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Executive Summary

This report aims to be a baseline analysis on the institutional settings for risk assessment and management, looking at core policy messages and allocation of roles and responsibilities at two levels : 1)International and European ; 2)Country level : Spain, France and Romania.

1) The International and European levels, exploring the implications for Climate Change Adaptation, Disaster Risk Reduction and Ecosystem Services that different Strategies and Directives open, the current policy contexts and the potential windows of opportunity to mainstream the Insurance Value of Ecosystem Services:

- The Sendai Framework for Disaster Risk Reduction
- Revision of EU Adaptation strategy
- Sustainable Development Goals (SDGs)
- Urban Agenda
- CAP and Rural Development Policy
- EU Strategy on Green infrastructure
- Nature action plan and EU Biodiversity Strategy to 2020
- WFD and Blue Print
- Floods Directive
- Drought Risk Management

At international level frameworks such as Sendai or Agenda 2030 set up a path for an holistic approach to disaster resilience, providing useful indicators and criteria to monitor achievements while strengthening governance and allowing coherence among different policies and sectors. The main barrier at the moment is the complex framework for reporting, done at member state level, the incentive however is how a co-benefits approach from the adoption of NBS could help comply with Agenda 2030. At European level we distinguish between Strategies and Directives. The first provide policy frameworks and advice while the second are to be incorporated into national laws. Rules, as incentives can provide the rules of the game and can shift the whole system as levers for action/inaction/conflict/cooperation.

From the Urban Agenda, Adaptation Strategy, Green Infrastructure strategy, it is concluded that Member States and regions need to start to draft spatial development policies that consider how Nature-Based Solutions should be integrated into broader urban land use planning. Introducing and developing these concepts require, in many cases, employing innovative tools and policy approaches, like e.g. developing incentive-based and financial instruments able to support effective spatial and urban policies. In terms of funding. It is already acknowledge that the implementation of NBS solutions results “in many benefits for the environment, economy and society, and they offer an opportunity to turn challenges that urban areas face into innovation opportunities. Nature based solutions may contribute to sustainable urbanisation and improving well-being in urban areas, including restoration of degraded ecosystems, urban regeneration and adaptation to climate change. For instance, to reduce

pollution and increase liveability in cities, networks of green areas and waterfronts in cities are important due to the ecosystem services that they provide and should thus be preserved".

For the NAIAD cities it is recommended to promote the inclusion in the Covenant of Mayors initiative, in the Mayors Adapt specially, in order to gain connections and mainstream CC adaptation through NBS.

The Common Agricultural Policy also represents an incentive towards the mainstreaming of Ecosystem Services of Nature Based Solutions. However, adequate coordination between policies, regulations and community funds is essential so that the ones (Cohesion, PAC) do not hinder or prevent compliance with the others (DMA). This coordination concerns the Commission itself in the first place.

In both WFD and Floods Directive, ecosystems services are not explicitly mentioned but the references and links are obvious. The Directive requires the floods and river management plans to take into account relevant aspects such as costs and benefits. The Directive furthermore stipulates that international action plans should undergo a cost-benefit analysis. In both cases, integration of ecosystem service considerations could allow systematic analysis and communication of relevant costs and benefits. A systematic consideration of ecosystem services in both the WFD and the FD will support the required coordination of the implementation of the two directives.

There is no drought policy as such in the EU. Droughts are covered under the WFD's objective of guaranteeing access to good quality and sufficient quantity of water while ensuring a good status of water bodies. In addition, droughts are specifically targeted by a series of drought management plans that have a non-permanent character. More studies are needed to establish the link between NBS and risk for droughts.

In Europe, beneficiaries of structural defences are the citizens, to protect human lives and their properties. Which is different from whom can receive subsidies to finance protective measures (beneficiaries of subsidies). As demonstrated in chapter 6, in France for example, only local communities with risk prevention plans and natural or legal person living in these communities (companies with less than 20 employees) can be the beneficiaries of the "Barnier Fund". The involvement of the insurance industry in DRR can impact data and information exchange to incentivize risk awareness or to guide decision-making. Thanks to new financial instruments against disaster such as the "resilience bonds", the insurance industry is now connected to governmental institutions. However, some reports suggest that there is very little evidence of insurance schemes actually inducing risk-reducing behaviours (though the theoretical potential is widely acknowledged). Further research will be carried out during the Project.

2) Country level : we explored and analysed how risks are defined and assessed in **Spain, France and Romania**, what roles different actors have for the assessment and reduction of the risks, and what incentives different institutional settings provide for Insurance Value of Ecosystems mainstreaming.

The analysis in Spain, Romania and France, shows that there are efforts being made at policy level and roles distributed between different institutions and organizations, that help mainstreaming of IVE, but more effort and coordination will be needed. In the three countries a selection of gaps and incentives in the promotion of ecosystem services and incentives has been identified.

In France, the interlocking of numerous actors within GEMAPI can be a force to mainstream ES and IVE at all scales and into the policy framework. This will work only if the role of each partner is well defined to avoid overlapping or gaps. Even if it is sometimes very complex to know and to understand the role of each stakeholder in DRR. Romania faces two main challenges: firstly, its multilevel governance is based on a complex legal framework (with over-regulation through the secondary and tertiary levels of legislation) which impacts the DRM more generally. Secondly, a high number of stakeholders with very diverse profiles, restricted legal competencies and limited technical expertise who, as such, lack awareness of ecosystem services and their insurance potential. In Spain, the adoption of WFS and Floods Directive, and other conservation related plans are opening the floor for NBS however more efforts on drought preparedness and adaptation to climate change should be done.

Different gaps have been identified, namely: difficulty to understand the concepts (NBS, IVE…) which can in turn hinder their development and adoption; lack of coordination between policies; lack of coordination between agencies and institutions; the financial aspects on how to implement cost-effective measures, how to invest, how to monetize nature and how to calculate the value of ecosystem services. The opportunity to mainstream eco-based approaches for DRR into private sector (insurance sector) activities should not be missed: as an innovative risk management

1 Introduction

The aim of this document is to provide a baseline analysis for the institutional settings around risk assessment and management at two levels: first in terms of international and EU policy frames and contexts and second, at the national level of some of the NAIAD DEMO´s countries, to explore the interface among Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and Ecosystem Services (ES) mainstreaming for the potential or de facto incorporation of the insurance value of ecosystems in different policies. The hypothesis is that at present there is no explicit incorporation yet there are potential institutional settings that could incorporate the impact on NBS services on Risk Reduction. Thus, the uptake of the IVE at present is partly limited because of the lack of proper institutional framework that supports it and that can be quantified. The aim is to explore the cost-effectiveness of the policies that are being promoted. We do so by focusing on the interventions and measures promoted by the policies. The rationale here is that when the cost-effectiveness of measures can be operationalized to assess the effect not only on the policy's own objective, but generally on risk and ecosystem services, the link to insurance moves from implicit to quantifiable. The institutional analysis will operate at two levels: international and EU; and national level. The DEMO level analysis has started and will be reported in D5.6.

The mapping exercise performed in D.8.1 was done at European and national level, for 11 countries in the EU looking in particular at the legal and implementation frame on insurance. One of the main results from this analysis was that the number of stakeholders involved, and the complexity of national systems make it very difficult to identify relevant stakeholders that can act as 'change agents' and the specific actions these agents could take. This is why the NAIAD DEMOS will become particularly important to study the operationalization of potential "natural assurance schemes" more in-depth, by

looking at specific real water risks identified and confirmed by the stakeholders as vulnerable areas. This highlights the importance of the local scale.

This document builds on the actions that were already pinpointed in D8.1 to perform a policy and institutional analysis. D5.6 will continue this analysis, deepening on the regulatory frameworks at DEMO level focusing on actor´s incentives, adding a comparative analysis layer across demos. Once we understand the policy and Institutional settings, it will be easier to understand the potential barriers for the uptake of the IVE innovations that NAIAD project aims to test in the different DEMOs as prototypes to mainstream the IVE in CCA and DRR in water risks.

The document is structured in four distinct parts: the first part outlines the main aims and objectives. The second part provides a summary of (and reference to) the main policy initiatives at international and national level, and relevance to NAIAD. The third part addresses key questions related to risk which are then in turn applied to three of our demo countries. The last part summarises the main conclusions and recommendations.

2 Research framework and concepts

2.1 Aim: Policy and Institutional analysis for risk assessment

This deliverable is part of WP3 that deals with the interface and alignment of social risk perception and scientific risk assessment. The Institutional Analysis part aims to contribute to the outcomes of this work package by gaining insight on the interplay of institutional settings on risk perception, and that help (or not) to incentivize the operationalization of the Insurance Value of Ecosystems (IVE) for disaster risk management, through the implementation of NBS.

2.2 Objectives and Research questions

The main aim is to understand the current policy context and institutional settings in terms of risk management and the incentives experienced by the actors potentially involved in the operationalization of the Insurance Value of Ecosystems (IVE) for disaster risk management. The objective of the deliverable is to provide policy recommendations to connect three aspects – DRR, Ecosystem Services of NBS and CCA- in the operationalisation of the insurance value of ecosystems through NBS.

Special attention is paid to floods due to its ease of comparison with the Floods Directive. Other water risks that apply to the demos will be included, water scarcity and drought, and other water risks related to water quality and quantity, as framed by the EU Water Framework Directive.

A first part will continue the work undertaken under D8.1. This will include a mapping of main policies, legal and regulatory frameworks from the perspective of the insurance value of ecosystems[i]. Special emphasis will be put on **identifying the gaps and opportunities for the integration of ecosystem services and natural capital into EU and national policy frameworks, particularly at the operational level.**

The current policy initiatives, policy principles and potential instruments, that could offer "policy windows" to incorporate the insurance value of ecosystems and nature based solutions[ii] are mapped. For example, this is currently the case with the review of the EU adaptation strategy or the review of the river basin management plans and the Flood Risk Management Plans prepared by all EU Member States.

A second part reviews the main regulations and directives that directly or indirectly influence the insurance value of ecosystems in two main areas: environmental directives (Water Directive, Floods Directive). The regulations linked to funding programmes are not considered here (except briefly under the CAP and cross compliance) or the Solvency Directive since this will be covered in the upcoming D7.3, or the Habitats and Birds Directive.

A third part of the study looks at the national level, with baseline studies on current institutional setting at three of our six demo countries[iii], to better understand the interplay between the current policy settings and the institutional framing on the incentives experienced by each of the actors, mapping the most relevant stakeholders and potential 'agents of change' from government, business, financial sector and civil society. We will aim to answer the following questions:

a) How is risk assessed and by whom?
b) How are risks mitigated? What is the allocation of responsibilities on DRR/M between the different actors?
c) Who carries the costs of DRM or makes the investments for DRM versus who benefits from these ex-ante investments?
d) Who influences the risk prevention versus who carries the damage costs in case of a disaster?

In the last section we will reflect on current gaps per country to reflect on how aligned or misaligned current incentives are to ensure DRR and its link with Insurance Value of Ecosystems.

2.3 Conceptual framework and guidelines for the analysis: understanding the policy and Institutional settings

Institutions are the rules of the game in a society; the accepted organizations, regulations, social norms that shape human interactions and the role each one follows in those interactions (Young, 2002). The analysis of the policy and institutional context takes into account the capacities, relationships and rules of the interactions, as well as the mechanisms that govern them. Therefore, it is necessary to analyze institutions at different governance levels.

At policy level, there are no clear links between Disaster Risk Reduction and Management (DRR/M) and Ecosystem Services for Risk Reduction that NBS provide - such as water quality, quantity, flow regulation, soil and water conservation - and how to determine the insurance value of ecosystems. The impact of NBS services on risk reduction is currently not systematically quantified. Thus, there is scope for new knowledge from understading, quantifying and when relevant mainstreaming this link, and including it into decision making and in the implementation of NBS for DRR and CCA for water risks.

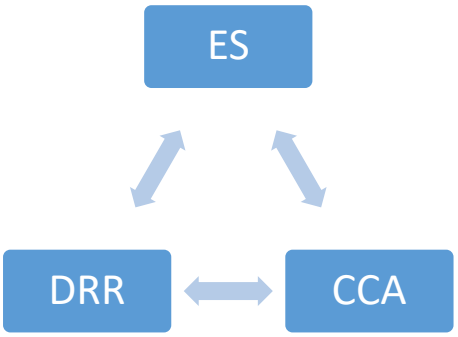

Figure 1. Main concepts explored in NAIAD

Table 1. Examples of Grey, Hybrid and green structural and non-structural solutions

	Structural Solutions	Non-structural or "soft" solutions
Grey	Transfer, dams	Subsidies
Hybrid	Managed Aquifer Recharge, wáter reuse	Control, fines
Green (NBS)	soil conservation; afforestation; river restoration	(G)WUAs …

When exploring the Insurance Value of Ecosystems, the hypothesis is that by investing in nature, or in some cases in hybrid solutions, the damage costs can be reduced, human wellbeing can be improved and co-benefits can be exploited. The EU estimates that for every euro invested in risk prevention, saves up to 7 euros in disaster response efforts. The main difference in this case is that the euros are invested in nature-based solutions[iv]. In addition, another aspect (emerging from the NAIAD IVE Survey results) is that as yet there are few experiences or indeed examples on insuring the insurance value of ecosystems, where new products and services could emerge. There might also be barriers to the adoption of innovative financing schemes or legal and contractual issues (formal institutions). This will be studied in D7.1., D7.2.and D7.3. Thus, this report briefly analyses whether policies are currently incentivizing -and whether they pro-actively incentivise the adoption of Natural Assurance Schemes.

2.4 *Institutional response on the different phases of Disaster Risk assessment and Reduction*

Risk assessment is the overall process of risk identification, risk analysis, and risk evaluation. It is a necessary step for disaster management strategy design and implementation. As G20/OECD states, *risk assessment guides the optimal allocation of scarce resources available to the phases of disaster risk management (DRM). By identifying and assessing the likelihood and consequences of potentially disastrous events, risk assessment provides governments with the basis for the prioritization of investments in disaster risk reduction, the improvement of emergency management capabilities and*

the design of financial protection strategies in a manner tailored to local conditions, needs and preferences.

Therefore, for the analysis, besides the risk assessment phase, the different phases for Disaster Risk Management considered include:

a) risk prevention (structural measures for DRR, like coastal barriers, river channels, dikes, water retention areas, spatial planning, etc.);
b) preparedness (like early warning systems, crisis management protocols);
c) response (emergency measures);
d) recovery (insurance and compensation, government reconstruction and activities).

