key issues pertaining to the policy and regulatory contexts surrounding the understanding and potential operationalization of the "insurance value of ecosystems" within the implementation of nature based solutions in Europe.

The "insurance value of ecosystems" (IVE) can be defined as having two dimensions or possible interpretations. The first refers to the value provided by an ecosystem service to mitigate risk that either is insured or would need to be insured. For example, this could include flood mitigation performed by a wetland. The second potential application of the insurance value of ecosystems could refer to economic valuation of an ecosystem, so that if it is degraded and needs to be rehabilitated that cost could be covered through an insurance policy. The insurance value would thus be based on the economic valuation of the services provided and required payments for rehabilitation to restore the system if it is damaged by natural or other causes. This paper, consistently with the IVE's definition proposed by the European Commission (2015a p. 14), only considers the first within its scope as it focuses on the operationalization of IVE within the development and implementation of NBS.

An important aspect that will be explored at later stage, as the project evolves, are the potential business models and finance for these ecosystem service provision/restoration from those benefiting from risk reduction. This could be reflected for example in the case of Copenhagen one of NAIAD DEMOS, when public actions by the city to prevent future damages from Cloudbursts through a Cloudburst management plan that includes a range of nature based solutions among others, are paid through water rates, and in turn the insurance companies that operate in Copenhagen will proportionally reduce the citizens' insurance premiums to account from less damage costs (Rasmussen, 2017)[5]. Another option is a completely new type of product where the insurance is in the physical good itself, where the beneficiary if shown that risk is reduced could pay to "protect" the insurance value of a specific ecosystem function like e.g. regulatory functions of river systems.

Insurance value is broadly defined through consideration of the "risk triangle": hazard, vulnerability and exposure. With the example of flooding, hazard would be defined by the level of incoming water from a storm, exposure by the value of assets or lives that can be affected, and vulnerability by the level of hazard that can be withstood before assets or lives are impacted (low vulnerability equating to being able withstand a large hazard event, and high vulnerability being able to be impacted by minor hazards). It is important to point out that social and

[5] Rassmusen, J. 2017. Risks and insurance: Climate Adaptation in Copenhagen. Presentation at the DGClima/Ramboll Conference on Insurance and Climate Related Disasters (30. June 2017, Brussels)

economic factors play an important role on the level of vulnerability e.g. in terms of risk perception and behavior. The insurance system broadly works to balance against the risk triangle through risk prevention (ex-ante reduction of exposure); risk mitigation (ex-ante reduction of vulnerability) and recovery (ex-post compensation for losses).

IVE, as provided by an NBS, can contribute to the reduction of vulnerability (risk mitigation). It does not generally impact (directly) on the level of exposure or the actual hazard (determined by precipitation/climate events). Thus, the insurance value referred to can be more specifically described as the quantification of the hazard risk mitigation provided by an ecosystem service or NBS. Within the context of the NAIAD project and this analysis, focus is on water related risks, and even more specifically flood risk and drought risk. Within this, flood risk is assessed in greater detail as insurance against floods is nearly universally provided within Europe whereas insurance for drought is relatively scarce (and falls under agricultural insurance primarily). In the case of NAIAD for example, two of the DEMOS in the case of Spain and France will include drought (and drought insurance) in their frame of analysis.

These distinctions are important in determining the relevant legal and regulatory frameworks for the operationalization of IVE; as the frameworks that must be analyzed are those relating to: insurance (specifically flood and drought insurance); disaster risk reduction and climate adaptation (primarily to flood risk but possibly also in some contexts to heatwaves and/or fires or a combination thereof- a multi hazard approach); and ecosystems/environment and biodiversity.

The operationalization of IVE also falls within a broader question facing the European Union and its member states: **“how to use insurance as a lever for ex-ante risk reduction and disaster prevention efforts (for floods and droughts)”?**

This also will often mean by definition a level of adaptation to climate change impacts, thus achieving compliance with DRR and adaptation

Here we face continually challenging, but rather well researched, areas, the:

- measurement of flood risk mitigation potential of a NBS/ ecosystem service;
- integration of the flood risk mitigation potential of a NBS/ecosystem service into DRR measures
- integration of DRR measures into insurance schemes and/or new type of insurance schemes and/or cross subsidies when insurance becomes a beneficiary from public investment which reduces overall damages (and thus their re-insurance costs).

To this we add the novel question of how to assess a relevant insurance value of an ecosystem service and translate that value into ex-ante investments in NBS. This sequence of questions addressed is shown in Figure 1.

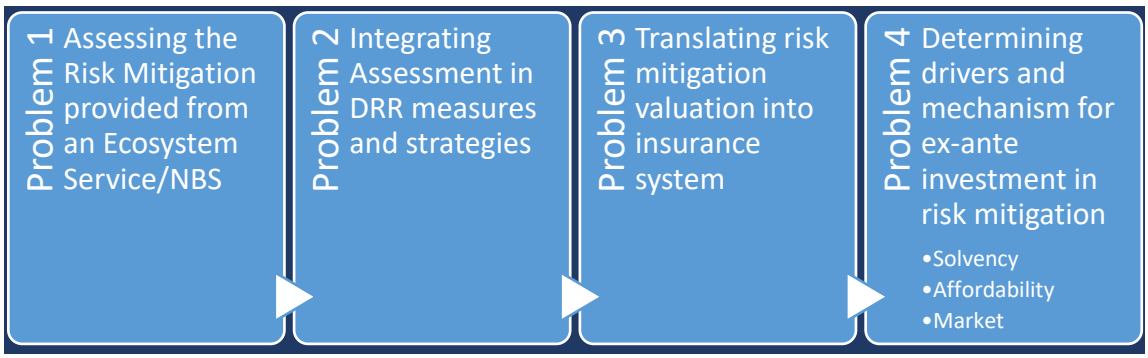


**Figure 1: Problem Hierarchy for operationalization of IVE**

Sequencing these issues highlights that much of the legal and regulatory context to be considered for the "insurance value of ecosystems" falls within the wider, unsolved, challenge to link insurance and disaster risk reduction in the European Union more broadly, including specifically for flood risk. This background helps define the relevant legal and regulatory context we will briefly assess in this report. As one objective of the NAIAD project is to demonstrate the insurance value of nature based solutions (obtained by reducing level of risks posed by floods and droughts), question 1 (Quantifying the (water-related) risk mitigation value of a nature-based solution) is of critical importance to the project but not for this report. Here, we will look **at what the relevant policy and legislative context for the uptake of that information in different member states would be if the flood related disaster risk reduction potential of a nature based solution could be clearly assessed and agreed upon**. Thus, focus will be on questions 2, 3 and 4 (Integrating risk mitigation services from Nature Based Solutions within DRR policies/strategies and translation of DRR policies, strategies and specific measures into 'insurance value' to improve solvency and/or premium rates).

## 3.1 FLOOD INSURANCE AND DRR IN EU

Surminski et al. (2015), through the FP-7 programme ENHANCE (Partnership for Risk Reduction) detailed a number of specific barriers faced to address this challenge in the working paper *Reflection on the current debate on how to link flood insurance and disaster risk reduction in the European Union*. First, they note there is little desire from either the insurance sector, member states, or the European Commission for harmonization of insurance policies; and thus, linkages between insurance value of disaster risk mitigation will be constructed primarily at the member state level: "the design and implementation of insurance schemes remains a national concern (p 24)". That is there is limited desire and/or political will for harmonization of insurance systems, which remain heavily regulated but primarily at national level. The only aspect where the EU intervenes is in relation to solvency and capital required from insurance companies to be able to operate within the EU single market. For this reason, the mapping exercise performed in this paper (see Annex) was done at national level, for 11 countries in the EU. However, the volume of stakeholders involved and complexity of national systems have made it difficult to make clear assertions on the relevant stakeholders to define as 'change agents' and the specific actions these agents could take. This is where the NAIAD DEMOS will become particularly

important to study in more depth the real life operationalization of these potential new schemes, looking at specific concrete water risks in areas already identified as vulnerable. In this first document[6] an attempt with generalized stakeholders and actions taken is made instead. Further, overarching issues and priority action areas that are relevant across the EU, to facilitate the operationalization of IVE, are raised in section 4.2.

Second, there is general consensus (among the authors of that report) that public investment from the State in flood risk management and preventive measures is more cost-effective than government subsidies provided to support insurance providers to cover payment costs after a disaster. Thus, it is better to prevent damage in advance than to pay for it after it occurs. For example, in a recent "Flood Resilience conference held in Berlin, the case of Hamburg was mentioned where ex- ante actions meant an investment of 2Bn euros, when the estimated losses without that 2Bn invested where calculated at 20Bn euros, thus a potential saving of 18Bn euros through ex-ante action (Merz, 2017). Within the OECD recommendations for DRR for example, this corresponds to recommendation 5.4: "Assessing the benefit of risk retention or risk transfer relative to ex ante investments in risk prevention, taking into account appropriate discount rates". However, the use of flood insurance as a lever for flood risk prevention is weak; and while it may be mentioned as important in most countries there is little evidence of actual integration (Surminski et al. 2015).

Third, risk-based insurance premiums can theoretically provide incentive to reduce the underlying risk and indirectly promote increased DRR. They argue that risk based insurance pricing is not likely to be sufficient to incentivize enough to stimulate sufficient private investment in resilience against flooding. This also represents a problem for some insurance systems that are based on the solidarity principle (e.g. Spanish system of the *Consorcio Compensacion de Seguros*). Requiring that certain qualifications are met to be eligible for insurance coverage can reduce underlying risk. It can ensure certain risk reducing behaviors, particularly related to e.g. building codes and zoning. Suykens et al. (2016) argue that these linkages are often facilitated through insurance between flood prevention, mitigation and ex-post compensation and can be improved to increase investment in resilience.

Fourth, integration of insurance and DRR policy is inhibited by challenges in coordination and construction of partnerships; due partially to a lack of specific authorities with the mandate over DRR, as well as information gaps on the effectiveness of specific measures to reduce risk at a sufficient level of resolution. Further, within each regulatory regime they must determine whether or not different preventative actions should be led by the state or the individual, as well as who pays for the preventative measures.

The linkages between DRR and insurance systems is and will always remain a large and critical challenge – but it is an area of extensive analysis and is impacted by a number of regulations and policy frameworks at different levels. These mainly fall in the areas of DRR, Insurance (and solvency laws) and Climate Change Adaptation. A timeline of the development of existing EU

[6] D3.2.will continue to develop this line of work.

and international policies and/or frameworks in these areas are listed and described in brief in section 4.1. Relevant national level policies, regulations and frameworks are provided for 11 countries in Annex 1.

## 3.2 INSURANCE STRUCTURES AND IMPLICATIONS FOR IVE

It is useful in this context to consider how flood insurance is provided by each member state, as this will impact both the incentives for risk mitigation, as well as the stakeholder who is incentivized to mitigate the risk. Lomond and Penning-Rowsell (2014) characterized four general ways flood insurance is provided worldwide; either part of a bundled insurance package or as a separate policy; and either provided by a private insurer or by the State. If provided by the State, there are incentives by the public sector to reduce the underlying risk (whether bundled or separate); if provided by private insurers, there can be an incentive for the individual if these are able to lower their premium in separate policies, or for the insurance company to mitigate risk. In Europe, studies have shown that having flood insurance does not have significant impact on the actions taken to mitigate flood risk (Surminski et al 2015). However, monetary incentives to have lower premiums coupled with information on possible measures to be taken does have a positive effect. Bundled private insurance schemes are also unlikely to provide incentives for flood risk reduction actions taken, as this would not impact the overall costs or coverage. This said, even in states with private insurance provided; the public sector may consider investments to reduce underlying risks to ensure that insurance providers remain solvent, particularly in consideration of climate change, and may engage the insurance sector in dialogue on cost-sharing for such investment. Here the specific national set up for re-insurance plays a key role.

Thus the flood insurance system is an important element influencing who would pay for DRR measures and whether the insurance value of an ecosystem presents a meaningful investment possibility for a range of potential actors/investors. This also determines the core issues to be addressed to operationalize the insurance value of ecosystems that are potentially relevant to a range of stakeholders who would have an incentive to act.

Broadly speaking these driving factors could be to:

This can also determine the terms and roles for different stakeholders from the public

- maintain solvency or affordability under climate change or land-use change (private; public);
- reduce underlying risk/costs for public sector for disaster damage (public); or
- lower costs of premium (individual policy-holders, mainly relevant for unbundled flood insurance whether public or private).

authorities, private entities and insurance providers in relation to the investment in a potential NBS that would have a mitigating effect on disaster risk. For example, a first issue is that when insurance providers are private and thus compete in the market, the assessment of risk levels and mitigation impacts can run into challenges in relation to the openness and sharing of data. A second issue of concern is whether the assessment of the risk mitigation provided by an NBS or an ecosystem is done by the insurance company or by another e.g. public authority or an

independent expert in order to consider valid the risk mitigation measure (as well as its extent and/or value). Here is seems that practice varies between countries[7]. In the case where investment in DRR is primarily led and financed by a public authority, insurance companies may be requested to support the assessment if it has superior data or assessment capability. The figure below outlines how the structure of the insurance system could influence key drivers and issues to operationalize IVE, as well as considerations on who might lead the assessment or investment.

**Figure 2.** Key issues for operationalization of IVE under public, private, bundled and unbundled insurance systems.

[7] This will be further explored in the follow up deliverable.

## 3.3 ECOSYSTEMS AND INSURANCE – WHAT'S THE CONNECTION?

The incorporation of DRR values provided by ecosystems into insurance systems is an area where is far there is limited experience and/or specific systems to consider them. It involves connecting and coupling policies for disaster risk reduction strategies and insurance systems with ecosystem assessment and management and NBS. (These areas are also included in mapping in sections 4.1 and 4.2). This also shows the need to reconcile the regulatory and legal frames for three main areas: ecosystem management; hazard risk management and insurance.

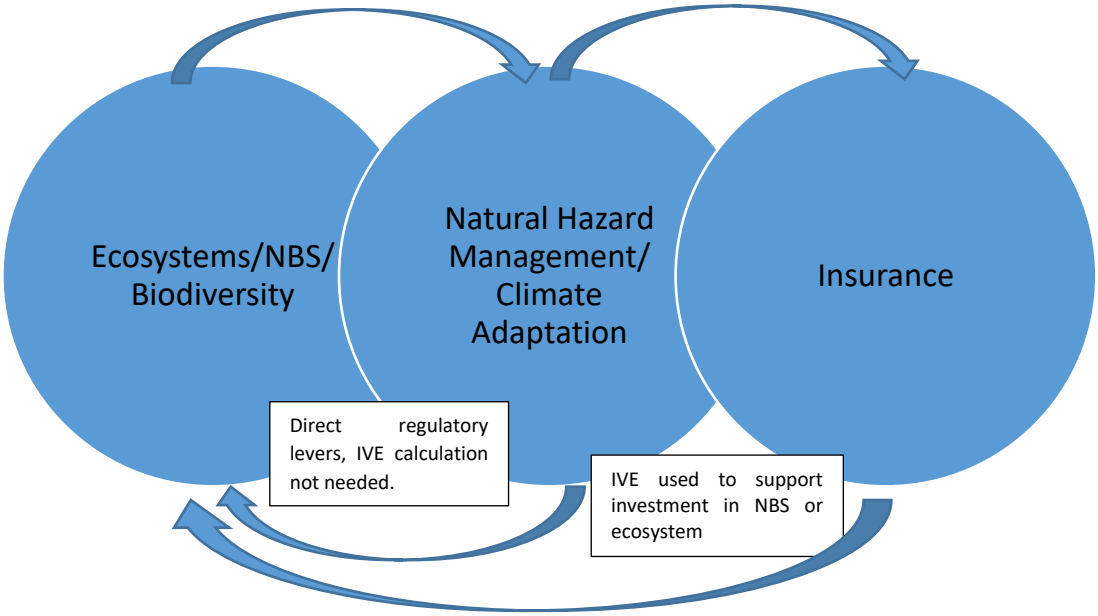


**Figure 2.** Spheres of regulatory and legal frameworks for IVE.

Regulatory and legal frameworks to be assessed relate to contributions of ecosystems to natural hazard management, and contributions of DRR to insurance. Insurance value assessment then feeds back into regulations for investment in ecosystem maintenance or NBS that produce an equivalent return in measured 'insurance value'. If regulatory driver is not linked to insurance or economic valuation of the risk (e.g. it is done to be in compliance with Flood Directive) than IVE may not need to be calculated.

The connection between the ecosystems and the insurance system is mediated through frameworks for natural hazard management. This can be a conceptual reason why the operationalization of IVE has proved challenging. The link between insurance and the NBS/ecosystem, where valid, is in a return loop as a potential source of capital, or justification of capital expenditure on nature based solutions to provide risk mitigation. **How to do this within current policy frameworks, or to advance this through new policies, institutions or financing mechanisms becomes the driving question once IVE has been successfully demonstrated and assessed.**

## 4. SYNERGIES OF POLICIES FROM GLOBAL TO EU LEVEL

This section provides a chronological overview of the European political guidance on disaster risk management framework, fostering development of policies and legal instruments related to nature-based solutions for disaster risk reduction, climate change adaptation, data collection, and solidarity clause in case of natural disasters.

### 4.1 TIMELINE OF THE DEVELOPMENT OF CLIMATE CHANGE ADAPTION (CCA), DISASTER RISK MANAGEMENT (DRM) AND NATURE-BASED SOLUTION (NBS) CONCEPTS:

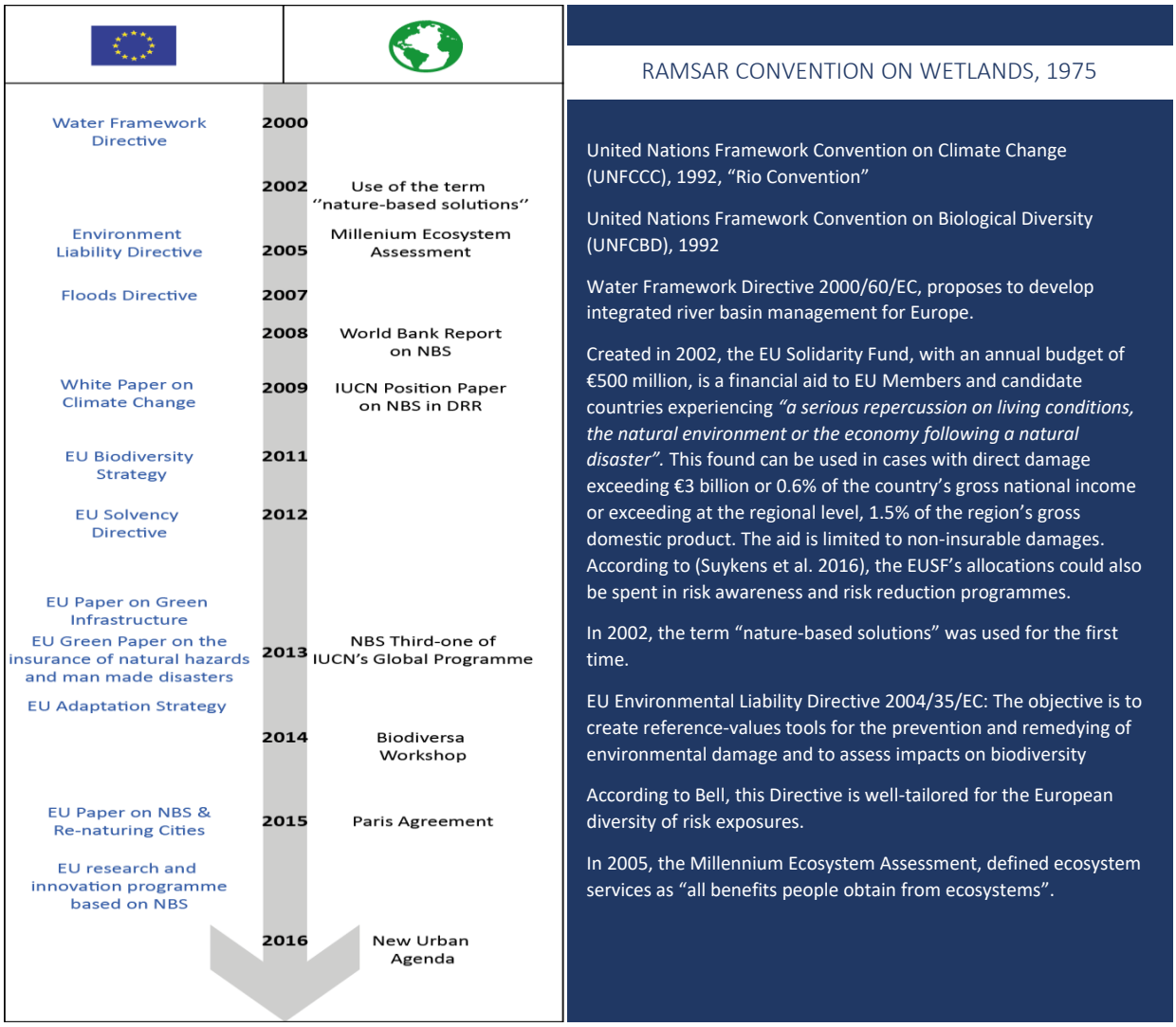


**Figure 4.** Key policies at the global and EU level on the NBS, DRM and CCA topics.

Since **2007'**s Lisbon Treaty, the European Union had acquired new competence in civil protection field within the implementation of the Civil Union Protection Mechanism Programme which aims at *"improving the effectiveness of systems for preventing, preparing for and responding to natural and man-made disasters*"(European Commission 2013a, 2013b). Solidarity is one of the main values of the EU (articles 36, 38, 147-175, 196, 222 of the TFEU). The article 107 (b) of the TFEU on free market competition and State aids, states -that *"aid to manage the damage caused by natural disasters or other extraordinary events*" should be provided. The article 222 on solidarity clause "the Union shall mobilise all the instruments at its disposal, including the military resources made available by the Member States to: prevent a terrorist attack or to assist a natural and man-made disaster".

The European Insurance market is defined according to the article 101 (1) TFEU (Treaty on the Functioning of the European Union) which fixes competition rules.

**EU Floods Directives 2007/60/EC**: The objective is to coordinate Member States flood risk management. Each Member State has to undertake mapping of flood hazard and risk and implementation of flood risk management plans.

According to (Suykens et al. 2016), the Directive should have been designed to include more mitigation measure schemes.

**EU Inspire Directive, 2007/2/EC,** implemented to easily exchange spatial data within the Member States.

**In 2008, World Bank Report on NBS**, (Bank 2008) highlights the role of NBS for reducing the risk of disaster and to develop methods for valuing ecosystem services (payment for ecosystem services).

**In 2009, IUCN, UNFCCC Position Paper on NBS**, for the use of NBS in DRR.

**White Paper on Climate change, 2009** "due to cross-border effects of climate change, there may be benefits in promoting EU-wide insurance as opposed to national or regional schemes", (European Commission 2009 p. 14).

According to Sudmeier-Rieux (2013), these three papers are innovative but "they do not go far enough in providing clear recommendations for integrating ecosystem management with DRR and CCA".

**EU Internal Security Strategy (ISS, 2010),** natural disasters are targeted by, "increase Europe's resilience to crises and disasters".

**EU Biodiversity Strategy to 2020,** (European Commission 2011a, 2011b), this paper is very linked to **NAIAD**, through aspects of the improvement of knowledge, cross-border standards on ecosystem services. The priorities are to restore and promote the use and the finance of green

infrastructure as well as ecosystem-based approach to CCA and DRM by highlighting their multiple co-benefits in comparison to grey solutions.

The target 2 "maintain and restore ecosystems and their services" highlights the need of clear definition of their economic value in markets and in society's decision-making. This target encourages collaboration between insurance companies and stakeholders.

**Council Conclusions on Further Developing Risk Assessment for Disaster Management within the EU, 2011**: focuses on the European harmonization of tools, methods and data collection in case of natural disasters.