OECD/G20 (2012) highlights the strong interconnections between disaster risk assessment, risk reduction and financial management, as key building blocks for dynamic and continually evolving DRM strategies. **Therefore, a baseline on policy and institutional settings on risk assessment will be crucial to determine the incentives, funding and financial strategies that may be followed to assess the insurance value of different ecosystem in nature-based solutions.**

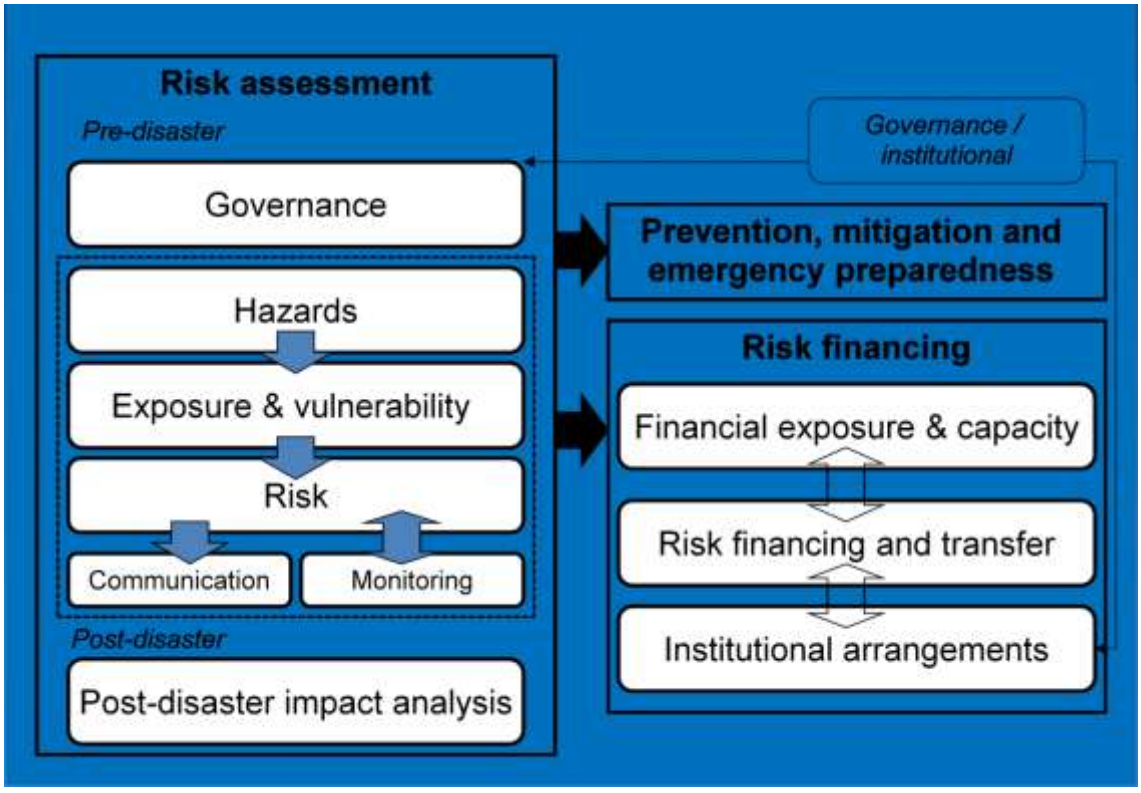

Figure 2. Framework to link Risk Assessment, reduction and financing. Source: OECD/G20, 2012

The so called New Institutional Economics approach is of special interest here since it combines perspectives on sociology and economics with institutional analysis. It focuses on the social, legal norms and rules (institutions) that underlie economic activity. Political economist Elinor Ostrom developed the institutional analysis and development (IAD) framework, to improve economic models

based on the theory of public choice, and specially applied on the policy and institutional analysis of Common Pool Resources and diverse property regimes (Polski and Ostrom, 1999). Williamson is another academic from this school of thought, who developed an institutional analysis by layers (figure 2). We will rely on both conceptual frameworks to carry out our analysis, where action arenas are risk assessment, disaster risk management and reduction and insurance, or risk transfer, and we will look at the different institutional layers suggested by Williamson in the different levels.

Institutional settings include cultural values, legal frameworks, market mechanisms and political processes: the rules of the game. The layers described below (table 2) will guide the framework for the analysis in this report.

Table 1. Analysis of institutional layers (based on Williamson, 2000)

Level I: social embeddedness	This layer builds on social theory and includes cultures and norms, informal rules of the game, social acceptance, social perception. It is the highest and broadest level in society, where changes take place at a slow rate. The factors of this layer are considered the "informal" incentives on behavior. More on this layer will be developed by other tasks in WP3 such as 3.1. This layer is out of the scope of this deliverable.
Level 2: Institutional Environment	In this level, Williamson includes the institutional environment and the formal set of rules, the rules of the game. We can find property rights systems, regulatory framework, water rights, tenure, allocation rules, allocation of responsibilities on disaster risk management, liability for damages, insurance rules.
Level 3: Economic Governance	In this level, we focus on the alignment of governance and rules setting with transaction costs[v]. Economic governance of risks and measures for risk reduction: how are roles, responsibilities, risks and rewards allocated between actors given a number of "contracts" in place. This is, governance, agreements, negotiations and contracts, insurance and reinsurance contracts. We can elaborate here on the transaction costs of risk assessment and disaster reduction, rule setting, monitoring, enforcement. Depending on the type of good - either a) the asset that needs to be protected, or b) the Ecosystem or measure that needs to be implemented- then we probably need to look at different governance modes, which are either: a) Public procurement contract options (i.e. PPP',s concession, etc) – in the case of toll or public goods. For example, green bonds and how they are used either by governments and/or companies to finance the measures. b) Common pool resources type of governance modes (i.e. PES, water funds, etc) – for the so called "common goods". In a few cases we may have to refer to private goods types of governance modes, where governments have been little active and "risk protection" has become a private responsibility.

	This layer will be further developed in task 5.4
Level 4: resource allocation (prices, etc)	The bottom layer builds on agency theory and neoclassical economics, focusing on individual analysis, resource allocation, prices, income. This layer will not be in the scope of this report.

3 International and European policy settings and incentives from the perspective of the insurance value of ecosystems for damage prevention

This section corresponds to the application of Williamson´s layer 2 of the analysis at EU and International level. Here we will focus on the current policy contexts and the potential windows of opportunity to mainstream the insurance value of ecosystem services. Also, how the IVE links to the larger policy frames and main objectives

The list of the relevant directives and current framework for DRR and DRM are detailed in the D8.1. In this report, we are mapping international and EU policies in terms of:

- Current status
- Barriers and incentives
- New directions/new trends

Whenever possible we will analyse whether there is: a) policy goals or principles that could help to mainstream the implementation of NBS, b) specific policies (and their regulatory frame) and c) relevant indicators or methodological frames to incentivize the adoption of the Insurance Value of Ecosystems.

3.1 The Sendai Framework for Disaster risk reduction

Current status and policy settings: shift to disaster risk management and prevention

In March 2015, the Sendai Framework for Disaster risk reduction was aopted by 187 UN member states, endorsed also by the European commission. In the case of Sendai, there has been a marked change towards disaster risk management, as compared to disaster management, and also towards prevention, reducing existing risk and strengthening resilience, with the Implementation of the Sendai framework over the period 2015-2030. Countries, and the EU itself must adopt a disaster risk management, as opposed to disaster management, where the reduction in disaster risk is the expected outcome. The Sendai framework includes a set of guiding principles, which includes giving states the primary responsibility to prevent and reduce disaster risk.

The rationale as stated by the EU itself is that “millions of people remain affected by natural disasters every year and the economic damages incurred continue to increase”.

Furthermore, Sendai acknowledges also that “disasters, many of which are exacerbated by climate change and which are increasing in frequency and intensity (…) evidence indicates that exposure of

persons and assets in all countries has increased faster than vulnerability has decreased, thus generating new risks and a steady rise in disaster related losses".

The clear focus that reducing disaster risk is a cost-effective investment in preventing future losses. The outcome sought by Sendai until 2030 is thus "The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries"

Overarching goal: "Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience".

The European commission is closely supporting the national risk assessment process, methodologies and cooperation. By august 2018 member states will have to fill in an assessment of their risk management capabilities.

In terms of action a Disaster Risk management knowledge centre was launched in September 2015 providing technical support. In June 2016 the Commission published an action plan to implement Sendai and in November 2017 the European commission published a communication with key actions to strengthen disaster management in Europe. The European Commission has also encouraged looking for innovative solutions to finance disaster prevention, "including the use of insurance as a tool for disaster management and as an incentive to promote risk awareness, prevention and mitigation (p 2). In May 2017 the Commission published an overview of key risks in Europe (EEA; 2017), considering 11 types of risks which did include floods, storms, and forest fires.

Sendai has a series of global priorities and targets (table 3 and 4). These principles are formalized in the form of soft law as an international convention under international law. Meanwhile the 7 Sendai global targets in effect become international objectives for countries to pursue. There are no penalties or sanctions for non-compliance except as a kind of collective global social norm.

Table 2. Sendai priorities for implementation

Sendai priorities
1) Each State has the primary responsibility to prevent and reduce disaster risk, including through international, regional, subregional, transboundary and bilateral cooperation. The reduction of disaster risk is a common concern for all States and the extent to which developing countries are able to effectively enhance and implement national disaster risk reduction policies and measures in the context of their respective circumstances and capabilities can be further enhanced through the provision of sustainable international cooperation;

2) Disaster risk reduction requires that responsibilities be shared by central Governments and relevant national authorities, sectors and stakeholders, as appropriate to their national circumstances and systems of governance;
3) Managing the risk of disasters is aimed at protecting persons and their property, health, livelihoods and productive assets, as well as cultural and environmental assets, while promoting and protecting all human rights, including the right to development;
4) Disaster risk reduction requires an all-of-society engagement and partnership. It also requires empowerment and inclusive, accessible and non-discriminatory participation, paying special attention to people disproportionately affected by disasters, especially the poorest. A gender, age, disability and cultural perspective should be integrated in all policies and practices, and women and youth leadership should be promoted. In this context, special attention should be paid to the improvement of organized voluntary work of citizens;
5) Disaster risk reduction and management depends on coordination mechanisms within and across sectors and with relevant stakeholders at all levels, and it requires the full engagement of all State institutions of an executive and legislative nature at national and local levels and a clear articulation of responsibilities across public and private stakeholders, including business and academia, to ensure mutual outreach, partnership, complementarity in roles and accountability and follow-up;
6) While the enabling, guiding and coordinating role of national and federal State Governments remain essential, it is necessary to empower local authorities and local communities to reduce disaster risk, including through resources, incentives and decision-making responsibilities, as appropriate;
7) Disaster risk reduction requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge;
8) The development, strengthening and implementation of relevant policies, plans, practices and mechanisms need to aim at coherence, as appropriate, across sustainable development and growth, food security, health and safety, climate change and variability, environmental management and disaster risk reduction agendas. Disaster risk reduction is essential to achieve sustainable development;
9) While the drivers of disaster risk may be local, national, regional or global in scope, disaster risks have local and specific characteristics that must be understood for the determination of measures to reduce disaster risk;
10) Addressing underlying disaster risk factors through disaster risk-informed public and private investments is more cost-effective than primary reliance on post-disaster response and recovery, and contributes to sustainable development;

Table 3.Sendai Global Targets for implementation

SENDAI Global Targets	
Target A: Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015.	Target A: Technical Note on Data and Methodology to Estimate Global Disaster Mortality to Measure the Achievement of Target A of the Sendai Framework for Disaster Risk Reduction
Target B: Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015	Target B: Technical Note on Data and Methodology to Estimate the Number of Affected People to Measure the Achievement of Target B of the Sendai Framework for Disaster Risk Reduction

Target C: Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030	Target C: Technical Note on Data and Methodology to Estimate Direct Economic Loss to Measure the Achievement of Target C of the Sendai Framework for Disaster Risk Reduction
Target D: Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030	Target D Technical note on Data and Methodology to Estimate Damages to Infrastructure and Disruptions to Basic Services to Measure the Achievement of Target D of the Sendai Framework for Disaster Risk Reduction
Target E: Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020	Target E Technical Note on Data and Methodology to Estimate the Global Progress in the Number of Countries with National and Local DRR Strategies to Measure the Achievement of Target E of the Sendai Framework for Disaster Risk Reduction
Target F: Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030.	Target F Technical Note on Data and Methodology to Estimate the Enhancement of International Cooperation to Developing Countries to Complement National Actions to Measure the Achievement of Target F of the Sendai Framework for Disaster Risk Reduction
Target G: Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030	Target G Technical Note on Data and Methodology to Estimate the Availability of and Access to Multi-Hazard Early Warning Systems and Disaster Risk Information and Assessments to Measure the Achievement of Target G of the Sendai Framework for Disaster Risk Reduction

Barriers and incentives : Key areas in EU policies and link to Sendai priorities

Thus, the whole framing of Sendai is very aligned with the approach in NAIAD in several ways:

- First a shift in the policy approach at the global level from disaster management to disaster risk management: the goal is to prevent new and reduce existing disaster risks,
- Second through an all-of-society and focus on reducing vulnerability and increase resilience
- Third an all-hazards risk approach across economic, social, and environmental policy areas,

The EU Commission has identified several links to EU policies, including climate change adaptation, critical infrastructure protection, flood risk management, water and biodiversity protection, research and innovation and global health security, food and nutrition security. Particularly relevant here are the linkages established between Sendai and the EU action Plan (table 5).