**EU Solvency II Directive (Solvency Capital Requirements)** (Insurance Europe 2012): Started in 2016, this directive aimed to improve provision of insurance by making calculations follow more uniform procedures in EU countries. It is a significant paradigm shift in insurance regulation based on three pillars.

- Capital requirement: all insurers from the 28 EU Member States must have sufficient financial resources to survive negative events that statistically occur once in 200 years.
- Governance and risk management: Own Risk and Solvency Assessment (ORSA). The insurers must be able to assess and to be aware of their own risk and their solvency situation to find appropriate solutions in case of disaster or financial issues. This pillar requires the implementation of sophisticated natural catastrophe models to improve exposure data quality for better understanding risk complexity.
- Reporting requirements: this section imposes transparency for the consumers thanks to standardized and detailed reporting sheets and data.

These pillars have been designed to protect the assets and claims of policyholders and for enhancing disaster resilience of European societies.

**In 2013, NBS constitutes one-third of IUCN's Global Programme.**

**EU Adaptation Strategy to Climate Change**, (European Commission 2013b), through this Adaptation Strategy, the Commission aims to improve the market penetration of natural hazards insurance for prevention and mitigation, through exchange between Member States on disaster risk management, e.g., through Action 8 *"promote insurance and other financial products for resilient investment and business decisions"*. And to promote climate resilient investment by both public and private sectors.

**EU Green Paper on natural hazards and man-made disasters** (European Commission 2013a). Regarding the objective to increase the European disaster risk insurance coverage defined in this paper, insurance sector may be interested in obtaining standardized data to better calculate their insurance premiums and their solvency (De Groeve et al. 2014).

This paper had raised some critics from The German Insurers, "*it generates the impression that there are no genuinely functioning insurance solutions for natural hazards and man-made disasters in Europe*[8]". According to, (German Insurance Association 2013), this paper has failed to answer why households are often unwilling to insure themselves.

(Bell 2013) reminds additionally that the insurance sector is not a panacea to cover all natural and man-made disaster and that this sector does not have unlimited resources.

Bell (2013) responses to this Green Paper, focuses on the diversity of legislative frameworks, culture, language, level of cover and thus sees no need for harmonization.

**EU Paper on Green Infrastructure – Enhancing Europe's Natural Capital (2013**), (European Commission 2013c). The EU has for ambition to put climate policies into practice, thanks to the development of various Green Infrastructure such as NBS to reduce the impact of natural disaster and insurance costs. (Re)establishing, improving the use of NBS is seen as an innovative and cost-effective risk management approach which can be used at every scale.

**EU Civil Protection Legislation, 2001**: The EUCPL was reformed in December 2013 to better respond and prevent natural and man-made disasters though emergency response capacity (Emergency Response Coordinator Centre), risk management planning.

**In 2014**, **Biodiversa NBS Workshop**, (Balian E. et al. 2014), identifies needs in the NBS research fields. Biodiversa demonstrates the two sides of NBS, they can mitigate disasters' impacts and they can become a disaster (e.g woody debris).

**From 2014 to 2016**, IUCN Work on NBS Framework to mainstream the use of NBS.

**In 2014**, the European Parliament[9] rejects the implementation of Europe-wide mandatory insurance for natural disaster because of too varied, complex, diverse and regionally natural hazards.

**Paris Agreement on Climate (article 8, §4 (f) - 201**5) *"risk insurance facilities, climate risk pooling and other insurance solutions"*. This Agreement highlights the major shift in the insurance sector: a move from ex-post disaster management, to ex-ante measures.

Following the Paris Agreement, the G7 Summit in Elmau in June 2015, has launched the Climate Insurance Initiative, *InsuResilience*, with objectives to expand natural hazards insurance coverages and to innovate in risk transfer mechanisms.

**2015-2016,** NBS at core of EU Research and Innovation programme.

**EU Paper on NBS, Re-naturing Cities and Innovation Policy**, (European Commission 2015a), NBS are used to provide more resilient responses to climate change and risks. As the example of

[8] www.en.gdv.de/2013/07/natural-hazard-insurance-eu-commission-missed-opportunity/
[9] www.en.gdv.de/2014/02/eu-parliament-rejects-mandatory-insurance-for-natural-disaters/

actions done in River Elbe, the total economic benefits are around €1.2 billion and the cost-benefit ratio is estimated at 3:1, this action had permit to re-connect people with nature and to raise awareness of societal benefits of ES.

**2015, 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs, ONU),** NBS to disaster are in part of SDGs 11 (Making cities and human settlement safe and resilient) and 13 (Mitigating and adapting to climate change).

**2015, Sendai Framework for DRR,** the insurance sector has to develop new risk transfer solutions.

**EU Horizon 2020 Work Programme 2016-2017 "Climate action, environment, resource efficiency and raw materials**", (European Commission 2015b), Chapter SC5-09-2016: Operationalising insurance value of ecosystems fixes challenges, scope and expected impacts of projects related to this topic.

**OECD, 23/02/2017, Disaster Risk Financing Strategies**, (OECD 2017), recommends risk transfer for encouraging risk reduction, PPPs to absorb better disaster losses.

**New Urban Agenda, Quito, adopted by the UN General Assembly, 25/01/2017**, a global commitment to sustainable urban development.

## 4.2 BARRIERS AND GAPS TO THE INSURANCE VALUE OF ECOSYSTEM IMPLEMENTATION

This section briefly outlines several overarching issues that form barriers to the operationalization of IVE, which include gaps in either knowledge, practical experience, or institutional response capacity. Figure 5 synthetize the main barriers one must address on the way to the IVE operationalization.

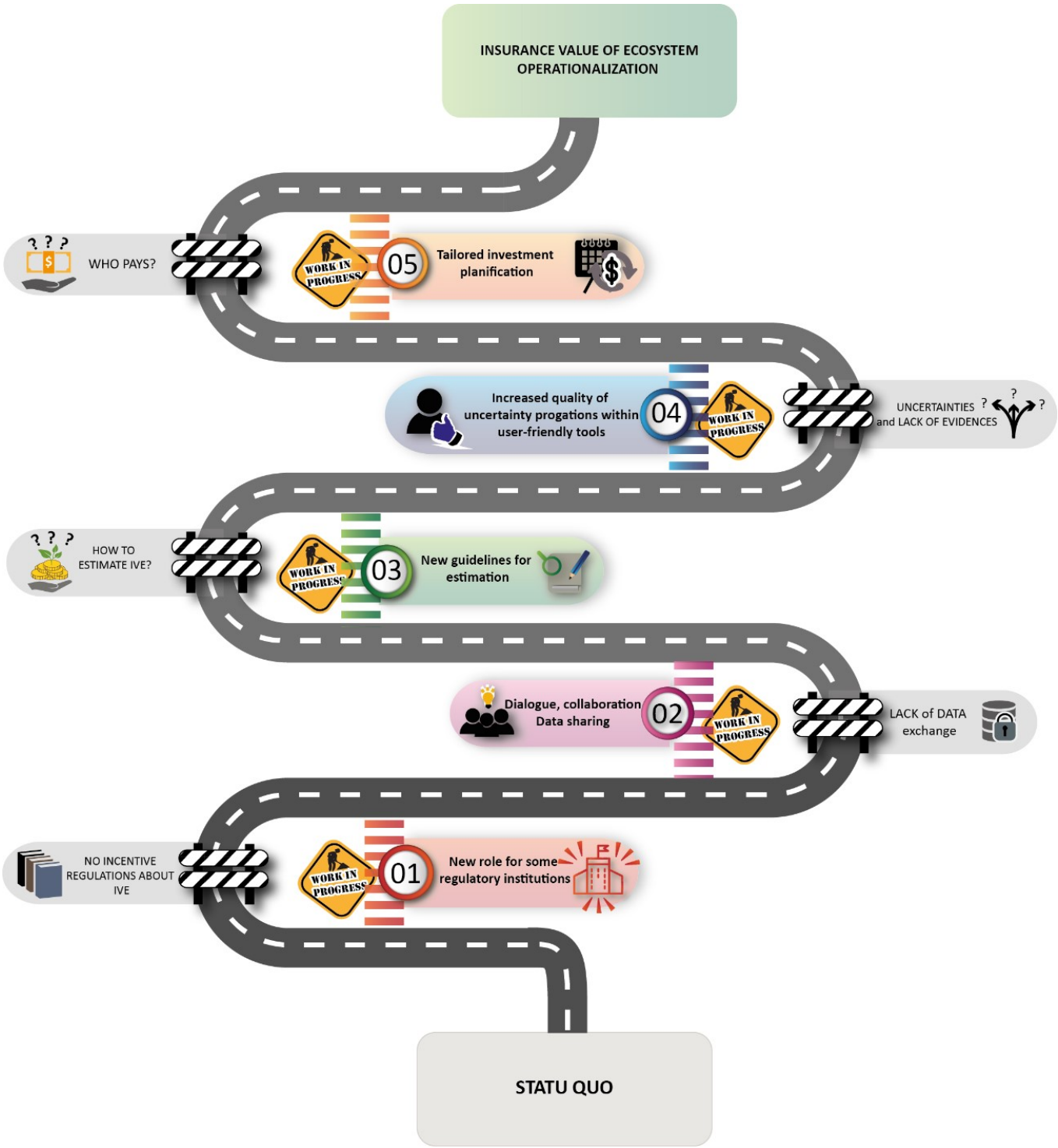


**Figure 3.** Process map to address barriers to the operationalization of the insurance value of ecosystems.

**NAIAD** is challenging to break these barriers by reducing the fragmentation of knowledge and data e.g. in relation to legal and institutional frameworks. General actions to contribute to addressing these legal and institutional frameworks are suggested which can help guide the implementation of the NAIAD program.

#### 4.2.1 ISSUE: Lack of targeted legislation on NBS or IVE but an abundance of possibly relevant ones

There are no precise directives, articles in the TFEU, policies or governing institutions with exact mandate over them. However there are a number of directives that are potentially relevant to NBS and IVE. In each European country, the large number of relevant actors in natural hazards management adds further complexity and challenges for coordination. This forms a barrier that can limit the implementation of NBS for risk reduction in Europe both in general and as part of hazard management and also specifically to have them be supported through an insurance frame. This represents the main difficulty to identify singular *agents of change* at either the institutional or individual level, and also may de-incentivize specific actors to take action.

**Possible action: Increase granularity of assessments to identify institutions that could facilitate and contribute to the integration of one component of IVE within each specific policy and regulation of relevance.**

#### 4.2.2 ISSUE: Quality of data, and disclosure of insurance risk related data in competitive markets

Even if the institutional, legal and regulatory frameworks are not yet well-aligned to integrate IVE into the overall insurance systems, the main bottleneck remains in the lack of an agreed framework to assess this value with sufficient data to underpin this assessment. The use of NBS can be an issue, notably to fund the implementation of a measure to utilize, maintain or maximize IVE.

Due to the current incentive (and sometime available finance) structure often regions and municipalities are not driven to take these ex-ante, preventative measures. Thus the improvement of data collection will be a core component for the potential future design of a new type of insurance scheme. Currently, we face both the fragmentation of existing data and a heterogeneous risk modelling process between each (re)insurance company and stakeholders (Know 4 DRR 2015).

The unwillingness to share information and the intellectual property of the data can also be an important obstacle. Indeed, synergies between the scientific community and the insurance

sector could be generated through the exchange of data and findings. Data is the cornerstone of any insurances' investment decisions and for any calculations. It is very difficult to have access to insurance data which tend to have highly confidential access. The (Messervy and McHale 2016) report encourages insurance companies to disclose natural hazards-related information with relevant stakeholders. It seems to be a key emerging step forward to help integrate NBS in insurance companies' portfolios.

During the CCR CAT of the 8th June 2017, Christian GOLLIER[10], reminded us that risk is insurable, only, if we have probabilities to estimate, with better accuracy, the actuarial value. In line with his presentation, it is not possible to insure biodiversity-related risk. This is currently the main barrier for insurers.

This makes the prospect of mainstreaming IVE inherently more difficult and also for the results of NBS investment to be more uncertain. It also leads to challenges on determining the cost-sharing/burden from investment in IVE and agreement on the valuation performed (or indeed who does the valuation in the first place).