Table 4. Key areas of Sendai and links to current EU policies

Key Area 1 – Building risk knowledge in all EU policies (Sendai Priority 1 "Understanding disaster risk")	•*Promote the collection and sharing of baseline loss and damage data* •*Use foresight, scenarios and risk assessments for better preparedness to existing, emerging risks and new types of risks* •*Further engage with the research community to better address disaster risk management knowledge and technology gaps and to encourage stronger science-policy interface in decision-making*
Key Area 2 – An all-of-society approach in disaster risk management (Sendai Priority 2	•Explore the potential of educational measures for reducing disaster risks

"Strengthening disaster risk governance to manage disaster risks")	*•Facilitate exchange of good practices and improvements in disaster management policy and operations through mutual learning and expert review* *•Work with stakeholders, including local authorities, civil society and communities, to develop specific strategies for risk awareness that include the most vulnerable groups, such as children and youth, elderly, persons with disabilities and indigenous people* *•Cooperate with the private sector to encourage business-driven innovation in all areas of disaster risk management* *•Strengthen the links between disaster risk management, climate change adaptation and biodiversity strategies* *•Reinforce the links between disaster risk management, climate change adaptation and urban policies and initiatives* *•Support the development of inclusive local and national disaster risk reduction strategies, with active engagement of active engagement of local actors - authorities, communities and civil society* *•Assist regional organisations in supporting national authorities to implement the Sendai Framework, including the development of National and Regional platforms for disaster risk reduction*
Key Area 3 - Promoting EU risk informed investments (Sendai Priority 3 "Investing in disaster risk reduction for resilience")	•Promote risk-informed investments in all EU external financial instruments, including multilateral and bilateral development assistance •Track investments in disaster risk reduction in all humanitarian and development assistance programmes *•Promote risk-proofed investments in the EU, including in the context of the Investment Plan for Europe* *•Promote the use of mechanisms for disaster risk financing, risk transfer and insurance, risk-sharing and retention* *•Foster and implement ecosystem-based approaches to disaster risk reduction*
Key Area 4 - Supporting the development of a holistic disaster risk management approach (Sendai Priority 4 "Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction")	•Develop good practices on the integration of cultural heritage in the national disaster risk reduction strategies to be developed by EU Member States •Enhance preparedness and response capacities for disasters with health consequences and cooperation between health authorities and other relevant stakeholders *•Facilitate capacity building of local and national authorities and communities and other actors in managing disaster risk* •Support the development and better integration of transnational detection and early warning and alert systems for better disaster preparedness and response action *•Integrate the "Build Back Better" objective into the assessment methodologies, projects and standards for disaster risk management and resilience*

(NOTE: marked in italic those linked to NAIAD)

Another important driver is the need to report on 7 agreed global targets, most of which should be achieved by 2030 on specific targets and indicators measured globally by appropriate indicators to contribute to the implementation of the priorities. The EU itself, thus an important driver for EU policy identifies “a broader, introducing new focus areas such as ecosystem conservation and restoration”.

Equally at the national level countries have already made by voluntary commitments by Governments[vi]. Table 6 outlines a list of the ones that have been made by the national governments included in NAIAD and other relevant voluntary commitments from other stakeholders like the private sector, NGOs, local communities, science organizations, etc.

Table 5. Political and Voluntary commitments made under Sendai relevant to NAIAD

Government	Type	Goal	Scope	Title
Netherlands, the	Central Government	Goal 1 - Risk prevention	National	Commitment on behalf of the Government of the Netherlands towards the implementation of the post 2015 DRR framework for action
Slovenia	Central Government	Goal 1 - Risk prevention	National	Government of Slovenia
France	Central Government	Goal 3 - Strengthening resilience	Global	French commitments

Organization	Goal	Scope	Title
CANEUS (Canada-Europe-US-Asia-Africa) Organization	Goal 1 - Risk prevention	Global	New Global Framework for Sharing of Space Technology and Data Standards to Serve Nation's Disaster Management Needs: Bridging the "Gap" between the "haves" and "have-nots"
INTERNATIONAL SOCIETY OF CITY AND REGIONAL PLANNERS (ISOCARP)	Goal 2 - Risk reduction	Global	Promote the Integration of Hazard, Risk and Climate Change Information into City and Regional Planning
International Steering Committee for Global Mapping (ISCGM)	Goal 3 - Strengthening resilience	Global	Launching of a web portal of urban hazard maps of major cities in the world to monitor the progress of their development
Oasis Loss modelling Framework	Goal 3 - Strengthening resilience	Global	A portal for the distillation and dissemination of environmental data.
Observatoire National des Risques Naturels (ONRN)	Goal 3 - Strengthening resilience	National	A PPP platform for risk data sharing and participative governance: the French National Observatory for Natural Risks (ONRN)

New directions/new trends : Sendai targets and indicators, terminology and measures

The main output relevant to NAIAD is the incorporation of the reporting framework for Sendai at national level[vii], and how this could be downscaled at demo level. Equally crucial is the shift in focus towards both prevention and the systemic approach towards resilience. These indicators for example are relevant to D4.3. on damage costs (and terminology). Also relevant are definitions around

infrastructure and basic services, included in Annex 1. These indicators and definitions can be incorporated into the NAIAD modelling and glossary initiatives.

Also in terms of terminology, Sendai can offer guidance on the concepts of both infrastructure and basic services to be incorporated into our analytical framework of IVE policy frames (see Annex 1 for a review on SENDAI terminology). In addition, and highly relevant for the development of the NAIAD methodology, it makes a distinction between structural and non-structural measures[viii]

Structural measures are any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems. Non-structural measures are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education.

Annotation: Common structural measures for disaster risk reduction include dams, flood levies, ocean wave barriers, earthquake-resistant construction and evacuation shelters. Common non-structural measures include building codes, land-use planning laws and their enforcement, research and assessment, information resources and public awareness programmes. Note that in civil and structural engineering, the term "structural" is used in a more restricted sense to mean just the load-bearing structure, and other parts such as wall cladding and interior fittings are termed "non-structural".

3.2 Revision of EU Adaptation strategy

Current status and core policy messages: 3 objectives and 8 actions

The EU Adaptation Strategy was formally adopted in 2013. It is currently undergoing a process of review (including a public consultation) on its actual implementation and performance on experience gained, lessons learnt to assess if it has matched expectations.

The EU Adaptation Strategy had three main objectives, which would be implemented through 8 actions as can be seen in Table 7.

Table 6. EU Adaptation strategy objectives and actions

1) *Promoting action by member states*: To promote action by member states to achieve coordination and coherence of different levels and planning (akin to multilevel governance)
    a. Action 1: encourage member states to adopt compregensive adaptation strategies
    b. Action 2: Provide LIFE funding to support capacity building and step up adaptation action in Europe (2013-2020)
    c. Action 3: Introduce adaptation in the Covenant of Mayors framework (2013/2014)
2) *Better informed decision making*: To improve adaptation knowledge that can support decision making
    a. Action 4: Bridge the knowledge gap
    b. Action 5: Further develop Climate ADAPT as the one stop shop for adaptation in Europe
3) *Climate proofing EU action*: To climate proof EU action mainstreaming adaptation into EU policies and for key vulnerable sectors
    a. Action 6: Facilitate climate proofing the CAP, the CFP and the Cohesion policy
    b. Action 7: Ensuring more resilient infrastructure
    c. Action 8: Promote insurance and other financial products for resilience investment and business decisions

The results of the review focus on the relevance, effectiveness, efficiency, coherence and EU added value of the strategy (see annex 2) and will be published during 2018.

Barriers and incentives: review of progress on the main actions identified in the Strategy based on national scorecards

In relation to NAIAD and institutional analysis, a number of actions and their implementation are key, namely

- Action 1 (national adaptation strategies),
- Action 3 on the Covenant of Mayors (for NAIAD city demos),
- Particularly relevant to consider Action 4 (knowledge) on new evidence to be generated on potential costs savings from the IVE
- Action 7 on resilience infrastructure which would consider green infrastructure and nature based solutions as part of the portfolio of options
- Action 8 on the role of insurance.

This section thus summarises the results obtained from these actions as these relate to NAIAD´s goals and objectives in setting the policy frame.

Action 1: Member states adaptation strategy

Here a comparative summary of the adaptation scorecard for the countries that host NAIAD Demos is presented. Please note that the Commission itself clearly states that it is necessary to read the full report for each of these aspects and that it has no comparative value across countries but rather it has value as to the country itself in its own policy context.

It is however relevant to note the pattern that emerges in terms of gaps overall and which is where additional research can help shed light or indeed help strengthen these weaker areas. The areas were most countries score badly can be seen in the table below.

Table 7. Adaptation scorecard in NAIAD´s DEMO countries

STEP	AREA	INDICATORS	SP	UK	FR	SLO	DK	NT	RU
Step B: Assessing risks and vulnerabilities to climate change	***Current and projected climate change***	Climate risks/vulnerability assessments take transboundary risks into account, when relevant							
Step C: Identifying adaptation options	***Identification of adaptation options***	The selection of priority adaptation options is based on robust methods (e.g. multi-criteria analyses, stakeholders' consultation, etc.) and consistent with existing decision-making frameworks							

	Funding resources identified and allocated	Mechanisms are in place to coordinate disaster risk management and climate change adaptation and to ensure coherence between the two policies						
		Funding is available to increase climate resilience in vulnerable sectors and for cross-cutting adaptation action						
Step D: Implementing adaptation action	***Mainstreaming adaptation in planning processes***	Prevention/preparedness strategies in place under national disaster risk management plans take into account climate change impacts and projections						
		Key land use, spatial planning, urban planning and maritime spatial planning policies take into account the impacts of climate change						
		National policy instruments promote adaptation at sectoral level, in line with national priorities and in areas where adaptation is mainstreamed in EU policies						
		Adaptation is mainstreamed in insurance or alternative policy instruments, where relevant, to provide incentives for investments in risk prevention						
		Adaptation policies and measures are implemented, e.g. as defined in action plans or sectoral policy documents						

As can be seen in the table there are several areas highly relevant to NAIAD where **most cases need further work.** The valuing of IVE through NBS is related to the importance of prevention (and in line with Sendai, as seen below) and with the idea of prevention pays.

- Prevention/preparedness strategies in place under national disaster risk management plans consider climate change impacts and projections

Three are related to sectoral integration of adaptation, namely:

- National policy instruments promote adaptation at sectoral level, in line with national priorities and in areas where adaptation is mainstreamed in EU policies
- Adaptation policies and measures are implemented, e.g. as defined in action plans or sectoral policy documents
- The integration of climate change adaptation in sectoral policies is monitored and the results of the monitoring are disseminated

One refers to the participation of key stakeholders:

- There are processes for stakeholders' involvement in the implementation of adaptation policies and measures.to provide incentives for investments in risk prevention

And finally, and particularly relevant for NAIAD, one refers specifically to insurance:

- Adaptation is mainstreamed in insurance or alternative policy instruments, where relevant,

Action 3: Introduce adaptation in the Covenant of Mayors framework (2013/2014)

Only some cities that participate in NAIAD have subscribed the Covenant of Mayors (see table 9), and only 2 (Rotterdam and Copenhagen) have also subscribed to the Mayors Adapt initiative. Thus an important element will be to follow up with the relevant municipal office on current actions to implement the Mayors Adapt. This is also because it is deeply connected with the implementation of the EU Urban agenda (see below) which most cities in Europe are currently in the process of implementing.

Table 8.Signatories to the Covenant of Mayors

Signatories	Population	Adhesion date	Mayors Adapt
Rotterdam, NL	600000	2009	yes
Nice, FR	520000	2009	no
Nice Côte d'Azur, FR	525000	2008	no
Copenhagen, DK	528208	2009	yes
Ljubljana, SI	269972	2009	no
London, GB	7800000	2009	no
Valladolid, ES	325000	2011	no

For example, and surprisingly, neither Montpellier nor Lodz appear listed as signatories to the Covenant of Mayors. In the case of Medina del Campo we have the capital of the province, Valladolid, which is a signatory and could possibly act to draw other cities in the province to commit.

Other actions:

Action 4 on Bridging the knowledge gap will not be discussed in this context, since it is the subject of the project by linking it to. **Action 7: Ensuring more resilient infrastructure** through the incorporation of green infrastructure and the nature based solutions.

Whereas **Action 6: Facilitate climate proofing the CAP, the CFP and the Cohesion policy** is discussed below under the section on ESIF.

New directions/new trends : zooming in on actions on prevention and insurance

An important element is the current review of the Multiannual financial framework (2014-2020) where at least 20% of the EU budget are earmarked to support adaptation and mitigation. Here we include

the results from the scorecard on actions related to prevention and insurance as important policy trends that NAIAD can build upon at country level.

Action 8: Promote insurance and other financial products for resilience investment and business decisions

In Annex 2 the main results from the scorecard are summarised as it relates to two central themes in NAIAD: prevention and insurance for The Netherlands, Denmark, Romania, UK, Spain, France, Slovenia and Poland.

3.3 Sustainable Development Goals (SDGs)

Current status on SDGs implementation

In 2015 world leaders, at the 70th GA of the UN on 25th September 2015, adopted the 2030 Agenda for Sustainable Development which includes 17 Sustainable Development Goals (SDGs) and 169 targets. SDGs are global in nature and universal in their application, and are all interlinked, to achieve by countries and stakeholders. The EU was instrumental in shaping the 2030 agenda, which is fully aligned with Europe´s vision (see table 10) and thus the EU has committed to implement the SDGs both in its internal and external policies.

Table 9. Link between SGGs agenda and current EU policy actions

The 2030 Agenda Sustainable Development Goals	
Goal 1. End poverty in all its forms everywhere	Europe 2020 Strategy
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Reformed CAP: three objectives - viable food production, sustainable management of natural resources and climate action, and balanced territorial development. FOOD 2030- research and innovation on food and nutrition security Fund for European Aid to the most Deprived the EU supports Member States' actions (safe and nutritious food)
Goal 3. Ensure healthy lives and promote well-being for all at all ages	Legislation and other initiatives on public health, health systems and environment related health problems (including air quality, chemicals and waste)
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Europe 2020 headline targets on the number of early school leavers and on tertiary educational attainment. Skills Agenda Education and Training 2020 strategic framework for peer learning and exchange Erasmus+ programme
Goal 5. Achieve gender equality and empower all women and girls	Gender equality is enshrined in the EU political and legal framework since the onset
Goal 6. Ensure availability and sustainable management of water and sanitation for all	
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all	Package initiatives clean energy transition Energy Union 2030 Climate and Energy policy framework -2030 targets (reduce greenhouse gas emissions, improve energy efficiency ; increase share renewable energy)
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Labour policies : labour market disparities across Member States remain large compared to the pre-crisis period challenges as regards youth unemployment and unemployment of disabled persons remain in several Member States

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Investment Plan for Europe (strategic investments in key areas such as in infrastructure, research and innovation + risk finance for small businesses) European Structural and Investment Funds investments in infrastructure and research and innovation. Connecting Europe Facility- transport, telecommunications and energy. Framework Programme for Research and Innovation (Horizon 2020) 2016 European Innovation Scoreboard
Goal 10. Reduce inequality within and among countries	EU's social agenda cohesion policy.
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	The Urban Agenda The EU Covenant of Mayors for Climate and Energy
Goal 12. Ensure sustainable consumption and production patterns	resource efficiency and circular economy actions (decouple economic growth from resource use and environmental degradation). Sustainable consumption - consumer policies awareness + informed choices contributing to sustainability.
Goal 13. Take urgent action to combat climate change and its impacts*[ix]	there is a political commitment of devoting at least 20% of the EU budget to climate action.
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	strongly science-based Common Fisheries Policy. Joint Communication on International Ocean Governance
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	The Birds and Habitats Directives the expansion Natura 2000 network of protected areas to 18% of EU land has been an important achievement. EU targets of halting biodiversity loss by 2020 and restoring at least 15% of degraded ecosystems.
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	Treaty on European Union EU Charter on Fundamental Rights
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	"Trade for all strategy" adopted right after the UN 2030 Agenda, commits the EU to a responsible trade and investment policy as an instrument of SDG implementation contributing to boosting jobs, sustainable growth and investment in Europe and outside

The EU sustainable development strategy was launched in 2001, revised in 2006, reviewed in 2009 and updated in 2016 to align with the SGDs agenda, with the goal that sustainable development be mainstreamed in the Europe 2020 strategy[x]. The EU´ has two work streams to implement the 2030 agenda. First, through the integration of the SDGs into the European policy framework and policy priorities and a second stream to work on "reflection work on further developing our longer-term vision and the focus of sectoral policies after 2020, preparing for the long term implementation of the SDGs. The new Multiannual Financial Framework beyond 2020 will also reorient the EU budget's contributions towards the achievement of the EU's long-term objectives" (COM (2016, 239, p.3).