**Possible action: Develop an effective dialogue (at national levels) to reach decision on an accepted framework and sharing of assessment (and its underlying data).**

### 4.2.3 ISSUE: Estimating overall damage, i.e., not only to some assets

The estimation of ecosystem services in monetary value is also challenging. Negative externalities impacting on ecosystem services values are easily considered into cost-benefit accounting. This is similar to the ongoing challenge to consider the negative effects economic activities have on nature (CGDD 2014). For instance, there were no monetary reparation for ecological damages in France in 2009 (Chevassus-Au-Louis et al. 2009). Currently, only measures for reinstatements and reparations have been developed, such as those implemented by MEEM (2017). This also includes methods to evaluate the size of reparation area.

During the CCR CAT of the 8th June 2017, Vincent LIDSKY and Georges-Pierre MALPEL[11], have raised another issue: the assessment of prevention measures that are not taken into account. These was exemplified for the agricultural sector where anti-hail nets or anti-freeze wind turbines were not taken into the insurance calculation.

[10] Professor of Economy at the Toulouse School of Economics and member of the GIEC.

[11] Respectively General inspector of Finance and General Inspector of Agriculture. Both members of the CGAAER-IGF missions on agricultural risk management. Issue highlighted during their CCR CAT presentation "What agricultural risk management in France?"

**Possible action: Propose guidelines to include the economical values of ecosystem services as well as protections measures in damage estimation. This will be done within NAIAD WP4 for flood and drought.**

### 4.2.4 ISSUE: Climate change impacts on hazard risk increases uncertainty

Quantifying the uncertainty into the economic impacts of climate change related disasters' is a very complex area for (re)insurance companies (LSE 2015). Detailed data and information is consequently crucial for (re)insurers to better understand the trends in frequency and magnitude of disasters. Fair estimation of the probability of losses helps them to build a robust capital base. On the other hand, Climate Europe (climateeurope.com) highlights that "climate projections and predictions are limited by the mismatch between insurance desires and current scientific practice". These climate projections are made at different time-scales that do not coincide with the traditional annual insurance contract or multi-year reinsurance business plans. This leads to uncertainty that poses dangers and is difficult to resolve. In addition models are made based on historical data, rather than projections. Risk mitigation (via ecosystems/NBS or otherwise) may be required to maintain current levels of pricing and ensure solvency; and could justify public spending or subsidies if considered unaffordable by private insurance providers. Considering the scope of resources at stake and potentially the huge amount of resources required, an agreement on the veracity of the overall risk assessment and the IVE provided through NBS is thus crucial. Both of those are currently difficult to do to achieve high levels of certainty. Thus action for risk mitigation can be impeded and systems could potentially get insolvent and pose enormous risk to governments and/or re-insurance that would need to pay compensation if insurance providers go insolvent.

**Possible action: Development of transparent and best possible assessment of climate change impacts on hazard risk in multi-disciplinary groups involving the insurance industry.**

### 4.2.5 ISSUE: Clarifying who should pay for DRR, ecosystem protection and who benefits

Policy-holders are often unaware of the natural hazard coverage and terms in their insurance contracts. Here it is important to consider that worldwide it is relatively rare that insurers themselves make direct investments in risk mitigation measures (Atreya et al 2015). Rather insurers may make insurance coverage conditional upon the uptake of risk reducing actions taken through warranties or 'must-do' clauses; provide premium/deductible discounts or client awareness raising (ibid). Instead of investing directly, it is more common for insurance groups to advocate public investment or stricter regulations for DRR.

In the case of the implementation of premium discounts for policyholders who have incorporated prevention measures, the relationship must be trusted (Bonfield 2016). The insurance company will operate monitoring actions to verify specified standards have been met

by the policyholders. These monitoring measures are expensive (Botzen and Bergh 2008). For instance, insurers are reluctant to propose "betterment clauses" for the installation of resilient measures. This reluctance acts as a barrier to increase public awareness on risks. The unknown potential impacts on the market is a barrier too - "the role of the insurance industry is the transfer of risk not the financing of additional measures" (White et al. 2011).

This means the primary actors investing in NBS to capitalize on IVE will be from public authorities and public financing, unless there are reforms or structural changes to the way insurance is provided in most places.

**Possible action: Develop terms and reasoning behind public expenditure in DRR, and the benefits of doing so through NBS. A clarification needed and decision to be made is whether such investments are made from existing funds set aside for disaster relief (re-allocated via, for example, a resilience bond) or whether this would come from additional financing allocated, which ultimately also is derived from taxes in some form. One solution can be the integration of insurance industry into PPPs with relevant stakeholders. This will involve top-down ((re)insurances and stakeholders) and bottom-up (policyholders) processes.**

## 5. CONCLUSION

The European Commission is exploring options to integrate ecosystem insurance value into conventional insurance frameworks and risk modelling. The potential benefits could take the form of actions that can lower (or maintain) premiums for policyholders, increase required public expenditures in risk management (particularly on risk prevention) due to potential damage costs reductions through protection/restoration of ecosystem insurance value. The insurance industry can contribute to the development of innovations within current business models or the development of new ones that can improve our ability to maximize and maintain IVE. A key element to succeed in advancing in this area are to boost the synergies between knowledge and information in databases of the insurance industry, and advances in academic research (including particularly transdisciplinary approaches).

Policy frameworks to mainstream the implementation of IVE into the insurance industry need to evaluate the DRR policy processes at the national level, their implementation at local scale, as well as the current and potential financing arrangements and mechanisms to integrate IVE into the system. Current adaptation policy frameworks will often need to prioritize short term actions to reduce long-term vulnerabilities and impacts. This may further benefit from actions that can facilitate cross-sectoral cooperation, multi-stakeholder involvement, knowledge sharing, bridging local gaps and international cooperation. Importantly, this must effectively connect to the broad ambitions to advance uptake and implementation of NBS to support a wide range of green growth, low-carbon development and sustainability strategies developed at multiple levels. Situating IVE as one benefit among several co-benefits delivered from an NBS

will probably swing the balance in favour of these multiple benefit investments. The DEMO sites in the NAIAD project can provide arenas and avenues to gain insights into how this can be done in practice. DEMOS have been selected to test scenarios for the implementation of NBS to assess the IVE for risk mitigation, and may give rise to possibility replicate, re-iterate or adapt this to other locations at different scales. Clarification of monetary value of NBS and ES within the EU based upon their DRM contributions will be decisive factors that can enable their introduction into the market as well as their integration into DRM and CCA planning.

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## 7. APPENDIX: MAPPING OF POLICIES, AGENTS AND CAPACITIES OF EU MEMBER STATES

# Approach retained in this mapping

NAIAD gathers **23 partners** from **11 European countries**[12], with **9 DEMO site** applications for **8**[13] countries. Several approaches for this D8.1 were possible, however after realisation that insurance remains a heavily regulated industry at NATIONAL level, it was considered essential for NAIAD to study all different European insurance systems:

- at the EU level;
- at the 11 NAIAD's country partners that include most of the EU biggest countries that exemplify most of the insurance systems' diversity; or
- at the level of the 8 countries with DEMOs sites;

The second option has been chosen in version 0.1 of this deliverable. Information is given in comparative tables listing the differences between the numerous European insurance systems. It gives element to build a preliminary analysis of the *"clear gaps in the integration of ecosystem services and natural capital into EU policy frameworks, particularly at the operational level."*

**The tables below gather information collected from literature reviews and websites concerning 3 main topics:**

[12] Denmark, France, Germany, Italy, Netherlands, Poland, Romania, Slovenia, Spain, Sweden, United-Kingdom
[13] Denmark, France (2 DEMOs), Netherlands, Poland, Romania, Slovenia, Spain, United-Kingdom

## 7.1 ISSUE: LIST OF MOST RELEVANT POLICY QUESTIONS

- National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM), for the part "a. ISSUE: List of most relevant policy questions" Two websites are very good reference to go beyond our work and list EU countries' laws related to the topic:
    - European Climate Adaptation Platform, www.climate-adapt.eea.europea.eu/countries-regions/countries
    - Prevention Web Platform on national application of the Sendai Framework, www.preventionweb.net/english/hyogo/national/list
- **List of relevant stakeholders for CCA and DRM**, for the part "b. AGENTS: List the most relevant stakeholders and potential 'agents of change'"
- **National strategy on prevention and mitigation policies** from the individual, municipal to the insurance initiative level, for the part "c. ACTIONS: Evaluate differences in the capacity to implement insurance value of ecosystems between member states"

The following researches in policy questions on Climate Change Adaptation and Disaster Risk Management, demonstrate the European Countries' capacity to adapt laws and policies according to the European Commission (EC) guidelines and ambitions (e.g., compulsory transposition in national law of EC Directives).

### 7.1.1 Denmark

| Denmark | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Flood Act of 1991, flood insurance scheme dedicated to coastal flooding<br>• Flood and Windthrow Act of 2000<br>Since March 2008, Water Environment has been regulated in several principle acts:<br>• Act on flood and storm damage 20/10/2014 n°1129<br>• Act on Compensation for Damages Caused by Storm (chapter 6 §24 fixes an annual mandatory tax of DKK 20,00 per fire policy and 10kr per police storm damage)<br>• Building regulation: Building Code addresses the need for CCA<br>• Notice for compensation cases for damage caused by storm surge and the creation, transfer and use of a registry and a case support system (15/04/2014) | (Nordic Insurance Associations et al. 2013)<br><br>Nature Agency website, www.naturstyrelsen.dk/vandet/lovstof.htm |

| | |
|---|---|
| • Notice for compensation cases for damage caused by flooding from rivers and lakes (14/04/2014)<br>• Act on forest of 18/06/2012<br><br>Insurance Legislation:<br>• Danish Legislation does not allow insurers to create tax-free provisions to deal with any fluctuations in claims for damage arising from natural catastrophe.<br>• Order on insurance of private forest against storm damage and subsidies for replanting etc. after storm (2/11/1996)<br>• Order on minimum conditions for insurers drawing of basic insurance against storm damage (17/02/2000) | All Danish legislation, www.retsinformation.dk<br><br>(Maccaferri et al. 2012) |

### 7.1.2 France

| France | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• French NATCAT Regime 13/07/1982 (by the French Parliament, created for an indefinite duration, as a Public Private Partnership (PPP) between insurance companies, CCR and the State:<br>• Article 1(3) the State defines the "NAT CAT" state; "the insurance contract subscribed by any physical or moral person other than the State and guaranteeing damages located in France, as well as the non-motor and motor, open the right to the guarantee or the insured against the effect of natural disasters on the assets subject to such contracts"<br>• Article 7 "are excluded from the scope of this law, damages caused to crop no garnered, to crop, to soils and to living herd out of building, the compensation stay managed by the provision of the law n°64-706 of the 10/07/1964, modified, organizing a guarantee scheme against agricultural disasters".<br>There are also:<br>• Law of 1987 on civil security management, forest protection against fire and prevention of disasters<br>• French Decree 13/07/1994, to ensure security of campsite and occupants<br>• Law 02/02/1995 n°95-101, on the Fonds Barnier, for financing preventive measures related to vulnerability and prevention efforts linked to the article L561-3 of the Environment Code | (Veyret et al. 2004)<br><br>(Boissier 2013)<br><br>(Pothon 2013)<br><br>(Suykens et al. 2016)<br><br>(MEEM 2017) |