There are specifically SDGs related to water (SDG6), climate (SDG 13), SDG 15 (habitats) and SDG 9 (resilient infrastructure).

Specifically, the EU as part of its Development policy has developed the GCCA+, a seven-year thematic flagship programme to help the world's poorest and most vulnerable places to facilitate the transition to a climate resilient low-carbon future.one of the world's largest climate change funds, that supports adaptation and mitigation efforts in Least Developed Countries (LDCs) and Small Island Developing States (SIDS). It currently supports climate change programmes in 38 countries and 8 regions and subregions around the world with a variety of partners to leverage its financial resources including

national and local governments, regional organisations, non-governmental organisations, academic and scientific institutions, plus local representations of international organisations, multilateral and bilateral development agencies. It specifically looks at the impacts of climate change.

The more direct link to ecosystems and nature-based solutions is under SDG 15 Goal 15 to Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Meanwhile SDG 9 refers to Resilient Infrastructure. This is relevant because the EU here makes specific reference to blended finance "Blending, which combines EU grants with loans or other public and private funding, is increasingly supportive of actions on infrastructure which have a multiplier effect on sustainable development in partner countries". Equally under SDG 11 on Sustainable cities reference is made to "disaster prevention and preparedness and how the EU promotes sustainable urbanisation as a basic tool to enhance more effective development at local level". (see later under Section on the Urban Agenda).

The SDGs have implications both internally and externally. Internally as all EU member states will have to report on Agenda 2030. Externally it has a key role due to its current integration on the EU development policy.

Figure 3. The 17thSustainable Development Goals

Barriers and incentives from the SDGs implementation : complex framework

According to UNISDR (2015) there are references to DRR in the Declaration and Goals and Targets sections related to "poverty, ending hunger, ensuring healthy lives, education, sustainable

management of water, building resilient infrastructure, resilient cities, climate change and marine and terrestrial ecosystems".

Nature based solutions to reduce the risk of a disaster or hazard represent therefore a path towards achieving SDGs. In a recent session at World Water Day based on the "ecosystems theme", the advantage of the multiple benefits of integrated green and grey solutions was raised. Looking at it from a different point of view, the implementing framework of the SDGs is a potential incentive to mainstreaming NBS and ecosystem services.

The main barrier at the moment is the complex framework for reporting, done at member state level, the incentive however as stated earlier is how a co-benefits approach from the adoption of NBS could

help comply with Agenda 2030. Annex 3 includes the list of goals, targets and indicators that could potentially be incorporated into NAIAD as part of the SDG reporting framework.

New directions/new trends : EU Commision 10 priorities and SDGs indicators

The commission has identified 10 priorities for action for the Commission for the period 2017-2019, which marks the main political focus of action and priority (table 11). In terms of new directions and trends, an Annex has been included that lists the current list of indicators that could be applied to NAIAD. This links to the work on Task forces of the NAIAD clustering process, and the meeting at Tallin where the different projects recommended adding these indicators to the list of EKLIPSE indicators, since the SDGs indicators will have to be reported on by all countries.

Table 10. EU priority actions related to SDGs

EU PRIORITY	SDGs	Initiatives
Priority 1. A new boost for jobs, growth and investment" is directly delivering on various SDGs and addressing key sustainability challenges Europe faces.	SDG 8,9, 12 and 13	Investment Plan for Europe European Fund for Strategic Investments (EFSI) by 2020. EFSI 2.0 COM (2016) 581 final
	SDG 6, 8, 9, 11, 12, 13, 14, 15	Circular economy including monitoring framework (2017) + platform to support the financing of the circular economy to scale up investment
	SDG 6	To promote safe reuse of treated wastewater, minimum requirements for reused water will be set.
	SDG 12	Action on sustainable food systems and preventing food waste will be taken through the EU Platform on Food Losses and Food Waste, to support the UN target of halving per capita global food waste by 2030. Targeted action is planned to facilitate food donation and the safe use of food not suited for human consumption for production of animal feed as well as more effective date marking on food.
	SDGs 6, 14, 15	Implementation of the EU's environmental acquis remains vital for long-term sustainability 7th Environment Action Programme, maintenance and improvement of our natural resource base is also essential for our economic sectors to deliver their services, e.g. agriculture, fisheries or energy.
	SDG 17	Tracking of progress of environmental objectives through the Environmental Implementation Review simplify environmental reporting, facilitate access to justice, and support environmental compliance in Member States
	SDG 2 + SDGs 8, 12, 6, 13 and 15	Agriculture plays a substantial role in the 2030 Agenda Agricultural Policy to maximize its contribution to the Commission's ten priorities and to the Sustainable Development Goals any sustainable future as it is intrinsically linked to issues such as jobs, food, air, climate change, water, soil and biodiversity simplification and modernization of the Common
Priority 3. A resilient Energy Union with a forward-looking climate change policy", the EU has adopted a clear 2030 framework and is actively working	SDG 13	The 2015 Paris Agreement is a historically significant landmark in the global fight against **climate change** a success for the world and a confirmation of the EU's path to a low-carbon and climate resilient economy. The EU has set an ambitious economy-wide domestic target of a reduction of greenhouse gas emissions of at least 40% for 2030. The target is based on global projections that are in line with the medium term ambition of the Paris Agreement. The EU will continue to lead by example and by action on regulatory policies to reduce emissions, strengthen climate change adaptation and disaster risk management, but also on enabling factors that accelerate public and private investment in innovation and modernisation in all key sectors. The low-emission mobility strategy contributes to achieving a competitive and resource efficient transport system. On aviation and shipping, the EU played a leading role in the global

towards the two relevant SDGs		agreements reached this year to tackle emissions. Proposals to accelerate the low-carbon transition, covering all sectors of the economy in the EU are being negotiated24.
Priority 4. A deeper and fairer internal market with a strengthened Industrial base", in particular the Capital Markets Union, a new and forward looking approach to ensure sustainable finance is taken forward, linked to several SDGs.	SDG 8, 9, 13, 14 and 15	**Sustainable finance** (G20 and in Europe, finance ministers, regulators and industry **Capital Markets Union** concrete initiatives for example on green bonds, promotion of long-term investments or the prudential aspects linked to the regulation of banks. increased transparency for investors on disclosure of non-financial and diversity information, including on environmental matters, social and employee aspects, respect for human rights, anti-corruption, bribery and other matters. Capital Markets Union mid-term review in 2017. a **coherent EU strategy on sustainable finance** : establish a high-level expert group to provide advice on developing an overarching and comprehensive EU strategy on sustainable finance, having particular regard to the challenges posed by climate and environmental risk to the financial system and the need to harness financial markets in responding to these challenges. The expert group will also reflect on how pertinent recommendations can be extended to other dimensions of sustainability. maintain international leadership in the development of sustainable markets. The Commission will follow up on this work in the
Priority 5. A deeper and fairer Economic and Monetary Union", in particular the European Pillar of Social Rights and action on Corporate Social Responsibility help to address the challenges of work in the 21st century as required by the SDGs.	SDG 8	inclusive and sustainable growth, employment and decent work (is more topical than ever for Europe. **European Pillar of Social Rights** aims at putting social fairness at the heart of EU policies. A set of key principles for the conduct of employment and social policies will help to take into account better new economic, social and demographic trends.
	SDGs 1, 3 and 10.	Health is one of the elements playing a role in boosting human capital in terms of productivity and labour participation. As a way to enhance upward social and labour market convergence, particularly within the euro area, the Pillar will help deliver on
	SDG 8	**Corporate Social Responsibility and Responsible Business Conduct** encourages the private sector to contribute to the achievement of social and environmental objectives, thereby fostering equitable and sustainable growth and the protection of social rights Throughout global supply chains EU policies contribute to more sustainable practices in forest management, better working and environmental conditions in textiles and ship recycling, combatting illegal fishing and trade in conflict minerals and endangered species. Responsible Business Conduct, focusing on concrete actions to meet current and future social, environmental and governance challenges, building upon the main principles and policy approach Commission's 2011 EU Corporate Social Responsibility Strategy.

3.4 Urban Agenda

Current status and core policy messages : an Urban agenda and an Urban water agenda 2030 for europe

According to Eurostat, 70% of EU citizens live in cities, 70% of EU legislation is implemented by cities, 70% of jobs are created in cities and 85% of GDP is generated in cities. This means the EU has prioritised actions in cities. Furthermore, it is estimated that over 80% of Europe's population will live in the urban areas by the middle of this century[xi]. The EU has thus generated a series of policy documents that directly or indirectly consider the urban environment (see Table 12)

Table 11. : List of relevant policy documents applicable to the Urban Agenda and urban areas in the EU (source : Orientation paper 2017)

Sustainable Urban Development in the EU: a framework for action (COM (98) 605)
Strategy on Urban Environment (COM (2005) 0718)
Leipzig Charter on Sustainable European Cities (2007)
The Declaration of Marseille (2008)
Green Paper on Urban Environment
Europa 2020 Strategy
The Toledo Declaration (2010)
EU Biodiversity strategy to 2020 (COM, 2011,244)
The Roadmap to a Resource Efficient Europe (COM(2011) 571)
The Charter of European Planning (ECTP-CEU, 2013)
The Communication on Green Infrastructure (COM 2013/0249)
7th Environmental Action Programme (2014-2020);
The Territorial Agenda of the European Union 2020 (2015/C 195/05) towards more sustainable Europe
The UN sustainable development goals (2015)
The Pact of Amsterdam (2016)
The New Urban Agenda (HABITAT III, 2016)

The Urban agenda of the EU is a joint effort between the Commission, the member states and european cities, which focuses on stregthening the urban dimension of European and national policies. It brings the EU in line with the UN New Urban Agenda approved in Habitat II. In line with the UN New Urban Agenda, the EU strengthens the resilience of urban settings through prevention of disaster and climate related risks (European Commission, 2016 p. 6). The EU Urban agenda is re-enforced by the EU Covenant of Mayors iniative as a bottom up initiative led by local and regional governments.

It has 3 main objectives and 8 principles (see Table 13). The objectives are: 1) Better regulation, better funding and better knowledge. By better *regulation* is meant a revision of existing new legislation to better include city needs; in the case of *funding* it looks at more opportunities for funding across EU policies, particularly under the Cohesion policy and in terms of knowledge to introduce and define the content of specific Climate Adaptation Better Funding Actions; for knowledge it seeks to increase the knowledge base and the promotion of big, linked and open data.

Table 12. Guiding principles of the EU Urban Agenda

- Multilevel governance: Each Partnership is composed by Local Authorities, Member States and representatives of European Commission
- Partnership: Urban Agenda Priority Themes are tackled by engagement in twelve different Partnerships.
- Integrated approach: Focus on all major aspects of urban development: economy, environment, social, territory and culture, to ensure a sound urban governance and policy.
- Sustainable urban development: Link with the 17 Sustainable Development Goals of the UN.
- United Nation Goals: Link with the New Urban Agenda (Habitat III) of the UN and the Climate Change Paris Agreement of the UNFCCC.
- Functional urban areas: The nature of Urban challenges are local but require wider territorial solutions and cooperation within their functional areas and with their surrounding regions.
- Urban-rural linkages: Complexity of urban challenge requires governance across administrative boundaries: urban-rural, urban-urban and cross-border cooperation.
- Cities of all sizes: Urban Agenda for the EU acknowledge the importance of Urban Areas of all size.

In addition to the EU Urban Agenda, the EU has also adopted the EU Urban water agenda 2030[xii], as a joint initiative of the European Commission and local governments to protect Europe's water resources and strengthen the implementation of European Union water policies by fostering sustainable urban water management water in cities. A declaration signed in Porto (2017) identifies cities as critical stakeholders in the implementation of the European Union water policy that is aiming at a good status of all water bodies.

The Urban water agenda has also identified the following barriers or pressures for local governments:

- An ageing infrastructure in water, waste water and stormwater management systems;
- Inefficiencies caused by water leakages, over-abstraction, and wastewater treatment effluents;
- Impacts of climate change, including an increasing occurrence of extreme floods and droughts and more widespread water scarcity;
- A deteriorating water quality due to primary substances, pharmaceuticals, and upstream agricultural pollution.

Barriers and incentives : climate change adaptation partnership and the sustainable land use and nature based solutions partnership

It has identified 12 priority themes of which 2 are directly relevant to NAIAD and will be analysed here as potential incentives; namely the focus on Climate adaptation, and the focus on Sustainable use of land and nature-based solutions. The Pact of Amsterdam signed on 30 May 2016 meant the kick off of the implementation of the Urban agenda process, with the launch of a series of partnerships in 12 thematic areas with their respective action plans.