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| • Law L562-1 of the Environment Code, defined PPR (Risk Prevention Plan: land use regulation depending on risks)<br>• Law L561-1 of the Environment Code, defined the expropriation measures<br>• Insurance Code, article A-125-1, the deductible (EUR 380) can be doubled if a property receives compensation three times, tripled from the 4th time and quadrupled for the 5th time compensation providing;<br>• Insurance Code, article A-125-2, on the natural catastrophe additional premium (mandatory, and fuels the NATCAT insurance scheme), the rate is fixed at 12% of the amount of property insurance premium and 6% of the amount of the contribution corresponding to the theft and fire guarantees;<br>• Insurance Code, article A-125-3, the victims of natural disaster living in a municipality without PPR endure modulation of their deductibles<br>• Insurance Code, article L-125-6 and the "arrêté" of the 04/08/2003, establish the amount of deductible based on the Risk Prevention Plan on the commune<br>• Insurer can legally refuse to cover flood risk for new properties built in area designated as un-buildable by a PPR Inundation, but the insurer need to notify the insured and to gain the approval of the Tariff Office (Insurance Code, article R-250-3)<br>• Insurance Code, article R-250-3, the insured must be complying with the requirements or the PPR after a period of 5 years after the PPR's publication, the insurer can refer to the BCT (Bureau Central de Tarification); the BCT can increase the deductible (art A 250-1), exclude the property or do the both;<br>• Insurance Code, article L-125-6, implemented the PPR<br>• Article L-151-1: states that compensation is possible only if traditional mitigation measures were not sufficient to prevent the risk, a condition that is strictly interpreted by the Court<br>• Action Programme on Floods, aims to improve risk-awareness.<br>• Law for the recapture of biodiversity, nature, and landscape (08/08/2016), Article 4 on ecological prejudice "all people responsible of ecological prejudice must repair it"<br>• Civil Code, article 1249 "ecological prejudice reparation is done, in priority in nature". | |

### 7.1.4 Germany

| Germany | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Act to Improve Preventive Flood Control (2005), flood resilience strategies, State Agencies implement flood defence strategy in land-use management according to Water Laws; flood preparedness measures;<br>• Article 1a, section 2, obligates private persons to use flood resilience practices to avoid flood losses<br>  • Federal Building Code (2007), requirements concerning construction norms and materials to be used in flood-prone areas; a system of "building passports" with information relevant to flood management and information can be available to owners;<br>  • Federal Regional Planning Act (2007)<br>  • Federal Water Resources Act (2009, Wasserhaushalts-gesetz), transposition into national law of the EU Floods Directives<br>  • Regional Planning Act, requires a development plan to include retention areas for flood protection<br>• Regional Planning Procedure<br>• Local Use Plan<br>• Master zoning plan<br>  • Insurance Policies, 18/12/2007 §7VVG, creation of standards for insurance general policy conditions<br><br>**First assessment of main issues from NAIAD perspective**:<br>There are possibly as many different laws as Länders. | (Veyret et al. 2004)<br><br>(White et al. 2011)<br><br>(Rancitelli 2014) |

### 7.1.5 Italy

| Italy | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Law of May 1989, risk mapping management<br>• Law to finance the reconstruction of damaged areas | (Gizzi et al. 2016)<br><br>(Rancitelli 2014) |

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| • General Regulation, articles 182-183 (209/7/9/2005), article 185, article 120, article 121<br>• LIFE circular letter 551, 01/03/2005, to be provided by the insurer: synthetic form, information note, insurance conditions, glossary, answer form;<br>• Budget law 2005, introduced a voluntary natural catastrophe insurance (only for buildings);<br>• Guarantee Fund, managed by Consap SpA, with an annual budget of EUR 50 million;<br>• Legislative Decree 49/2010, Flood Directive transposition, coordination and data management<br>• Decree 28/02/2017, directive lines related to the classification of seismic risk for building to estimate the annual average loss (PAM) and to classify buildings according to this PAM.<br>• Reconstruction costs, Lo Stato del territorio italiano insediamento e rischio sismico e idrologica | (Porrini 2016)<br><br>(Didier Combescure during the CCR CAT 8/06/2017) |

### 7.1.6 The Netherlands

| The Netherlands | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Water Embankment Act (1995), guarantees a certain level of protection against flood risk within each dike ring area;<br>• Dutch Flood Risk, Act on Flood Defenses (1996): flood risk management for over 50-year time return;<br>• Calamities and Compensation Act (WTS, 1998), ex-post disaster relief; for flooding and earthquake (excluded storm damage)<br>•<br>• Act of 25/05/1998, CCA, regulations on contribution for the damage and the costs in case of flooding, earthquakes, other catastrophes and large accidents - only applicable in cases in which flood has been formally declared to be a disaster; for smaller floods, no compensation will be provided;<br>• National Governmental Agreement on Water (2008), states that spatial planners and water authorities should cooperate in the establishment of spatial development plans; it also includes one paragraph that describes the impacts of spatial development on the water system, and how the development improves the water situation;<br>• Dutch National Water Act, Water Safety ("Omgevingswet" 2009), holistic approach in water management and spatial planning is advised | (Suykens et al. 2016)<br><br>(White et al. 2011)<br><br>(Aerts and Botzen 2011)<br><br>(Infrastructure and Environment (Rijkswaterstaat) 2012) |

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| • National Water Plan (2010), distinguishes 3 "layers of safety": prevention, durable spatial planning, emergency management; new innovative defence structures;<br>• National Water Law<br>• National and City Regulations, states that buildings should be watertight (water from the surface and groundwater cannot enter the building, minimum level of water provisions above the main street level)<br>**First assessment of main issues from NAIAD perspective**:<br>• It seems that the implementation of the EU Floods Directive induced negligible changes in flood management policies in the country. Is it the sign of a divergence in flood protection approaches (national VS EU) or higher national flood protection standards, making EU Flood Directive not tailored to the importance of flood risk in Netherlands? NAIAD should clarify this point.<br>• Calamities and Compensation Act (WTS) compensations are accessible only to households located within dyke-protected areas. This system being the only possible flood compensation scheme, there is no legal possibility to purchase private flood insurance. | |

### 7.1.7 Poland

| Poland | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• National Programme for Restoration and Modernization, covers damages caused by flood to individual, commercial and local community property;<br>• Flood Management legislation, regulates issues in the direct public action, disaster relief, payment of compensation<br>• Act of 28/03/1951, mandatory building insurance expanded the liability coverage for storm damage<br>• Act of 22 May 2003, Compulsory insurance, Insurance Guarantee Fund and Polish Motor Insurers' Bureau<br>• Act of 7 July 2005, Agricultural Crop and Livestock Insurance<br>• Act on Insurance Business<br>• Act on Insurance Activity, states the insurance regulations<br>• Article 817 §1 Civil Code, the insurance company has to pay compensation within 30 days from the date of notification of the loss;<br>• Article 819 §1 Civil Code, claims expire after 3 months for people flooded | (Maccaferri et al. 2012) |

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| • Law to reduce the effects of natural catastrophe and to provide assistance to insured parties within an ad hoc compensation scheme; | |

### 7.1.8 Romania

| Romania | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Government Decision 739/2016 for the approving the National Climate Change Strategy and National Action Plan on Climate Change for 2016-2020<br>• Government Emergency Ordinance 21/2014 for establishing the National System of Management for Emergency Situations<br>• Law N°260/2008, creation of the PAID (Pool-Ul de Asigurare Impotriva Dezastrelor Naturale); definition of deductibles;<br>• Order N°7 of 28/05/2009, to implement the norms concerning the examination, evaluation and settlement of claims for compulsory home insurance;<br>• Rule N°6 of 14/08/2013, creation of the pool of insurance against natural disasters;<br>• Rule N°7 of 14/08/2013, regarding the form and content of contract of mandatory home insurance;<br>• Law N°191 of 02/06/2015, amending the law N° 260/2008, concerning compulsory home insurance against earthquake, landslide and floods;<br>• Law N°237 of 28/10/2015, regarding the authorization and supervision of insurance and reinsurance business; | World Forum of Catastrophe Programmes, www.wfcatprogrammes.com<br><br>http://www.mmediu.ro/categorie/schimbari-climatice/1<br><br>PAID website, www.paidromania.ro<br>(Rancitelli 2014) |
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Law N°260/2008, creation of the PAID (Pool-Ul de Asigurare Impotriva Dezastrelor Naturale); definition of deductibles;<br>• Order N°7 of 28/05/2009, to implement the norms concerning the examination, evaluation and settlement of claims for compulsory home insurance;<br>• Rule N°6 of 14/08/2013, creation of the pool of insurance against natural disasters;<br>• Rule N°7 of 14/08/2013, regarding the form and content of contract of mandatory home insurance; | World Forum of Catastrophe Programmes, www.wfcatprogrammes.com |

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| • Law N°191 of 02/06/2015, amending the law N° 260/2008, concerning compulsory home insurance against earthquake, landslide and floods;<br>• Law N°237 of 28/10/2015, regarding the authorization and supervision of insurance and reinsurance business; | PAID website, www.paidromania.ro (Rancitelli 2014) |

### 7.1.9 Slovenia

| Slovenia | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Insurance Code (1999)<br>• Insurance Act ZZavar-1 (OG RS 99/10 and OG RS 93/15 – national transposition of the Solvency II Directive)<br>• Act and rules of procedure on the Protection Against Natural and other disasters 64/94, created the Administration for Civil Protection and Disaster Relief; regulates the protection of peoples, animals, property, cultural heritage, environment against natural hazards;<br>• Special Act on the Elimination of Consequences of Natural Disasters, defines the State's role (compensation features)<br>• Act on the Recovery from the consequences of natural disasters 75/2003<br>• Law on Protection against Natural and Other Disasters, article 97, sets the Decree on the Damage Evaluation Methodology detail the methodology for determining, assessing and documenting the damage on the national, regional and municipal level;<br>• Flood Protection and Rescue Plan<br>• Earthquake Protection and Rescue Plan<br>• Rules of Procedure of the Work of Damage Assessment Commissions (2004) | Insurance Europe website, www.insuranceeurope.com<br><br>(De Groeve et al. 2014) |

### 7.1.11 Spain

| Spain | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• 1950: Creation of the *Consorcio de Compensacion de Seguros* (CCS), following laws:<br>• Law of 1992, article 16: the CCS, required to prepare risk prevention plans and programs and implement those through adequate campaigns and prevention measures<br>• Law 6/1997 of the 14/04/1997, legal obligation to insure against damage caused by natural hazards;<br>• Act N° 87/1978 of the 28/12/1978 and Royal Decree N° 2329/1979 of the 14/09/1979, combined Agricultural Insurance Act<br>• Insurance Contract Act (Law 50/1980 of the 08/10/1980)<br>• Private Insurance Ordering and Supervision Act<br>• Woodland Law 43/2003 of the 21/11/2003<br>• Regulation for Extraordinary Risk Insurance<br>• Law 20/2015 of the 14/07/2015, Final Provision Eighth, implementation of the Solvency II Directive, arrangement, supervision and solvency of insurance and reinsurance companies;<br>• Flood Risk Management Plans, implementation of the Floods Directive;<br>• Land-use Act (Ley del Suelo)<br>• National Hydrological Plan, areas prone to flood risks are classified as unsuitable for development;<br>• Flood Damages Assessment Guidance<br>• Building Regulations, new buildings must be orientated according to the flood flow direction in order to mitigate the barrier effect of the building; flood resilience garage ramps are sometimes used as a condition of building permits; | (Monti 2002)<br><br>CCS website, www.consorseguros.es<br><br>(White et al. 2011)<br><br>(Schwarze and Wagner 2009) |

### 7.1.13 Sweden

| Sweden | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Environmental Act<br>• Chapter 5, art 1 Insurance Contract Act (2005:104), provides general guidelines on the insurance company's obligations to provide information to policyholders;<br>• Water Service Act (2006:412), municipalities are responsible for black-flow in sewage system;<br>• Planning and Build Act (2010:900), municipalities shall take all risks into consideration; | (Nordic Insurance Associations et al. 2013)<br><br>(Rancitelli 2014) |

### 7.1.14 United Kingdom

| United Kingdom | References |
|---|---|
| **National Laws on Climate Change Adaptation (CCA) and Disaster Risk Management (DRM)**<br>• Gentlemen's agreement, BIA/FOC 1961, between the UK Government and the ABI (Association of British Insurers), the ABI continue to provide flood insurance only if the government enhances flood defences and flood management;<br>• National Document (1993), defence strategy against flooding managed by the Environment Agency;<br>• Planning Policy Guidance Development and Flood Risk<br>• Flood Risk Management Act (2009), transposes the Floods Directives<br>• Building Regulations (2010), local authorities are able to use "where appropriate" flood resistance material;<br>• Water Act of 2014 (Chapter 21 part 4)<br>• Flood Reinsurance (Flood Re, April 2016) Statutory Instrument N°1875, this new program represents the largest change to insurance provision in UK; it aims to maintain the affordability of flood insurance for homeowners in high-risk areas, through the pooling of higher risks; establishes a not-for-profit reinsurance fund from private insurance companies (cross-subsidy system); it is managed by insurance industry and funded through premiums; in case of flood event, the insurers will be reimbursed from Flood Re for the claims of the reinsured homeowners;<br>• Coast Protection Act 1949, "protection" means protection against erosion or encroachment by the sea; | (Veyret et al. 2004)<br>(Suykens et al. 2016)<br>(Honegger et al. 2016)<br>(OECD 2015)<br>(Altamirano et al. 2016)<br>(White et al. 2011) |

## 7.2 AGENTS: LIST THE MOST RELEVANT STAKEHOLDERS AND POTENTIAL 'AGENTS OF CHANGE'

To resume the following tables, the main issue to define the relevant stakeholders and the potential "agent of change", is the huge number of stakeholders from the national to the local scale. Thus, it can be an issue in the way to explain clearly and to well-implement the IVE. Also, it can be difficult to find the appropriate "agent of change".