Climate Change Adaptation Partnership

The Climate Adaptation Partnership has identified as a general objective: “to anticipate the adverse effects of climate change and take appropriate action to prevent or minimise the damage it can cause

to Urban Areas. The focus will be on: vulnerability assessments, climate resilience and risk management (including the social dimension of climate adaptation strategies). The Partnership has identified the incidence of climate related extremes on all natural disasters as particularly important (EEA, 2017[xiii]) since these represent 90% number of events, 77% of all fatalities, 82% of economy losses and 97% insured losses.

The group has identified 3 main areas namely a) governance (political cycle, mandate, integrated strategic planning, decision-making, experienced staff) b) knowledge (data, expertise, methodologies, tools, risk assessment, indicators, capacity building, hazard/exposure, vulnerability analysis) and c) resources (funding, people, cost-benefits analysis, climate adaptation monetizing). Also 3 transversal issues to focus on: a) monitoring and indicators (looking at parameters like model uncertainty, high resolution climate scenario, local level indicators); b) communication (R&I stakeholders' engagement, dissemination and public education, local action groups and communities involvement) and c) sectorial impact in sectors related to the biosphere and the anthropic systems.

In terms of barriers or as described by the group "bottlenecks/potentials" the Working Group has identified and ranked them based on a questionnaire (0 to 5):

- 1. Climate change adaptation is only in the mandate of city environmental departments- 3,45
- 2. Too many tools and templates exist on adaptation to climate change, making it difficult for cities to find their way- 2,62
- 3. The different time horizons of political cycles and climate adaptation policies 3,43
- 4. Barriers to obtaining needed data- 3,45
- 5. The communication used to 'spread the word' about climate adaptation policies aren't suited to their target audience. 3,20
- 6. Conflicting budget priorities within local authorities. 3,68
- 7. Insufficient resources and time/scale to finance projects 4,20
- 8. Lack of capabilities and resources within Local Authorities to draft SECAPs 3,17

Sustainable Use of Land and Nature-Based Solutions (SUL-NBS) Partnership

A relevant partnership for NAIAD and IVE is the SUL-NBS partnership, which has as its main objective to ensure the efficient and sustainable use of land to help create compact, liveable and inclusive European cities for everyone. It has two main topics: 1) Liveable compactness and 2) Nature-based Solutions in urban areas.

The partnership has identified the following main issues:

- the lack of overarching European Land Use Policy;
- inefficient or poor data on spatial development and its use for urban governance and efficient tools for planning and re-use of land. Mostly it relates to urban sprawl which is broadly analyzed but there is no comprehensive analysis, in particular, which EU policies and policies at national level exacerbate or limit urban sprawl;
- insufficient capacity of urban municipalities and their planning services to deal with complexity of socioeconomic and spatial development and its interconnections;
- shortcomings or lack of efficient regulatory or financial instruments integrating multi-functional and circular management of land use in urban governance (at level of district, city or functional urban area), and combining spatial planning with socio-economic development,

the spatial mismatch between the de facto urban territories (administrative borders of cities) and the de jure city borders (functional urban areas);

- lack of effective regulatory and fiscal incentives to attract private investments on brownfields
- lack of knowledge/capacity of staff & human resources in municipalities dedicated to implementation mechanisms for unlocking development on brownfield land – e.g. EU funding, blending various financing instruments;
- nature-based solutions are not high on agenda of urban authorities due to low awareness of its social and economic benefits (i.e. positive effect on people's health, reduction of flood risk, air quality, urban biodiversity, public health and well-being).

The last one is particularly relevant for this report, since it identifies as a key challenge "Protection of urban green areas and promotion of nature-based solutions for the environmental protection".

Thus in relation to the topics of NBS, the Orientation paper (2016) of the Group has identified nature-based solutions (NBS) associated to healthy ecosystem functions while protecting the environment and providing sustainable socio-economic benefits.

The group has identified how implementing NBS means greater room for green/blue spaces and infrastructures within the city, which contributes to both a compact and sustainable city model, "by mitigating, e.g. urban heat islands, Wateral risks due to soil sealing, air pollution, lost of ecological heritage, etc".

Thus the partnership aims to:

1) review and understand the processes of suburbanization and the role of nature-based solutions within the current development processes and the regeneration of the existing city;
2) formulate specific concepts and modes of action regarding sustainable use of land and implementation of the nature-based solutions within urban areas as well as concrete proposals for territorial instruments and funding;
3) identify best practices in innovative urban development across Europe

In particular it makes special emphasis on land and soil, since "land is a non-renewable and scarce resource, more and more Member States and regions need to start to develop spatial development policies to reduce land take and to bring an end to soil sealing". Also how "Nature-based solutions should be integrated into broader urban land use planning";

Introducing and developing these concepts require, in many cases, employing innovative tools and policy approaches, like e.g. developing incentive-based and financial instruments able to support effective spatial and urban policies. In terms of funding.

The implementation of NBS solutions results "in many benefits for the environment, economy and society, and they offer an opportunity to turn challenges that urban areas face into innovation opportunities. Nature based solutions may contribute to sustainable urbanisation and improving well-being in urban areas, including restoration of degraded ecosystems, urban regeneration and adaptation to climate change. For instance, to reduce pollution and increase liveability in cities, networks of green areas and waterfronts in cities are important due to the ecosystem services that they provide and should thus be preserved". This approach is relevant to NAIAD because it inherently considers co-benefits of NBS, with the aim of enhancing "the evidence base on the social, economic and environmental benefits of nature-based solutions referring to e.g.: health impacts (i.e. decreased

air pollution, increased physical activity), social benefits (i.e. crime reduction, inclusion), climate adaptation and climate related risk reduction"…"solutions based on urban green infrastructure are cost-effective, environmentally friendly and multifunctional; can be seen as complementary, and in some cases cost effective comparing to standard "grey" solutions". (p. 9).

The partnership will also focus on the comparison between traditional and grey infrastructure, and green and nature-based solutions. Moreover it will investigate the limits of nature-based solutions, understanding the transferability to different geographies and regulatory environments, and the impact on the overall attractiveness of a city (tourism, circular economy, attracting business, developing socially responsible businesses, making cities attractive for the high-skilled labour).

New trends and pointers for NAIAD´s work building on the Urban Agenda: funding, regulation and knowledge

The SUL-NBS partnership has identified a number of topics and subtopics (see below) in its Orientation paper which gives several pointers that are relevant to the IVE approach in NAIAD.

Table 13. List of topics and subtopics of the SUL-NBS Partnership under the EU Urban Agenda (2017)

1. Liveable Compactness	1. Polycentric urbanization, functional urban areas and rural urban interface 2. Social, economic and physical regeneration of urban neighbourhoods through the compact city model 3. Redevelopment of brownfield and re-edification and reuse of vacant and underutilized land
2. Nature-based solutions in urban areas	1. Ecosystem services 2. Green and blue infrastructures 3. Framework conditions for NBS and resilience projects
3. Tools and policy approaches	1. Urban governance and territorial instruments, regulations and policies 2. Participation and citizens/civil society engagement. 3. Improvement of existing infrastructures/new infrastructure for resilient cities 4. Financial models, financing mechanisms and business cases (finance)

In relation to *funding* it states: "the discussions around "financing NBS" should be moved to "How can NBS be made attractive for financing". The paper identifies that often is not lack of finance but rather of decision makers and citizens as key agents for adoption of NBS[xiv]. It also refers to innovative financing schemes like the the EIB-EU blending instrument called Natural Capital Financing Facility. It refers to city investment programmes based on grant-loan blending and revolving funds, new territorial instruments, and strategies designed for attracting private investment. It specifically identifies understanding the current incentive framework to align or create incentives to integrate the spatial planning of self-government units (municipalities, or districts) within urban functional areas. Also how to encourage strategies for attracting private investment keeping and thus the implementation of nature-based solutions funded by private actors.

In relation to *regulation*, it points to the key link to *urban planning and compact design*[xv]. In the context of NAIAD however this means good linkages to flood planning, since compact design without integrating risk could in fact aggravate the problem. It makes specific reference to the possibility to introduce conditionality in EU regulations in the spending cohesion funds for integrated urban development with fiscal policies that steer the market towards urban planning goals that incorporate nature-based solutions. For example, in the regeneration, protection and preservation of soil to avoid urban sprawl, avoiding soil compaction and adopting a multi-functional approach to soil.

In relation to *knowledge* an important aspect is that it also makes a specific point of making the most of existing infrastructure first, before considering new infrastructure, to avoid the externalisation of costs from new development in private property land. This gives clear pointers of understanding the IVE of existing green infrastructure, or of proper maintenance of existing green infrastructure. It refers to "re-infrastructuring" the city in the context of inner "redevelopment" with examples with nature based solutions (like "rainwater harvesting") or to technical solutions (like "drainage systems") where "Climate change is obliging us to redefine the basis of the design of city infrastructures such as the drainage system, the transport networks or parking spaces (p.11)

Follow the sustainable development principles (…) achieve maximum effects for minimum costs (not only financial costs, but also costs related to other resources, e.g. open space, natural resources). The basic rule should be the maximum use of the existing infrastructure (which might sometimes require minor investment undertakings or modification of the system to tap this potential). Only when these actions result to be insufficient, a new investment should be planned (…) also explore concrete examples of how investing in existing infrastructure can be more cost-effective than investing in new infrastructure that often encourages further land take.

The table below summarises the main focus identified for action by the SUS-NBS Partnership and how NAIAD could take it into consideration for the IVE. In addition, the 7th Environmental Action Programme has included urban issues under Priority Objective 8, entitled, Sustainable Cities: "Working together for Common Solutions".

Table 14. Regulation, funding, and knowledge: best practice, adoption and recommendations.

Objective	Action	Relation to IVE
Better Regulation	1. Identify good practices in regulation; 2. Identify to what extent these practices are general nature and/or replicable across Europe; 3. Formulate recommendations regarding policy alternatives.	Look at legislation at EU and member state level (like in this report). Focus particularly on recommendations based on barriers and incentives
Better Funding	1. Identify the best practices in funding schemes; 2. Identify to what extent these practices are general and/or replicable across Europe; 3. Formulate recommendations regarding alternatives in funding schemes.	Next deliverables related to current funding and finance and innovative funding and financing schemes (as well as their link to institutional arrangements)

Better Knowledge	1. Identify the best practices regarding knowledge creation, sharing and dissemination; 2. Identify to what extent these practices are of universal nature and/or replicable across Europe; 3.Formulate recommendations –regarding best possible modes of making the knowledge available to all key stakeholders. 4.Explore the role of existing data: GIS / spatial data infrastructure / remote sensing / statistics[xvi]. 5. Standarize vocabulary base[xvii] 6. Identify the main projects, data sources concerning land take and nature-based solutions	Zoon on urban demos in relation to tools being developed. Look at current standards, apply current standards (on data etc) and if possible go beyond current standards as they relate to the IVE.

In Annex 4 we include a list of data bases and work in progress that the cities considering IVE should integrate in the design of tools and methods.

3.5 CAP and Rural Development Policy

Current status and Core Policy messages

Cohesion Policy

Through the European Structural and Investment Funds - is the EU's main investment policy, aiming to achieve economic, social and territorial cohesion by reducing disparities between the levels of development of the various regions. It contributes to the Europe 2020 strategy and to the diverse development needs in all EU regions with EUR 350 billion for the period 2014-2020. Also the EU Framework Programme for Research and Innovation, Horizon 2020, is cross-cutting and funds projects underpinning many SDGs (European commission, 2016 p. 7).

During the past decades, the Common Agricultural Policy has shifted from price and production support towards measures for direct income aid and rural development, including environmental protection and sustainability. CAP payments are the incentives to ensure that farmers engage in a deliver a competitive agricultural sector, while at the same time ensuring a sustainable farming activity while contributing to rural development.

The CAP:

CAP spending primarily takes the form of direct payments to farmers (roughly 70 % of total CAP spending – which is close to 30 % of the EU's total annual budget). Direct payments (DPs) are paid fully from the EU budget and are made to farmers in the form of basic income support based on the number of hectares farmed. All farmers receiving direct payments must respect the environmental standards set by the EU, contributing to the sustainable management of natural resources and help contribute to the EU's wider efforts to tackle both the causes and effects of climate change. These standards are known as the **cross-compliance** set of rules**:**

- Statutory Management Requirements (SMRs): 13 legislative requirements written into EU law that concern public health, animal and plant health, the identification and registration of animals, environment and animal welfare.
- Good agricultural and environmental conditions (GAECs): Farmers are obliged to maintain their land in good agricultural and environmental condition (protecting the soil against

erosion, maintaining soil organic matter and soil structure, avoiding the deterioration of habitats, water management and safeguarding landscape features). The exact standards that farmers must meet in these cases are set at the national, not EU, level.

Non-compliance is sanctioned with payment reductions.

An additional layer of the direct payments system – known as **'greening'** – was first implemented in 2015 and covers more than 70% of farmed land. It conditions the granting of a significant share of direct payments to actions which are beneficial for the environment and for climate: crop diversification, maintenance of permanent grassland, and Ecological Focus Areas[xviii]. Member States have a choice of 10 standard elements that they can make available to farmers to fulfil their Ecological Focus Areas obligations on arable land.

Barriers and incentives

The CAP cross compliance and the three "greening" measures should encourage a wider uptake of actions which benefit biodiversity, soil, water and climate in different farming systems and in different biogeographic and climatic situations. However, there is evidence that farmers find it difficult to comply with the requirements of the different payments and it is not clear to what extent they are being adopted (European Court of Auditors, 2016). Control procedures and penalties associated with non-compliance may act as a disincentive to administrations to develop innovative schemes to encourage environmental land management or to farmers to enter such schemes (Hart *et al*, 2016)

New trends

The EU Common Agricultural Policy (CAP) is under a revision process, since in 2020a new period will start. In November 2017 the Commission published a Communication on the future of food and farming, where their opinion on CAP trend was stated. The food and agriculture sector is facing a global challenge, securing access to safe, healthy and nutritious food for a growing world population, while at the same time using natural resources more sustainably and making an effective contribution to climate change adaptation and mitigation. How the CAP will tackle the challenge is still unkown, but its budget could be reduced by 15 or 30%.

On its Communication, the EC explores some possibilities to support farmers while achieving environment and climate action:

- Support for farmers will continue through the system of direct payments.
- Climate change and pressures on natural resources will continue affecting farming and food production. The future CAP should reflect higher ambition as regards resource efficiency, environmental care and climate action.
- Encouraging the use of modern technologies to support farmers on the ground and provide greater market transparency and certainty
- Attention to the "socio-economic fabric" of rural areas;
- Greater focus on sustainable agricultural production, health, nutrition, food waste and animal welfare;
- Better use of research, innovation and technology, and financial instruments; and • a new delivery model based on greater flexibility and subsidiarity – giving Member States more responsibility for performance.

- Greater attention to encourage young people to take up farming, to be coordinated with Member States' own powers in such areas as land taxation, planning and skills development
- Address citizens' concerns regarding sustainable agricultural production, including health, nutrition, food waste and animal welfare
- Seek coherent action among its policies in line with its global dimension, notably on trade, migration and sustainable development
- Creating an EU-level platform on risk management on how best to help farmers cope with the uncertainty of climate, market volatility and other risks

Full legislative proposals on how concretely to meet the goals outlined in the Communication will be published by the Commission in the first half of 2018. From the Communication insights, more input from member states on setting the objectives and targets of the policy in expected. Therefore, member states will have to define the conditions that farmers must meet in order to respect the environment and the climate. Next steps will therefore come in hand with the new Multi annual Financial Framework of the Commission

3.6 EU Strategy on Green infrastructure[xix]

Core policy messages : a vision for a Green-T for europe

On 6th May 2013, the Commission adopted an EU wide strategy on Green Infrastructure to promote investments. It is committed to support and invest in Green Infrastructure. But, what is exactly Green Infrastructure according to this strategy[xx]? Green Infrastructure (GI) is a strategically planned network of natural and semi natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine áreas (European Commission, 2013). It includes:

- The network of green spaces in which and through which natural functions and processes are sustained.
- Interventions designed to conserve, improve or restore nature, natural functions and processes to secure multiple ecosystem services for human society.
- Integrating the conservation, improvement and restoration of nature, natural functions and processes into spatial planning and territorial development and sustainably delivering the associated benefits for human society.
- Methodologies and techniques that help us understand the value of the benefits nature provides to human society and mobilise the investments necessary to sustain and enhance those benefits.

The strategy is therefore focused on a range of policy areas that integrates regional development, climate change, building resilience to natural disasters, agriculture and forestry, eco-innovation, water policy, health and environment, promoting a multifunctional spatial planning.

An important vision is the deployment of green infrastructure in Europe, the so called TEN-G equivalent to the existing networks of transport, energy and ICT in the EU. Relevant to the IVE and

projects is for example, the Study on permitting and facilitating the preparation of TEN-T core network projects[xxi].

What incentives and institutional reforms are being promoted?

The Commission has mobilized several funds to promote GI throughout Europe, to carry out several actions such as integrating GI into key policy areas, improving the knowledge base and encouraging innovation in relation to GI, and assessing the opportunities for developing a Trans European network in terms of governance and financing mechanisms for GI.

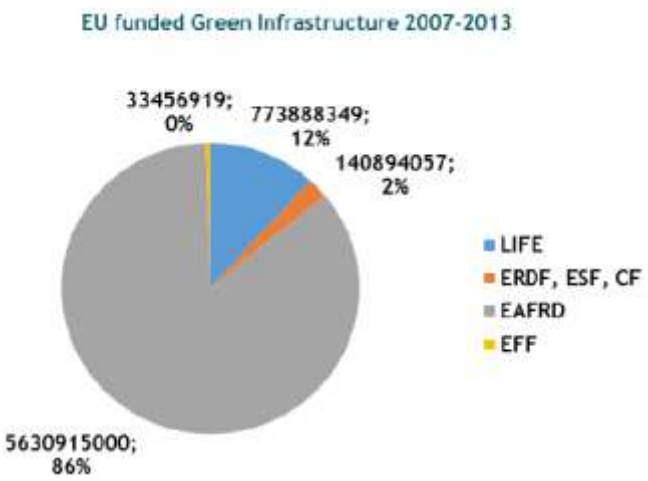

Figure 4. GI funding mechanisms. Source: European Commussion (2016)

According to European Commission (2016) during 2007-2013, the investment on green infrastructure by EU finance amounted to €6,579 million through various funding mechanisms (figure 4), namely: LIFE+; the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund; the European Agricultural Fund for Rural Development (EAFRD); and the European Fisheries Fund (EFF). It is estimated that during 2014-2020 green infrastructure will likely receive EU finance amounting approximately to €6,397 million by public EU funds.

There are different policies that help to promote GI, such as Natura 2000, providing a legal and organizational network to support ecosystem connectivity, and the Floods Directive promoting natural flood management. Other EU policies are integrating green infrastructure and working to harness its potential for agriculture and forestry (CAP, EU Forest strategy), climate change mitigation and adaptation (EU Adaptation Strategy), research (EU Research and Innovation policy agenda on Nature-Based Solutions and Re-Naturing Cities) or disaster prevention.

New trends : a wealth of baselines and methods on green infrastucture to be incorporated into NAIAD assessments

For institutional analysis, there a a number of documents listed in Annex 5 below that can act as baseline for the use of methods, methodologies etc, and that will be taken into account in the development of the assessment frameowkr and its application to the demos for the role of IVE in green infrastructure.

3.7 Nature action plan and EU Biodiversity Strategy to 2020[xxii]

To have more information on the laws on biodiversity and framework dedicated to ecosystem services, please visit the Biodiversity Information System for Europe (BISExxiii). It is an ongoing process

which gathered first elements related to implementation and mainstreaming of Green Infrastructure within the European Member States.

In 2011, the EU adopted an ambitious strategy setting out 6 targets and 20 actions to halt the loss of biodiversity and ecosystem services in the EU by 2020. In particular Target 2 of the EU Biodiversity strategy refered to: 'By 2020, ecosystems and their services are maintained and enhanced by including green infrastructure in spatial planning and restoring at least 15 % of degraded ecosystems'.
The aim is to contribute to the EU's sustainable growth and help mitigate and adapt to climate change. while promoting economic, territorial and social cohesion and safeguard our cultural heritage.
Linking with the Strategy on Green Infrastructure it aims to ensure ecosystems are better connected, within and between Natura 2000 areas as well as in the wider countryside. The strategy midterm review provides a detailed assessment of progress towards target to assess whether the EU is on track to achieve this objective[xxiv].

In addition, the Nature Action[xxv] was adopted after an evaluation of the Birds and Habitats Directives, as an "Action Plan for nature, people and the economy" in April 2017. It strengthens and supports the EU Biodiversity strategy to help reach the EU's biodiversity targets for 2020. The Action Plan focuses on four priority areas and comprises 15 actions[xxvi] to be carried out between 2017 to 2019. Several of those actions are directly relevant to urban green infrastructure: Actions 10, 12 and 13. TESS aimed to assist the integration of biodiversity information from the local level into planning and land-use decisions, while at the same time encouraging local people to collect such information in order to maintain and restore biodiversity and ecosystem services.

4 European legislation related to water risks and hazards

4.1 WFD and Blue Print

Status quo and core policy messages

The Water Framework Directive is an ambitious policy for the protection of all surface, groundwater and coastal waters adopted in 2000 (WFD, Directive 2000/60/EC). The WFD aims to protect and enhance the status of aquatic ecosystems and to promote sustainable water use. To achieve these ambitious goals, the Directive foresees the adoption of River Basin Management Plans (RBMP) and Programmes of Measures (PoMs) to reduce the pressures on aquatic ecosystems.

The Blue Print is the policy response to the challenges presented in the State of Water Report and aims to improve water policy and integrate it with other policies, such as the Common Agriculture Policy (CAP), the Cohesion and Structural Funds and the policies on renewable energy, transport and integrated disaster management

Barriers and incentives

While the concept of ecosystem services is not mentioned directly, the WFD clearly supports the protection of ecosystems to secure long-term availability of water resources and benefits from aquatic ecosystems" (Grizzetti et al., 2016)

The implicit incentives in the WFD for ESS assessment adoption are embedded in the following (based on Evers, 2013):

- EC-WFD counteracts a degradation of ESS
- implicitly integrates ESS in management and action plans in compliance with all aspects of sustainability
- Monitoring of ESS quantity and quality by inventories
- Readjustment to achieve the objectives

New direction [1]

The Blueprint to safeguard Europe's water resources (European Commission, 2012a) suggests to include ecosystem services in the cost-benefit analysis of water measures, and to adopt measures that foster ecosystem services for mitigating the effects of floods and droughts, such as natural water retention measures." (Grizzetti et al., 2016)

This is made explicit in the 2014 Policy note on the integration of ecosystem services assessment as support to WFD and FD implementation. This note states:

> "The selection of the most cost-effective PoMs is the area where the introduction of ecosystem service consideration could have the most significant impact on the decision-making process. "The comprehensive consideration of all relevant ecosystem services could mean that measures which deliver multiple benefits and which maintain the integrity of the ecosystem to deliver services may come out better in the assessment and improve their ranking. They typically provide additional benefits such as increased flood protection, increased biodiversity preservation and some also recreational opportunities. The inclusion of such co-benefit considerations is one main advantages of integrating ecosystem services considerations in a more systematic way."

4.2 Floods Directive

Status quo and core policy messages

The Floods Directive (EC-FD 2007/60/EC), came into force in 2007 as a framework for the assessment of flood risk in EU Member States. Its main goal is to reduce floods and coordinate (transboundary) flood risk management. It does so by developing flood risk management plans at regular intervals in 6-yearly cycles (2015, 2021, 2027) using a river basin approach and considering scenarios of different probabilities of floods.

Its main instrument is the Flood Risk Management Plans (article 7): "*Flood risk management plans shall take into account relevant aspects such as costs and benefits, floods extent and flood conveyance routes and areas which have the potential to retain flood water, such as natural floodplains, the environmental objectives of article 4 of Directive 2000/60/EC, soil and water management, spatial planning, land use, nature conservation, navigation and port infrastructure.*"

[1] (induced by Blueprint and 2014 Policy note on integration of ES in WFD and FD):

Barriers and incentives

Some barriers might exist as the FD does not oppose those flood protection measures that can have negative impacts on the ESS such as (Evers, 2013):

- Technical infrastructure, straightening of rivers, dikes etc. can have negative impacts on hydromorphological or physical-chemical status, biological quality component and groundwater dependent ecosystems
- Removal of organic structures (wood, trees etc) in the river as they can cause an increasing roughness factor and therefore locally higher water levels, reduction of cross section dimension
- Weirs, put in place a flood protection measures are barriers for migrating species (fishes, macro zoobenthos etc)

COWI 2014 (p25): "The FD encompasses a number of explicit references to the consideration of economics in flood risk management where the link to ecosystem services can be established (Table 2-3 in COWI, 2014). While there are no explicit references to the incorporation of ecosystem services into this process, there are a number of implicit references, which relate either to synergies with the WFD or to utilising natural processes for flood risk management. This also includes references to climate change mitigation and adaptation. Considerations of the ecosystem services are most relevant in flood risk assessment (Article 4) and in the development of Flood Risks Management Plans (FRMPs) required by Article 7."

New direction

The new direction for FD is in line with the observations made for the WFD. In addition to that, the 2014 COWI policy note (COWI, 2014 p 110) mentions that as "compared with the WFD, the FD (Art. 7.3) places more focus on the need to integrate costs and benefits into the Flood Risk Management Plans of the individual river basins. The Directive requires the FRMP to take into account relevant aspects such as costs and benefits. The Directive furthermore stipulates that international action plans should undergo a cost-benefit analysis. In both cases, integration of ecosystem service considerations could allow systematic analysis and communication of relevant costs and benefits. A systematic consideration of ecosystem services in both the WFD and the FD will support the required coordination of the implementation of the two directives."

4.3 Drought Risk Management

Current status

The current policy communication in the EU address droughts in connection to water scarcity[2], explicitly recognizing increasingly frequent droughts as a long-term imbalance stemming from water demand exceeding water availability. Whereas the importance of droughts is growing, there is no drought policy as such in the EU. Droughts are covered under the WFD's objective of guaranteeing access to good quality and sufficient quantity of water while ensuring a good status of water bodies. In addition, droughts are specifically targeted by a series of drought management plans that have a non-permanent character. As stated by a policy officer "The contribution of NBS to reduction of

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52012DC0672

drought risk is much less understood and researched than the one of flood risk. More studies are needed to establish the link between NBS and risk for droughts."

Box 1. *From revision note 3 on drought management plan report (staff working doc, section 5.1)*

At the European level, as well as in CH, restrictions on water use were reported as having been applied to preserve aquatic life and the ecological status of water bodies (AT, CY, CZ, ES, FR, HU, IT, NL, PT, RO, SK, SE, UK). In CY an index of pressures on river ecosystems is calculated in order to monitor the effects of droughts on the environment. Only few Member States reported that the minimum water flow and groundwater level conservation have not been taken into account yet (EE, IE, LU, MT) or are planned but not implemented yet (BE, BG).
With respect to specific drought management plans, several Member States reported not to have separate plans. These are in most cases considered as part of RBMPs or regional plans (AT, BE, HU, NL, RO, SK), emergency management (LU) or specific early warning systems (PT). Three Member States reported that their drafting process for these plans is ongoing (MT, CZ, CY), and in others the need for such a plan is under discussion (EE), or they have regional plans (IT) or do not have such a plan at all (IE, SE, BG). FR, ES and UK are the only Member States who reported that separate drought management plans are already in place.

Barriers and incentives

At the moment, the only policy instrument directly tackling drought that exists at the European level is the European Commission's Communication on water scarcity and drought. However, due to its lesser status in relation to Directives, the Communication is still weak (Stein *et al*, 2016). There is no harmonized approach at member state level and therefore relevant policies do not integrate drought risk management at regional level.