### 7.2.1 Denmark

| Denmark | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br>• **State role**: The **State by the Storm Council (state body)** supplies a guarantee from its annual budget, if the tax-surcharge collected by the insurers on fire damage policies, are insufficient to cover the losses caused by storm and flood (DKK 200 million of budget).<br>**State's budget financing**: extra DKK 10 supplement taxes following a loss (ex-post surcharge)<br>**Storm Council (Ministry of Economic and Business Affairs):** 8 members from municipalities, ministry, insurance companies and consumer council; consider whether to insure or not the type of damage (only seawater, storm flood)<br>**Minister of Economy**: manage special funds devoted for reimbursing flood losses due to storm;<br>• **National Forest and Nature Agency**: assesses cases for compensation to the Danish Storm Council<br>• **Municipality role**: all municipalities must have a CCA plan; determine the flooding level (Committee of sewage, doc n°16-28), the occurrence frequency fixed is 10 years for common property and 5 years for separate property. If the land-use plan is not respected they can demolish property, like in Odense; responsible for the well-functioning and correct sizing of the sewer system;<br>• **Insurer role**: collect surcharge taxes for the Storm Council (monthly basis); receive claims; provide expert assistance;<br>• **DARIM, Risk Management Association** | (Gizzi et al. 2016)<br>(Porrini and Schwarze 2011)<br>(Nordic Insurance Associations et al. 2013)<br>(Maccaferri et al. 2012)<br>Storm Council website, www.danishstormcouncil.dk<br>Nature Agency website: www.naturstyrelsen.dk |

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| • **Forsikring & Pension**, Insurance association<br><br>**First assessment of main issues from NAIAD perspective:**<br>• The State provides compensation only for floods due to storms, after declaration of the event as a natural disaster.<br>• The Danish Storm Council decides to whom compensations will be paid out and it is limited to property in an area of dike protection. Properties outside the dike area are not entitled to compensation, as in Netherlands. | |

### 7.2.2 France

| France | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br>• **State role**: **Ministry of Ecology and Sustainable Development**, initiator of the regulations regarding flood prevention/protection; promotes flood resilience in areas where construction is forbidden but it is slow procedure and not cover all areas;<br><br>**CCR (Caisse Centrale de Réassurance),** State-owned company founded to support insurance companies to guarantee natural risks (reinsurance), with unlimitedState guarantee; and expertise for natural disasters;<br>**The Central Desk of Tarification**, set-up to ensure fairness in the system by fixing damage premiums in case of litigation between insured and insurer;<br>**ONRN, FFA,** other organisms having a role in DRM<br><br>• **Regional level**: departmental and regional "Prefets" initiated PPR<br><br>• **Environment and Energy Regional Direction (DRIEE),** coordinates State flood risk management actions at departmental scale<br><br>• **Regional Council (**in charge of flood management but it acts by financial means | (Veyret et al. 2004)<br>(White et al. 2011)<br>(Gizzi et al. 2016)<br>(Suykens et al. 2016)<br>(Paudel 2012)<br>(Botzen and Bergh 2008)<br>(Maccaferri et al. 2012)<br>(Tacnet 2004)<br>Insurance Europe website, www.insuranceeurope.com |

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| • **Departmental Public Works Directorate (DDT),** responsible for assessing natural hazard and risk prevention plan drafting for defining area where the building is permitted and or not; knows local specificities;<br>• **AMRAE (Management des Risques et des Assurances de l'Entreprise)**, Risk Management Association<br><br>• **Local level**: **County Council**, in charge of land planning and flood protection, competence shared with the Regional Council<br>  • **Water Authorities** manage water bodies<br>  • **Municipal Mayors**, responsible for public safety, including flood risk planning and land-use planning; delivers building permits according to the RPP recommendations;<br><br>**First assessment of main issues from NAIAD perspective:**<br>• It seems that there is a greater variety of stakeholders in France than in other countries. It thus may be difficult to define their roles and responsibilities precisely; and also to avoid overlaps.<br>• There are critics of the "NATCAT" system and surcharge: premiums' valuations are not risk-based, thus not being incentive for homeowner risk preventive measures' implementation. Only the deductible are risk-based which seems insufficiently incentive.<br>• However, the Barnier fund for prevention of major natural risks is fuelled by natural catastrophe insurance premiums.<br>• The low level of premium (20 € per year per individual risk) allows a full coverage of insurance on the territory and since 1982 the State guarantee has never been requested. | |

### 7.2.3 Germany

| Germany | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br>• **Federal level:** German Public Finances, intervenes in case of extraordinary natural disaster to help victims and to ensure the reconstruction through easy-terms (low interest rates) loans; compensation payments; finance strategies to improve flood resilience;<br>• **Regional level**: "Bundesanstalt für Gewässerkunde or LAWA, design law for the Länder; flood protection measures; | (Veyret et al. 2004) (Grislain-Letrémy and Peinturier 2010) (Gizzi et al. 2016) |

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| • **Local level**: Mayor is responsible of the local management;<br>• **Insurance sector**: full control of claim settlements;<br>**German Insurance Association (GDV),** strong lobbying power, collaboration with scientists for researches on CC;<br>• **NGO**'s are a primary political driver<br>• **GVNW,** Risk Management Association<br><br>**First assessment of main issues from NAIAD perspective:**<br>• The German Insurance Association has refused a German economists' proposition to build a compulsory flood insurance scheme in Germany. This position is defended with the idea that it is better to have locally-tailored insurance systems, than a pure market solution.<br>• The German Insurance Association has a great influence in the German insurance sector, possibly also at EU scale. | (Paudel 2012)<br>(Maccaferri et al. 2012)<br>(White et al. 2011)<br><br>(German Insurance Association 2013) |

### 7.2.4 Italy

| Italy | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br>• **State role**: enacts ad hoc rules to sustain the rebuilding following a disaster; there is no special ex-ante measures; ex-post reimbursement damages; risk mapping;<br>• **Basin Authorities**: coordinate management of flood and landslide hazards;<br>• **Regional level**: does the data collection under the supervision of the Italian Civil Protection Department and the Ministry of Environment (ISPRA)<br>• **Italian Meteorological Society (SMI)**<br>• **National Insurance Entreprises Association (ANIA)**<br>• **Italian Risk Managers Association (1972, ANRA**)<br>• **Civil Protection Agency,** provides information regarding fires, hydrological risks, volcanoes, earthquake, health risks<br>• **Civil Protection Club,** dedicated for 4th and 5th graders in elementary school for disaster risk prevention | (Gizzi et al. 2016)<br>(Maccaferri et al. 2012)<br>(De Groeve et al. 2014)<br><br>protezionecivile.it<br>stopdisasters.org<br>(Europe 2012) |

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| • **International Institute to Stop Disasters**<br><br>**First assessment of main issues from NAIAD perspective:**<br>Overall NAIAD has difficulties to find consistent information on the Italian Insurance System which is fully private. It seems that the diversity in market offer is great. | |

### 7.2.5 The Netherlands

| The Netherlands | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br>• **State level**: finances the WTS funds for uninsurable risks (no private insurance coverage of flood risks is available); the WTS funds are funded by the annual State budget and tax-surcharge on fire policies; manages main rivers, inner-dike areas and flood prevention; responsible for water management plans;<br>**Ministry of Justice and Security:** responsible for emergency services and civil protection issues + national risk assessment (every year)<br>**Ministry of Justice + National Coordination Council:** responsible for the national coordination in case of a disaster;<br>**Ministry of Infrastructure + Ministry of Biennenlandse Zaken**: have developed the Nationa Risicokaart (risk maps)<br>**Netherlands Environmental Protection Agency (Planbureau voor de Leefomgeving (PBL)),** flood risk zoning<br>• **Regional Water Boards, Water management centre**: manage small rivers, polders and canals; recording data on disasters<br>• **Municipalities**: manage sewer system, storm-water, groundwater and land-use planning (Spatial Planning Act "Bestemmingsplan")<br>• **Neerlandse**, provides data and flood maps;<br>• **Rijkswaterstaa**t, responsible for the registration of disasters on water and traffic on land; publication of storm maps with return periods of 10, 50, 100, 1000 years.<br>• **Instituut Fysieke Veiligheid**<br>• **CPB Netherlands Bureau for Economic Policy Analysis**, conducts ex-ante economic analysis | (Gizzi et al. 2016)<br><br>(Porrini and Schwarze 2011)<br><br>(Suykens et al. 2016)<br><br>(Botzen and Bergh 2008)<br><br>(White et al. 2011)<br><br>(De Groeve et al. 2014)<br><br>(verzekeraars.nl) |

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| • **Delta Committee**, investigates the current flood protection at the national level (coastal and river flooding) to develop and updated Delta Plan and Delta Law<br>• **Homeowners level**: they are explicitly responsible for protection from groundwater flooding, manage pluvial waters, storm-water storage and infiltration facilities;<br>• **NARIM,** Risk Management Association<br>• **Association of Insurers in the Netherlands**<br><br>**First assessment of main issues from NAIAD perspective:**<br>The Government would like:<br>• to see private insurances, play a more active role in providing insurance contracts; and<br>• that citizens be more responsible for their own properties. | Netherlands Environmental Protection Agency: www.pbl.nl |

### 7.2.6 Poland

| Poland | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br>• **State level**: public funds are used to compensate damages and mitigate the risks;<br>**Ministry of Interior**, working on a compulsory catastrophe insurance law which will make flood insurance compulsory for all homeowners; the state-owned companies PZU and Warta will offer a stand-alone flood insurance policy for homeowners;<br>**Ministry of Finance**, sets general conditions of compulsory insurance of building<br>**Council of Ministers**, declare events as natural disaster<br>**National Headquarters of the State Fire Service**<br>**National Board Water Management** (KZGW)<br>• **Polish National Platform for DRR** (NGO)<br>• **National Insurance Service**<br>• **Institute of Meteorology and Water Management**, national research institute (academic and research institution) | (Gizzi et al. 2016)<br><br>(Maccaferri et al. 2012)<br><br>(piu.org.pl) |

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| • **National Insurance Institute Poland**, 1989 (ww.kiu.pl)<br>• **Polish Flood Risk Governance**<br>• **Agency for Restructuring and Modernisation of Agriculture**, (1994, ARMA, www.arimr.gov.pl)<br>• **POLRISK,** Risk Management Association<br>• **Polish Chamber of Insurance**<br><br>**First assessment of main issues from NAIAD perspective:**<br>Overall NAIAD has difficulties to find consistent information on the Polish Insurance System, and to have a clear idea of the stakeholders' roles. | |