Some incentives are related to the common themes shared by drought policy objectives at the EU level. These include (1) the promotion of risk management policies, (2) promoting drought preparedness and mitigation and planning measures and (3) consideration of financial assistance tools (Wilhite et al. 2014 cited by Stein et al. 2016). Particular incentives are linked to theme 1 and 3. There are incentives on water efficiency but no good studies on actual contribution to reducing scarcity

New direction

Among the measures that can greatly contribute to limiting the negative effects of floods and droughts is green infrastructure, particularly natural water retention measures. These include restoring floodplains and wetlands, which can hold water in periods of abundant — or excessive — precipitation for use in periods of scarcity. Green infrastructure can help ensure the provision of ecosystem services in line with the EU Biodiversity Strategy. [34] Reducing soil sealing is another measure that can diminish flood risks [35]. These measures should be included in both RBMPs and FRMPs and, as mentioned, should become a priority for financing under the CAP, Cohesion and Structural Funds

Regarding droughts, the Commission will continue to develop the European Drought Observatory to act as an early-warning system to increase Member States' and stakeholders' preparedness. It will also enforce relevant requirements under the WFD and – through its feedback on the first cycle of RBMPs — encourage Member States to better integrate drought risk management and climate change

aspects in their future RBMPs and when developing cross sectoral and multi hazard risk management plans

5 Formal EU level rules of the game: allocation of responsibilities for DRM between member states

5.1 Who pays for protective measures vs. who benefits from protective measures

At the European level, governments supported by local authorities are the main institutions involved, responsible in the financing of protective measures (based on the State budget). Some Member States can rely on European Funds to finance DRR measures (Romania, Poland (Matczak et al. 2016, Radulecu et al. 2017)). Financing protective measures and DRR measures, in Europe, is based on governmental tax (Netherlands with Water Act and Water Board, as an "obligation to consent" (Rijkswaterstaat 2011), Germany or Poland (Matczak et al. 2016), France (with the new GEMAPI competences), on private sources of financing (United-Kingdom) or on additional tax on insurance contract (France, 12% additional tax). In these countries, numerous actors have precise role to finance protective measures. On the contrary, in Italy (National civil protection service) or in Denmark, the State is the only responsible party for protective infrastructures and the role of the sub-national level is not precisely detailed (Jachetti and Picard 2012, Sorensen et al. 2017).

Moreover, in the EU, the recurrent issue after "who pays", is "who maintain, and pays for maintenance?". The poor maintenance of flood-protection structures is one core European issue (European Commission 2016, Matczak et al. 2016, CEPRI 2017, Sorensen et al. 2017). This is notably due to limited resources and due to the diversity of actors. Nevertheless, some countries such a Romania or the Netherlands have already a performing maintenance of their protective infrastructures (Rijkswaterstaat 2011, Radulecu et al. 2017).

The Netherlands, under the Dutch Flood Protection Programme has well organized financing/maintenance of the protective measures. In case of first implementation of protective measures, the Ministry of Infrastructure and Environment pays 50%, the regional water authorities (all of them) pay 40% and the regional water authorities responsible for the project pays 10%. 90% of defence structures are managed by the regional water authorities and the remaining 10% by the Ministry of Infrastructure and Environment. If the protection is 100%-paid by the Ministry, the maintenance costs are paid by the Ministry too (Ministry responsible for management and maintenance of national protective infrastructures). In case of destruction of regional dikes, the reconstruction is co-financed by regional water authorities (50%) and the Ministry (50%). The budget calculated for financing protective measures is based on costs for operation of maintenance and reconstruction (Jorissen et al. 2016).

In Europe, beneficiaries of structural defences are the citizens, to protect human lives and their properties. Which is different from whom can receive subsidies to finance protective measures (beneficiaries of subsidies). As demonstrated in chapter 6, in France for example, only local communities with risk prevention plans and natural or legal person living in these communities (companies with less than 20 employees) can be the beneficiaries of the "Barnier Fund".

5.2 Who influences the risk and who pays in case of disaster

Different people, even if they live in the same area, have to face different natural hazards in different ways. In case of a hazardous event, it is important to reduce their vulnerability and to allow them to recover their property after disaster strikes.

At the EU level and due to the subsidiarity principle, the Member States must implement the European Law and Directives. The government of these Member States apply the European law within their national law. On this principle, implementation of Floods/Water Directives within the State involved *de facto* the government in DRR and thus influences the risk. Member States influence risk and institutionalize DRR in their policies by applying those directives in their national environmental strategies. They do so by defining flood management plans, long-term DRR programmes, setting up different scales of governance, raising people awareness etc. National stakeholders must be ready to prepare, prevent and respond adequately to natural disasters (advocacy process from institutions in DRR are crucial to achieve these goals).

More specifically, to influence the risk, some countries (France, Italy and Germany – in proposal in the United-States (NRDC 2017)) have implemented a strategy to reduce citizens' vulnerability which is friendly incentive expropriation of owners for reconstruction in another location (Jachetti and Picard 2012, European Commission 2016). And in the objective to convert the space function, potentially by integrating nature-based solutions in the expropriated area (e.g., Brague DEMO: previous camping area will be changed into NBS implementation).

On a certain point, the insurance companies according to the natural hazards insurance system can offer a means to influence the risks. Indeed, some authors highlight that mandatory insurance coverage has positive impacts. However, people are more vulnerable because less risk aware, less interested in protective measures and think that they will always be compensated in case of disaster (lack of knowledge on how works their national insurance system) (Flood Management 2012, European Commission 2013, Poland 2013, Le Quesne et al. 2017). Although, other and same authors (Botzen and Bergh 2008, Flood Management 2012, Bell 2013, Surminski et al. 2015, Hudson 2015) demonstrate that risk-based insurance premium has positive impact on people knowledge (influence the behaviour of individuals), it is an appropriate tool for risk management, and encourages insurers to innovate to mix and match risk-based pricing and affordable insurance coverage (Stern 2006, Insurance Europe 2012).

5.3 Who pays in case of disaster:

In Europe, more often, institutions who influence the risk and pay for protective measures are not the same who pay in case of disaster. EU aids, national ad-hoc fund, national pool or insurance companies without any State supports or insurance companies with State as reinsurer of last resort are just dome of the many different examples that highlighted the multiple actors involved or combination of actors which pay in case of disaster. This idea could be nuanced according to each national insurance system in Europe.

First, the diversity of the State's intervention in Europe in case of disaster and payment of compensations vary across Member States and according to the insurance systems (see D7.1 for more details on how these systems work). (i), in some countries such as, Italy, Poland, Slovenia, the State

directly compensates citizens strike by natural catastrophes, sometimes with the support of the European Solidarity Fund[xxvii] (European Parliament 2017)(EUSF); (ii) the State can offer ad-hoc compensations (Denmark, Netherlands); (iii), in other countries, the State do not compensate citizens in case of disaster (Germany, UK, Sweden); (iv), the State is not directly involved in compensation but intervenes in last resort, it is an institutionalized form of compensation (Spain, France, Romania).

In case of disaster, the main institution involved in compensation is the insurance industry. The degree of intervention of the insurance sector varies according to the national insurance system. Below a detailed overview of who and how compensation is paid in case of disaster in the 11 NAIAD countries (extract from the NAIAD MS4, Country fact sheets):

1. **France**: If a natural hazard strikes, and this hazard is recognised as a "natural disaster" - according to the list fixed by the law - by a governmental decree "Cat Nat", the "CatNat" compensation is unlocked. The claims adjusters' will assess the losses for each policyholder living in the areas defined in the decree. After that, the private insurance companies will indemnify the insured. If the natural hazard is not recognized as a "natural disaster", the insurance coverage is unlocked and based on the policy choice by the policyholder. As the insurance coverage is compulsory in France, 98% of the population is covered in case of disaster (CCR information)

2. **Denmark**: The Danish Storm Council (DSC) recognizes three types of natural disasters to unlock the compensations. If a storm surge strikes and it is recognized as a "1-20-year event" by a DSC declaration, the DSC fund is unlocked to compensate only insured private owners who asked for. If storm surge is not recognized by the DSC, the insurance coverage is unlocked to whom have purchase (on voluntary basis) an insurance contract. If a flood strikes, flood hazard is not insured by the private insurance sector. The citizens can only rely on a compensation given by the DSC. In the case of windfall strikes forest owners, they must be insured against storm damage to trees for their entire property to have the DSC compensation

3. **Germany**: To receive compensation after disaster losses, the citizens must be insured through private insurance companies. If they are not insured, they will not receive any compensation and should be able to cope with the losses thanks to their own money to restore their assets. Indeed, the State do not compensate in case of disaster

4. **Italy**: If citizens are insured or not, after an official declaration of "disaster", they will receive ad-hoc compensation from the "National Solidarity Fund" of the State. If the event is not recognized as a "disaster", not insured people will have to cope with the damages thanks to their own money. Insured people with rely on a compensation based on their policy. In case of earthquake large disaster, the European Solidarity Fund is unlocked, the State redistributes this money to the citizens.

5. **Poland**: In case of natural hazard, the compensation is divided into two elements: a private insurance in case of disaster listed in the policy complete by an ad-hoc compensation from the State regardless the individual policy coverage.

6. **Romania**: In case of earthquake, flood and landslide events, compensations are done through the PAID scheme and based on the Type A (compensation of €20.000) or Type B houses (compensation of €10.000). In case of wind storm and hail, if the citizens are insured for these perils they will receive a compensation based on the subscribe policy.

7. **Spain**: If a natural hazard strikes, and this hazard is recognised as an "extraordinary risks" - according to the list fixed by the Consorcio de Compensacion de Seguros - the CCS compensation is unlocked. After that, the private insurance companies will indemnify the insured. If the natural hazard is not recognized as an "extraordinary risk", the insurance coverage is unlocked and based on the policy choice by the policyholder. As the insurance coverage is compulsory in Spain, everyone must be covered in case of disaster (declared as "extraordinary risk" or not)

8. **Sweden**: In case of flood or storm event, the citizens must be insured to be compensated. There is no State aid to cope with the losses.

9. **UK:** In case of flood or storm event, the citizens must be insured to be compensated. There is no State aid to cope with the losses. In high flood areas, homes may be insured under a specific scheme: the Flood Re. In case of disaster, the compensation will then be provided by Flood Re, through the private insurers and to the policyholders.

10. **Netherlands:** In case of floods or earthquakes only, the Calamities Compensation Act (CCA, WTS) which is a "reimbursement policy" is unlocked only after official recognition of "disaster" by Royal Decree of the Ministry of Home Affairs. If the event is not recognized as "disaster" the citizens have to cope with the losses by themselves.
    The pilot scheme, Neerlandse, insures flood, earthquake and other hazards defined by the policy. In that case, if people are insured by private companies they cannot received any compensation from the CCA.

11. **Slovenia:** In case of natural catastrophes, to unlock the national compensation to citizens affected by it, the damages must exceed 0.3‰ of the national budget income/year. Insured citizens can receive both national compensation and compensation from their insurance coverage for natural hazards.

5.4 The insurance sector, an institution with new position/role in DRR/DRM

Linkages between insurance and risk reduction are at their infancy but in continuous and increasing development. The roles of insurance in DRR have been recognised in the Sendai framework for DRR. It is a current burgeoning literature topic. In few words, currently the insurance industry is based and works on the recovery/compensation stage (ex-post). The on-going switch is the insurance sector involvement on the prevention/preparedness stage (ex-ante). The insurance industry could be involved in the two stages (ex-post and ex-ante), to improve DRM/DRR and to provide financial security against disasters. Aligning private insurance objectives with national efforts would support local DRR (Rebound 2017).

(Rentschler and Tanner 2015, Surminski et al. 2015, Tanner et al. 2015) defend the idea that (flood) insurance and DRR should be link in the EU, as investment in DRR/DRM were demonstrated to be highly effective (cost-effective investments in ecosystems or insurance of the later) and cheaper that recovery processes. Financial institutions have a crucial role to play in minimising the economic threat posed by climate change. Thus, the insurance - DRR - ecosystem triad is linked because it enables society to recover, to reduce its vulnerability and to provide knowledge and incentives for reducing risks (IPCC 2014b). On-going discussion and reflexion on the triad demonstrated that the insurance can incentivize DRR in the EU to promote affordable insurance (notably through risk-based premium financial incentives for risk mitigation) (Hudson 2015, Aerts and Mysiak 2016, Kirbyshire et al. 2017).

Involving the insurance industry in DRR can impact data and information exchange to incentive risk awareness and good practices' use or to guide decision-making (Kirbyshire et al. 2017). Thanks to new financial instruments against disaster such as the "resilience bonds", the insurance industry is now connected to governmental institutions. They aim at reducing risk and defining the *"loss mitigation value of protective measures"* (which is currently rarely translated into insurance' financial models or portfolios). (Rebound 2017) gives an example of resilience bonds for flood protections. This bond provides opportunities for coastal communities to mobilize funding to finance coastal protective measures. Resilience bonds could be a tool to close DRR/IVE implementation, insurance protection and financial gaps.

The insurance industry itself works also on this triad (Le Quesne et al. 2017, Maynard 2017, Cohn 2017, Colgan et al. 2017). They state that the insurance industry is not a panacea/full substitute solution for DRM. These reports notably exemplify the integration of insurance into comprehensive risk management as new challenge and objective. The insurance industry could:

- create long-term investments, incentives,
- make disaster and climate risk more transparent,
- fix minimum conditions of planning and governance for DRM,
- incorporate climate change and protective measures into loss models

Once, *"stronger evidences"* will be further developed, the insurance industry could be *"involved in all areas of DRM"* (Le Quesne et al. 2017). The insurance industry's implication in eco-DRR on both financing and insuring ecosystem services is discussed by (Colgan et al. 2017). Another example is the new UK Flood Re mechanism which is created as an innovative approach to DRR but according to (Surminski 2017) fails to incentivize DRM/DRR efforts.

NAIAD performs on-going researches on the triad "insurance/DRR/ecosystems" through the definition of the insurance value of ecosystems in the context of natural disaster risk reduction. NAIAD Deliverable 7.1 will study how European insurance systems are different from one to another to consider ecosystem as a real reliable means to reduce risks.

6 PART 5 : Countries´ baseline

6.1 Institutional settings in Spain

Defining the problem scope

In this chapter we will explore and analyse how risks are defined and assessed in Spain, what roles different actors have for the assessment and reduction of the risks, and what incentives different institutional settings provide for Insurance Value of Ecosystems mainstreaming. Our focus is on drought, floods and the different institutional incentives that apply at the national level, that will affect the potential implementation of NBS in Medina del Campo and its Insurance Value.

It is worth mentioning that drought and water scarcity are not the same concepts and have different regulatory and institutional considerations, although sometimes these terms can be confused. We will specify the assessment and consideration these terms bring about.

The main Wateral risks in Medina del Campo Groundwater Body DEMO are water scarcity (induced by groundwater overexploitation and exacerbated by periodic droughts) and increasing deterioration of groundwater quality by agricultural pollution and by natural contamination by arsenic, which also derive in decreased water availability. The starting hypothesis of the Medina Demo is that NBS will help increase the provision level of many critical ecosystem services provided by groundwater, thus reducing disasters associated to those risks and strengthening the resilience of the socio-ecological system.