### 7.2.7 Romania

| Romania | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br>• **State role**: maintenance of flood defence infrastructure, intervention in case of extreme events, support for recovery in case of extraordinary losses;<br>Ministry of Environment Waters and Forests, general coordination of policies, strategies and actions on climate change<br>National Commission for Climate Change, interinstitutional coordination<br>Ministry of Finance**,** management of the financial instruments for climate change<br>Ministry of Regional Development Public Administration and European Funds, responsible for climate change impact on infrastructure, construction and urban development at regional and local level<br>Ministry of Agriculture and Rural Development, responsible for climate change impact on agriculture and rural development<br>The General Inspectorate for Emergency Situation (41 counties and the municipality of Bucharest, NUTS 3), responsible for coordination, prevention and management of emergency situations<br>National Administration Romanian Waters, responsible for monitoring surface water, groundwater and water quality in 11 hydrographic basins | (Gizzi et al. 2016)<br>(De Groeve et al. 2014)<br><br>World Forum of Catastrophe Programmes website, www.wfcatprogrammes.com |

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| National Administration of Meteorology, responsible for monitoring meteorological parameters<br><br>• **National Association of Insurance and Reinsurance Companies in Romania (UNSAR)**, member of Insurance Europe: professional association with 17 members and 5 associate members<br><br>• **The Insurance Pool against Natural Disasters (PAID):** insurance-reinsurance company, with private capital, formed by the association of insurance companies for the administration of the compulsory **home insurance system,** covering earthquake, floods and landslides; was formed in November 2009, and has currently 10 shareholders: ABC ((re)insurance company),), CITY ((re)insurance company), CERTASIG ((re)insurance company), CREDIT EUROPE ((re) insurance company), EUROINS Romania Insurance (reinsurance), GENERALI Romania (insurance company), GRAWE Romania (insurance company), GROUPAMA Insurance, PLATINIUM Insurance, UNIQA Insurances;<br><br>• **Financial Supervisory Authority (ASF):** Romanian Insurance Regulator: defines deductibles.<br><br>• **Romanian Actuarial Association (ARA)**: professional body (over 100 members), representation, professional standards, training<br>**First assessment of main issues from NAIAD perspective:**<br>From preliminary interviews already performed in WP3, the challenge seems to be to get the insurance sector interested and participative and the relevant stakeholders to cooperate in implementation of various DRM actions at local level. | http://www.mmediu.ro/categorie/schimbari-climatice/1<br><br>https://www.paidromania.ro/en/about-us<br><br>http://unsar.ro/en/despre-noi/cine-suntem<br><br>https://asfromania.ro/en/about-asf/about-us<br><br>http://www.actuariat.ro/despre-ara/ |

### 7.2.8 Slovenia

| Slovenia | References |
|---|---|
| **List of relevant stakeholders for CCA and DRM**<br><br>• **State role** through the Ministry of Environment and Spatial Planning: They are responsible for any and all water related issues all around the country: management, flood protection, environmental protection. They also intervene in case of extraordinary losses | (Gizzi et al. 2016)<br>(De Groeve et al. 2014) |

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| (if the evaluated total direct damage exceeds 0.3‰ of planned State budget income) by providing compensation to all impacted by that natural catastrophe - individual, commercial, local community property (buildings, roads, bridges, farmland, crops, forest areas, machinery, stock, loss of income); the State covers only perils related to earthquake, flood, landslide, avalanche, subsidence, frost, sleet, drought;<br>• **Ministry of Environment and Spatial Planning** established the **Slovenian Water Agency** in 2015 which replaced the Institute for Water and partially the Environmental Agency's role in water management. Now, the SWA are the most important stakeholder in CCA and DRM in relation to water, since they are the ones implementing the Floods Directive as well as water management. However, the water management department of SWA and the flood protection department of this agency are not cooperating. Furthermore, the same Ministry is also responsible for implementation of the Water Framework Directive, but this third working body is also not cooperating with the other two. So, flood protection measures are planned and implemented separately from the water maintenance measures, but also not taking into account the needs and goals of the WFD, resulting in partial and ineffective outcomes constantly failing and being challenged by society. The final result is mistrust of the general society towards any water related measures or initiatives suggested by the government and the government is responding by poor or minimal public consultations.<br>• Ministry of Agriculture, Forestry and Food is responsible for CCA and DRM on agricultural land and in aquaculture operations.<br>• Environmental Agency is collecting and managing environmental data, but has no role in CCA and DRM.<br>• Local communities – responsible for spatial management, excluding water bodies. However, due to the lack of financing and maintenance by the responsible governmental bodies, they often perform water management and maintenance themselves, only consulting national bodies for approval.<br>Association of Municipalities and Towns of Slovenia – mandated organisation for damage assessment<br>• **Administration for Civil Protection and Disaster Relief**, responsible for the maintenance of information system "AJDA" and immediate intervention during events, but their operation ceases as soon as the properties or lives are not in immediate danger any more. Therefore, they have no role in restoration, CCA or DRM.<br>• Slovenian Insurance Association (Slovensko Zavarovalno Zdruzenje, 1997)<br>• **SI. RISK**, Slovenia Association of Risk and Insurance Management<br>• **Red Cross and Karitas** – rarely rais funds and mostly support through humanitarian aid immediately after disaster during large or severe events | Ministry of Defence website, www.mop.gov.si<br>Administration for civil protection and disaster relief website, www.sos112.si<br>The Environmental Agency website, www.arso.gov.si<br>Agency for Agricultural Markets and Rural Development website, www.arsktrp.gov.si<br>Institute for Water of the Republic of Slovenia website, www.izvrs.si<br><br>(zaz-zdruzenje.si) |

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| **First assessment of main issues from NAIAD perspective:**<br>Most of the insurance companies, while private, have state ownership up to some level. A lot of ownership is also indirectly state controlled, e.g. state-owned banks own insurance companies. At the moment there is a good time to promote concepts such as NBS, because there is quite broad support for the "Transition to low carbon economy" initiative at the policy level and this somewhat open for contributions. | |

### 7.2.9 Spain

| Spain | References |
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| **List of relevant stakeholders for CCA and DRM**<br><br>• **State role**: responsible for coordination, support and water planning and management in the interregional basin districts; manages river management, hydrological information system; produces flood risk maps and coordinates operations; responsible for flood resilience measures; regions are responsible for water planning and management for intraregional basins. These includes preparation of both Flood risk plans per basin in compliance with the EU Floods directive, but also of Drought risks plans,<br>**National Civil Protection + Autonomous Communities:** coordinate plans and are responsible for civil protection which operates in three levels, in level 1 conditions municipalities are responsible; under level 2 this is up scaled to regional level and under level 3 (never called in Spain) it is the responsibility of the Ministry of Defence.<br>**National Water Council,** responsible for giving opinions (non-binding) on water policy; there are water councils also at basin level<br>**Technical Committee for Flood Emergency (CTEI,** 1983), aims to prevent and reduce the effects of flooding;<br>**Department of Natural Hazards**, produces list of floods by province from the Information System for Emergency management (SIGE) data and reports;<br>• **CCS role**: Public Business entity (attached to the Ministry of Economy and Finance) with unlimited guarantee, covers uninsurable and extraordinary risks: proposes also agricultural, motor and credit insurance; CCS is financed by a compulsory premium surcharge on the ordinary insurance policy; it covers risks like floods, hale, wind damage, etc.<br>• **ENESA:** National Agency for Agricultural Insurance, state owned company for the agricultural sector. | (Paudel 2012)<br><br>(Maccaferri et al. 2012)<br><br>(White et al. 2011)<br><br>(De Groeve et al. 2014)<br><br>proteccioncivil.org<br>cruzroja.es<br>(Europe 2012)<br><br>(unespa.es) |

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| • **Spanish Insurance Supervisor**: approves tariffs of insurance, single fixed tariff which varies depending on the type of amount of insured exposure (housing, industry, shops, civil works), in case of motor insurance it is applied a fixed amount;<br>**Spanish Insurance Consortium**<br>• **Regions**: responsible for land use planning, management, civil protection and environment; report the environmental issues; supports financially the building/infrastructure adaptation to flood risk (innovative, smart flood resilience);<br>**Hydrographic Public Bodies**: elaborate planning reports seeking to prevent the development of zones at flood risk<br>• **Local Authorities:** responsible for rivers in urban areas, local development plans, civil protection and flood resilience measures;<br>• **Insurance role**: sell and administer policies; monthly collection of surcharges to the CCS;<br>• **AGERS, Spanish Association of Insurance and Risk Management**<br>• **IGREA, Iniciativa Gerentes de Riesgo Españoles Asociados,** Risk Management Association<br>• **Spanish Civil Protection,** information and documents on risk prevention<br>• **Red Cross,** national documentation of disasters<br>• **Spanish Union of Insurance and Reinsurance**<br><br>**First assessment of main issues from NAIAD perspective:**<br>There are sometimes conflicts between different administration offices; lack of coordination for land-use practices (for flood risk planning regulations). There are some potential issues of moral hazard but these could be addressed through regulatory changes to incorporate a duty for investment in preventative actions as part of its statutory duty | |

### 7.2.10 Sweden

| Sweden | References |
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| **List of relevant stakeholders for CCA and DRM**<br>• **Swedish Civil Contingencies Agency**, ensures the development and the maintenance of the NDB (database);<br>• **Municipality level**: in 2011, 39% of municipalities have adopted guidelines or a policy for CCA; determine the flooding level in land-use planning; legal right to refuse or demolish property in high-risk areas; responsible for pumps and sewage systems; | (De Groeve et al. 2014) |

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| • **Individual level**: the property owner is responsible for the sewage systems to the private property from the house's border.<br>• **SWERMA, Swedish Risk Management Association**<br>• **Swedish Insurance Association**<br><br>**First assessment of main issues from NAIAD perspective:**<br>• A significant number of relevant stakeholders would be potential agents of change involved in the insurance value of ecosystems' implementation according to EEA and Prevention web platform. A lot of interactions between stakeholders can generate lack of coordination. | (Nordic Insurance Associations et al. 2013)<br><br>(svenskforsakring.se) |

### 7.2.11 United Kingdom

| United Kingdom | References |
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| **List of relevant stakeholders for CCA and DRM**<br>• **State role**: no State intervention and compensation in case of natural disasters; consultation role for Surface Water Management Plans;<br>**Ministry of Environment and Water**<br>**Department for Environment, Food and Rural Affairs (DEFRA),** responsible for preservation of natural environment and flood policies; sets national strategy for coastal risk management;<br>**Environment Agency (EA),** responsible for flood risk management; identifies areas at risk; flood warning system; designs Strategic Flood Risk Assessments (SFRAs); strategic overview of all flood and coastal erosion risk management<br>**Strategic Environmental Assessment (SEA),** provides a partial decision support system for strategic planning;<br>**UK Prudential Regulation Authority**, studies the physical impacts of CC;<br>• **Regional level:** 8 regional offices of the Environment Agency;<br>**Regional Flood Committees** | (Veyret et al. 2004)<br>(Gizzi et al. 2016)<br>(Botzen and Bergh 2008)<br>(Paudel 2012)<br>(White et al. 2011)<br>(Suykens et al. 2016)<br>(Bacani et al. 2015)<br>(Environment Agency 2010)<br>benfieldhrc.org<br>redcross.org.uk<br>(Europe 2012) |

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| • **Local level:** local offices of the Environment Agency; responsible for preliminary assessments, mapping, planning local flood risk, ensure flood resistance material, flood resilience systems, may provide resistance to the increased responsibilities that are being transferred to them;<br>**Local authority**: investigates coastal erosion, plans and implements coastal risk management; assesses planning applications for coast protection works;<br>**Conservation bodies**: assess proposals for coast protection works in terms of impacts on the natural environment and heritage<br>**Living With Environmental Change**, a cross-council research aims to spread innovations;<br>• **Individual level:** homeowner is responsible for managing its own flood risk; ensure maintenance of their property<br>• **National Flood Forum (a charity)**, provides support and advice for flood prevention measures;<br>• **AIRMIC, Risk Management Association**<br>• **Benfield Hazard Research Centre**<br>• **British Red Cross**<br>• **ABI**<br>• **International Underwriting Association of London**<br><br>**First assessment of main issues from NAIAD perspective:**<br>As in Sweden, a significant number of relevant stakeholders would be potential agents of change involved in the insurance value of ecosystems' implementation according to EEA and Prevention web platform. A lot of interactions between stakeholders can generate lack of coordination. | (iua.co.uk) |

## 7.4 ACTIONS: EVALUATE DIFFERENCES IN THE CAPACITY TO IMPLEMENT INSURANCE VALUE OF ECOSYSTEMS BETWEEN MEMBER STATES

It is possible to do this evaluation of differences in the capacity to implement IVE between member states through the current implementation or lack of prevention policies. Prevention sector can be an entry point for mainstreaming policy and researches actions on the IVE. These gaps reflect the current state of knowledge and member States' capacity to implement IVE.

### 7.4.1 Denmark

| Denmark | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>• **Individual prevention measures**: backwater valve, rain reservoir, raised bed, fascine, drain<br>People who have been flooded may be required to take preventive measures if they want to be entitled to Storm Council' compensation.<br>• **Municipal prevention measures**: mapping, dikes, drainage passages, backwater valves, floodgates, integrated into their areas of priority with regard to CCA efforts<br>• **Insurance companies' prevention measures:** good advices, application "Husets VejrAlarm", rain project where the insurances contribute with insurance data about the damage and to inform customers and municipalities<br><br>**First assessment of main issues from NAIAD perspective:**<br>• Lack of knowledge and tools for flood risk prevention and mitigation.<br>• Danish citizens are not familiar with recommendations for level for flooding while, the tax system includes incentives for the property owners to adapt to the climate change. | (Nordic Insurance Associations et al. 2013)<br><br>(Maccaferri et al. 2012)<br><br>Organisation which gathers Danish insurance companies' objectives www.forsikringsvejret.dk |

### 7.4.2 France

| France | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>The French national strategy of prevention is the implementation of PPR (risk maps) in order to institutionalize natural hazard mitigation measures. Also, a part of NATCAT surcharge on premiums goes to a public fund for investments in risk reduction measures (Barnier mitigation fund, National Fund for Natural Hazards and Prevention). Local authorities can receive grants if they want to implement barriers. This policy is aimed to reduce damage and to decrease NATCAT expenses.<br>Insurance companies cannot take punitive measures. They undertake prevention policies through the MRN (Mission Risques Naturels), to improve individual awareness of its own vulnerability to better understand the collective vulnerability.<br><br>**First assessment of main issues from NAIAD perspective:**<br>• The NATCAT Regime, does not encourage risk-reduction behaviours.<br>• There are no risk-based premiums, this weakens the incentives for homeowners to implement risk-reduction measures. But there are incentives based on the increase of deductibles after one disaster, which seems to be insufficient.<br>• Urban management plans and risk prevention plans differ from one municipality to another, lack of coherence.<br>• Lack of citizens' consultations for risk prevention strategies.<br>• However, the Barnier fund for prevention of major natural risks is fuelled by natural catastrophe insurance premiums.<br>• The low level of premium (20 € per year per individual risk) allows a full coverage of insurance on the territory and since 1982 the State guarantee has never been requested. | (Raadgever et al. 2014)<br>(Surminski et al. 2015)<br>(Gérin 2011)<br>(Hudson 2015)<br>(White et al. 2011, Paudel 2012, Suykens et al. 2016)<br>(Bos 2015) |

### 7.4.3 Germany

| Germany | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>Urban planning requires strict technical standards of building construction;<br>Urban planning requires area for flood retention basins and other green flood resilience measures;<br>Example of Flood Resilience Measures: "Living with Floods"<br><br>Insurance companies' incentives are based on premiums; but they do not provide incentives for the installation of flood resilience measures (before or after a disaster) apart from a few exceptions;<br>Lot of communication on flood risks (guidelines, papers, social medias) to raise awareness;<br><br>**First assessment of main issues from NAIAD perspective:**<br>• Most municipal decision-makers :<br>  ○ still see structural flood defence (grey, engineering) measures as the only answer to floods; and view NBS sceptically;<br>  ○ think it is the government's obligation to implement flood defence infrastructures.<br>• There are educational challenges to change this false sense of security within engineering infrastructures.<br>• Ad hoc disaster relief gives flood-prone homeowners a false sense of security and disincentives for implementing private mitigation measures.<br>• General unwillingness of private property owners to invest funds for their own flood-proofing.<br>• Homeowners' lack of knowledge if there are covered or not for natural hazards by their insurance contracts. | (Grislain-Letrémy and Peinturier 2010)<br><br>(Paudel 2012)<br><br>(White et al. 2011) |

### 7.4.5 Italy

| Italy | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>Any preventive measures can have effects on the insurance tariff;<br>Italy's specificity is that the Civil Protection (main role) matters than the regional level<br>The Italian State pays for the reconstruction of all buildings (grants for reconstruction). Lots of mutual help.<br><br>**First assessment of main issues from NAIAD perspective:**<br>• Poor risk culture, poor insurance culture.<br>• Strong conviction of existence of an important State compensation.<br>• Homeowners' lack of knowledge if there are covered or not for natural hazards by their insurance contracts. | Insurance Europe website, www.insuranceeurope.com<br><br>Didier Combescure during the CCR CAT 08/06/2017 |

### 7.4.6 The Netherlands

| The Netherlands | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>It is possible for insurers to exclude property in high risk areas (outside the dike areas). Flood defence is highly institutionalised, this strong government's role limits individual flood protection measures;<br>Thanks to the development of NBS, it is a challenge to build in flood-prone areas;<br><br>**First assessment of main issues from NAIAD perspective:**<br>• The most important barrier to implement IVE, is the lack of knowledge of available options. Grey solutions, such as dikes, are In favour.<br>• People think that only the government is responsible for their safety. | (Suykens et al. 2016)<br>(Raadgever et al. 2014)<br>(White et al. 2011) |

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| • The lack of interest from the insurers' point of view is another issue. They think flood prevention and mitigation is a decision to be taken at the water authority and household levels.<br>• No flood insurance available in the private sector. | |

### 7.4.7 Poland

| Poland | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>There are no risk prevention plans;<br>The NatCat Forum Initiative proposes to create a Polish Flood Risk Management and data quality guidelines;<br><br>**First assessment of main issues from NAIAD perspective:**<br>• Lack of risk-awareness, lack of a comprehensive emergency management legislation.<br>• Issues in the insurance role: lack proactivity in terms of promoting property-level adaptation and resilience after disaster.<br>• Homeowners' lack of knowledge if there are covered or not for natural hazards by their insurance contracts; | (Raadgever et al. 2014)<br><br>(OECD 2015)<br><br>(Maccaferri et al. 2012) |

### 7.4.8 Romania

| Romania | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>National Plan for Flood Risk Management (according with art 7 WFD)<br>National Program for the Prevention, Protection and Reduction of Flood Effects<br>National Strategy on reducing drought effects, prevention and fighting against land degradation**First assessment of main issues from**<br><br>**NAIAD perspective:**<br>• No clearly defined role for the insurance sector consequently limited or no involvement in campaigns at local level | http://www.mmediu.ro/app/webroot/uploads/files/2016-04-26_PMRI_Sinteza_Nationala.pdf |

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| | http://old.madr.ro/pages/strategie/strategie_antiseceta_update_09.05.2008.pdf |

### 7.4.9 Slovenia

| Slovenia | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>Preventive actions are: early warning system, flood risk maps, IT infrastructure, guidelines, monitoring, earthquake-resistant construction and emergency planning for preparedness protection and rescue relief, regular maintenance of rivers and streams (mostly removing vegetation from the banks and keeping structural integrity of barriers and erosion protection measures).<br>In accordance with the Floods Directive, a National Plan for lowering Flood Risk is being developed by Slovenian Water Agency of the Ministry for Environment and Spatial Planning. The same agency is also responsible for mitigation, but the plan for mitigation of flood damages is done ad-hoc each time a flood happens. In the last floods, the mitigation plan mostly included regular maintenance works for which state has been reducing budget for more than 10 years and the environmental assessment of the mitigation Action Plan was not required, so there was a huge environmental damage done during implementation of this Plan. The public outcry resulted in at least 2 companies being charged of restoring the destroyed sites.<br><br>FRISCO I project (started in 2017): Raising awareness on personal/individual flood protection measures among local people.<br>Due to the fact that waters are under exclusive jurisdiction of the government, the municipalities have very limited possibilities to intervene, even if they have the capacity and ambition.<br>Regular maintenance of rivers and streams (removing vegetation and keeping barriers structurally intact) is seen as the best preventive measure. | Ministry of Defence website www.mo.gov.si |

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| Insurance sector is strictly private and has no role in risk prevention.<br><br>Citizens are unaware of the flood risks to them, but also expect the government to protect them no matter what.<br>Building permits and spatial plans are often issued without considering flood risks, partly due to lack of capacity and partly due to corruption, since land around water bodies is seen as the most beautiful for living.<br><br>**First assessment of main issues from NAIAD perspective:**<br>• Lack of information of the existing prevention campaigns. | |

### 7.4.10 Spain

| Spain | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>There are active prevention policies as a part of the spatial planning and environmental protection policies;<br>There is a need for enhancing the public awareness about natural risks and building resilience options;<br>The State provides financial support for researches on natural perils; designs prevention campaigns address to municipalities;<br>The Spanish Insurance Consortium tries to implement flood resilience measures;<br><br>"Agricultural Insurance System (AIS) is almost 40 years old. Risks covered are the damages caused by abnormal variations of meteorological agents (hail, fire, drought, frost, flood, hurricane or warm wind, snowfall, excess humidity, other<br>Climatic adversities), accidents, pests and diseases on the agricultural productions and optionally on the installations.<br>These risks are covered in a combined way (multi-peril policies). Exceptionally isolated. Participation is voluntary for farmers" (Isabel de la Moneda, 2017[14])<br><br>**First assessment of main issues from NAIAD perspective:** | (Grislain-Letrémy and Peinturier 2010)<br><br>(Paudel 2012)<br><br>(White et al. 2011) |

[14] THE SPANISH AGRICULTURAL INSURANCE SYSTEM Conference on Insurance of Climate related disasters 30 June 2017

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| • There are no incentives based on premium or deductibles.<br>• The insurance companies seem not to play a role in prevention measures. | |

### 7.4.11 Sweden

| Sweden | References |
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| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>The tax system does not include incentives for the property owners to adapt to the CC;<br>Lot of prevention measures are taken by property owners such as flooding green areas, green roofs;<br>Insurance companies are engaged to propose prevention measures and to design informational flyers;<br><br>**First assessment of main issues from NAIAD perspective:**<br>• Citizens are not familiar with recommendations for flooding level in building measures.<br>• Different behaviours and risk-awareness from one person and one municipality to another. | (Nordic Insurance Associations et al. 2013)<br><br>(Raadgever et al. 2014) |

### 7.4.12 United Kingdom

| United Kingdom | References |
|---|---|
| **National strategy on prevention and mitigation policies from the individual, municipal to the insurance initiative level**<br>There is a high degree of knowledge and an active prevention policy from insurance companies; It is possible for insurers to exclude property in high-risk areas (in that case Flood Re intervenes);<br>Strong incentives based on risk-based premiums to enhance property owners' defence;<br>The Government must spend money on flood protection (according to the Gentlemen's Agreement with ABI);<br>There is a high institutionalisation of flood defence, mitigation and recovery; ABI, Environment Agency propose a great diversity of measures (e.g., guidance documents, website, simulations etc.) to raise people's awareness; | (Grislain-Letrémy and Peinturier 2010)<br><br>(Suykens et al. 2016)<br><br>(Raadgever et al. 2014) |

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| #floodfreehomes programme: the objective is to have no home at high flood risk by 2025 (spend £1bn per year to be spent on managing flood risk);<br>Floodlist, property flood resilience action plan: insurers can help homeowners at the repair stage (not prevention), resilient flood repair;<br><br>**First assessment of main issues from NAIAD perspective:**<br>• Spatial planners take into account the risk, but building companies can negotiate it.<br>• Insurance companies do not propose "betterment clauses" to help homeowners rebuild their houses in a resilient way, after have been flooded;<br>• It can be possible to create a "building-resilient certification" to ensure that building are (re)build in a resilient way.<br>• Property owners can think that visible flood resilience certification will devalue their assets; can be reluctant to spend money on flood resilience products. | (White et al. 2011)<br><br>(Paudel 2012) |