The formal rules of the game: main policy and regulatory frameworks

There are a number of policies and regulations that influence the way Spanish stakeholders respond towards climate risks such as floods and droughts, water scarcity issues, climate change and water use. In this section we will highlight the key aspects these regulatory frameworks bring for IVE purposes in Naiad, exploring whether ecosystem services are gaining importance or not.

The Water Act is the main Law regulating water related issues, released in 1985 and adapted in several occasions till its last revision in June 2017. Climate change, economic development and environmental improvement have driven recent on-going water reforms, as well as the adaptation to the European Water Framework Directive. Since the approval of this law, all the water is considered public property, but allows to use it privately if the water right was granted before the law was passed in 1985.

The Water Act is further developed by the Spanish Water Resources Regulations, RDPH, *(Reglamento del Dominio Público Hidráulico)*. These norms also contemplate the property and use regime of water, establishing a framework for water rights which is summarized in table 19.

Table 15. Type of water rights under the Spanish water law

TYPE OF WATER RIGHT			Is it posible to modify the right or transmit it?	Is it posible to transfer it?	Can the right be terminated?	How long is the Right?	Are water and land entitlements linked?	Has the right administrative protection?
PUBLIC WATER	Water Register	Section A: LICENCES	YES	YES	YES	75 yrs (máx.)	Yes for irrigation. (except Water User Associations) No for other cases.	YES
PUBLIC WATER	Water Register	Section B: INSCRIPTIONS (max. 7.000 m^3/yr)	NO	YES	YES	Unlimited*	YES	YES
PRIVATE WATER	Water Register	Section C: Temporary exploitation	NO	YES	YES	Until 2035*	YES	YES
PRIVATE WATER	Water Catalogue		NO	NO	YES	Unlimited*	YES	NO
*Changes require a new public water right								

It is worth to mention that in Spain, after the Water Framework Directive was adopted, minimum environmental flows are set in every water body so that water is available for the ecological functions of nature. From this estimation of environmental flows, the quantity of available water subject to exploit is determined. In periods of drought, however, this situation changes and special regulations apply.

National Water Plan, RBM plans and Water Framework Directive adaptation

The National Water Plan is the legal instrument that sets the objectives of water management at national level, coordinating the territorial interests and the different River Basin Management Plans. It also gives instructions on how to prepare and react for droughts and floods. Spain has 25 river basin districts, out of which 6 are international sharing water courses with France to the northeast and Portugal to the west. The NHP was approved in 2001, more focused in the internal conflict of the Ebro transfer than in the WFD adoption. Furthermore, it was assumed to not need to modify this law since the content was already integrated, despite not explicitly conceptualize the ecological process of rivers (La Calle, 2009).

River Basin Management Plans are what guide and structure water management in each river basin. After the WFD was released, RBMP had to be adapted to the new regulations and framework. In Spain, water policy had been traditionally focused on infrastructure development to meet urban and irrigation demands, and first the 1999 Water Act Reform and, more radically, the WFD shifted the focus on environmental concerns and governance issues, to maintain the ecosystem function of rivers, while promoting the recovery of the costs and cost-effective analysis of the actions implemented. The adaptation of the Water Policy and RBM plans to the WFD has been slow[3].

According to the WFD, water management and plans must start from a bio-physical assessment of the aquatic ecosystems, since ecosystem protection is the strategic objective to follow. It was therefore necessary to do a baseline study on the water bodies, determine the different ecosystems´ state and establish a monitoring system and a program of measures to reach good state, where exemptions were not being applied. One of the issues that WFD opens in the Spanish water policy framework, is the consideration of hydromorphological pressures on aquatic ecosystems, which opens the window to river restoration as a measure. **Floods management Plans: adapting the Floods Directive**

[3] see judgement of the EU Court of Justice of 4 October 2012 on case C-403/11 available at http://curia.europa.eu/juris/liste.jsf?language=en&jur=C,T,F&num=C-403/11&td=ALL

2007/60/CE. Both Water Act and RDPH define and regulate the limits and allowed land uses of flood prone areas next to rivers. This regulation takes into account the type of use (urbanized or rural), established by the land use Act (Ley del Suelo), and the flood risk (based on hazard maps).

The Royal Decree 903/2010, on the evaluation and management of flood risk, incorporates the Floods Directive into national law. Flood Risk Management Plans are elaborated by each River Basin Organization in coordination with the Water Authorities from the State and Civil Protection. Flood Risk Management Plans are done according to the assessment of "peligrosity and flood risk maps", and consider natural water retention measures as a mean to reduce the risk associated to floods, as well as natural flood management options.

The **National Strategy on River Restoration** draws from the WFD and Floods Directive and has the objective to implement a series of actions meant to initiate a 'process of change in the management of river systems', which will lead to an enhancement of the ecological status of rivers, while gradually increasing the involvement of the public.

Drought management

Perhaps the most notorious natural hazard affecting the DEMO of Medina is drought. Drought is characteristic in the Mediterranean climate, when rainfall is lower than the average in a certain region. The reduction of rainfall (meteorological drought) produces a reduction on the available water resources needed to guarantee the current demands (Wateral drought). As it was stated before, sometimes drought and water scarcity are easily interchangeable terms. The Spanish regulation considers drought as a natural phenomenon that occurs independently from human consumption, and scarcity to be directly linked to problems related with the impossibility to attend the existing water demands for socioeconomic uses of water. The regulation distinguishes between "structural scarcity", when there is a long-term situation where demand exceeds available resources, and "temporary scarcity", when resources are not available circumstantially. In this way, a drought could cause "temporary scarcity" or exacerbate an existing structural water scarcity issue. The ways situation of droughts or water scarcity are assessed and catalogued will determine the managerial reaction to prevent it and manage it. The regulation also considers drought to be an "unpredictable" phenomenon, since it also has juridical consequences that will allow certain measures to be applicable to meet water demands, which the WFD wouldn´t allow if it was predictable.

Efforts to tackle water scarcity as well as drought, from emergency considerations to management and early warning systems to prepare for it, exist but may not be sufficient. In times of drought, special laws are passed to face the situation, like the one currently released affecting the Douro basin. Droughts are a polemic issue, some consider Wateral drought as a structural problem and some consider it a product of a poor governance system based on guaranteeing demands regardless the possible supply. It is true that there is uncertainty on when a drought will occur, however the experience says drought is a periodic phenomenon, and certain level of readiness may be possible to obtain.

Drought Special Management Plans (DMPs*)* are passed at the river basin level. They were firstly released in 2007, and currently there is an ongoing revision process, where the central authorities are involved giving a Technical Instruction that will harmonize the revision process in all the intracommunitarian river basins. The indicators to assess the severity of the water risk are established

by each River Basin Authority, with Wateral and meteorolical information provides by other actors such as CEDEX (hydrographic studies center) or the Meteorological Institute.

«Greening» measures derived from the Common Agrarian Policy

Land use and the type of crop will influence on the natural hazard´s effect, and shape the landscape and ecosystem health. The Common Agrarian Policy payments scheme is an incentive to modify farmer´s behavior towards NBS implementation.

All the farmers which want to apply for subsidies from the Common Agrarian Policy need to comply with certain enviornmental measures or good practices to receive the « green payment ». This green payment is a percentage from the total basic payment the farmer would be subject to, generally around 50%. The payment is co-financed by the EU (70%) and by the member state (30%), and Spain will invest around 1453 M € each year. The environmental measures that are being promited are (MAPAMA, 2015) :

- diversifying crops
- maintaining permanent grassland
- dedicating 5% of arable land to 'ecologically beneficial elements' ('ecological focus areas').

Under the new rules, farmers receiving payments help conserve the environment and contribute to addressing greenhouse emissions by:

- making soil & ecosystems more resilient by growing a greater variety of crops
- conserving soil carbon & grassland habitats associated with permanent grassland
- protecting water & habitats by establishing ecological focus areas.

Mapping roles and responsibilities in the governance settings

Given the current legal and organizational framework, we will try to give answer to the questions

How is risk assessed and by whom?

Risk is assessed by different actors according to their different objectives. The Geological and Mining Institute of Spain, an autonomous research Institute with dependency on the Ministry of Economy and Competitiveness, provides risk assessment support on water and climate hazards to other administratiosn such as RBAs and Agricultural Ministries. The Office of Climate Change, dependent on the Agriculture Ministry, also performs risk evaluation on the impacts of climate change on different sectors, regions and ecosystems. Insurance companies, on their side, also perform risk assessments and model extreme climatic events.

Other actors exist and collaborate in the constellation of risk assessment in Spain. The question then would be, who takes the stake on the actions that need to be taken in order to mitigate the risks?

Allocation of responsibilities on DRR/M between the different actors

Different administrations in Spain play different legally defined roles:

- State: at central level, general policy coordination takes place under the *Ministry of Agriculture, Fishing, food and environment.* The Water Directory and the Office of Climate Change
- RBAs: River Basin Plans are elaborated by RBAs. They manage concessions and authorizations of water use, control and monitoring of the public water. They control networks for water quality monitoring and sanction non-compliance on this issue. They determine what is and when a drought is taking place. Therefore, they are a key actor when extreme events related to water, such as drought or floods, occur.
- Meteorological Agency: according to the National Plan on Climate Change Adaptation, this Agency has the role of coordinating the works for the generation of regionalized climate scenarios for the Spanish geography
- Regional governments (CCAA): under their scope are fishing and aquatic ecosystems, environment, forestry, spatial planning, health, natural spaces, coordination of civil protection...there are Environmental Agencies at regional level
- Municipalities: at this level, they mostly control water supply, sanitation and purification, waste collection, urban planning, actions in urban areas.
- Civil protection: in Spain, it is a public figure that operates at national, regional and local level, assessing, preventing and operating during emergencies and risk events.

	WATER QUANTITY (water scarcity context)	WATER QUALITY	FLOODS	DROUGHT
Who carries the costs in case of a disaster	Water users, environment (less availability traduces in economical loss), Water Authorities	Users, environment	Users, environment	Users, environment
Who assesses the risk?	Water Authorities (River Basin Organization)	Water Authorities (RBO)	Water Ministry, RBO, Geological Institute, Insurance companies	Water Ministry, RBO, Geological Institute, Insurance companies
Who makes the investments (in	Users, Water Authorities,	Junta Castile and Leon, CHD, DGA (Ministry)	RBO, DGA, Regional	RBO, DGA,

different phases)	Regional Authorities,		Government, Civil Protection	
Who benefits from the investments/ DRR measures? (sectorial links)	Users depending on water and connected to the system.		Users, inhabitants, civil society	
Who influences the risk	Market demands Urban planing	Agrarian policies Market	Municipal urban planning, land use, territorial planning	Agrarian policies Market
Who implements the measures	RBO	RBO	Civil protection: **INUNcyl**	RBO

Figure 5. Analysis of roles and responsibilities

Who carries the costs of DRM or make the investments for DRM versus who benefits from these ex-ante investments?

The main costs related to climatic disasters are done on prevention, mitigation during or after the event has occured, and compensation to citizens after it happened. In Spain, these costs are usually and mostly assumed by RBAs.

In Spain, the government has mobilized more than 12 M€ for the PIMA Adapta Water Plan for the moment, in which during 2015-2020 actions will be promoted with the aim to improve knowledge and monitoring of the impacts of climate change, minimizing its risks and increasing the resilience of the system. It follows four strategic lines: 1) Management measures and adaptation of river natural reserves, 2) Adaptation to extreme events, 3) Evaluation of the impact of climate change on water resources and development of adaptation strategies and 4) Development of projects to adapt to climate change in the public hydraulic domain. It is expected that the government launches PIMA Adapta- Ecosystems which will promote implementation of practices that enhance the synergies between adaptation and mitigation in the agricultural and forest areas of Spain.

This modest yet important fund, contributes to the development potential that Life Projects and other funds such as Social Cohesion EU funds or regional investments have on the mainstreaming of the ecosystem services of nature on the prevention of climate related disasters.

Windows of oportunity to mainstreaming Ecosystem Services and IVE in Spain

We have seen some windows of opportunity incentivized by the increasing plans on rivers and ecosystem restoration, greening measures on the CAP and mobilized funds towards climate change adaptation. Spanish administrations are already shyly starting to shift the focus towards risk prevention and ecosystem conservation on water resources management. In our Spanish NAIAD case, NBS will contribute to achieve the “good status” for the groundwater body of “Medina del Campo”

according to the Water Framework Directive (WFD), and Ground Water Directive. Management and mitigation measures are already proposed by the Duero River Basin Authority (DRBA) to achieve the environmental objectives that were set in compliance with the Water Framework Directive, which include the artificial recharge of aquifers and the control of extractions. The aim of the artificial recharge of the aquifer is to improve the general status of the aquifer of Medina del Campo.

However, there are still barriers to overcome on the implementation of NBS. The main barriers are:

High level of Uncertainty (as well as the other components of the water cycle). The impact of NBS such as the managed aquifer recharge is difficult to predict due to the complexity and unfeasibility to model all the components of the Water Balance of the aquifer. And the effectiveness of the recharge depends on: a) extraction pattern after recharge, b) drawdown, c) land conditions and use of the land d) Climate Change. The uncertainty can be reduced with an adequate monitoring.
Political resistance on the local level, major will be the problem due to political reasons and the opposition of the affected residents. On the national level there is no political resistance expected.

NAIAD contribution to facilitate NBS implementation

Naiad will provide new information to know what consequences may have, what costs, what co-benefits and ways of financing to carry out the project.
NAIAD: NBS: measures to reduce risks (droughts, floods, water quality).

Maybe there is a gap between the information an actor generates on risk assessment, and the information an actor holds to implement measures to mitigate risks. We see there are efforts being done towards the recognition of risk mitigation. Gaps between policies and sectors: urban planning have not taken into account drainage effects on cities for example. There is a wave to greening cities which impact we are still pending to see.

6.2 Institutional settings in Romania (BDG)

Romania has a long history of significant floods and droughts; consequently, since the beginning of the 19th century, various DRM measures have been developed and used to mitigate these phenomena. These measures are either grey (e.g. dam, dikes) or green (e.g. temporary basins for excess water storage, drainage channels, etc.).

Following the country's accession to EU, the legislation was aligned and the institutional framework was adjusted to comply with the European framework. The water sector in Romania is organized in 11 River Basin Administrations, each with River Basin Management Plans elaborated and updated in accordance with the WFD requirements.

The formal rules of the game: The policy & regulatory framework.

In Romania, the main policy documents concerning risk management for disasters caused by water are: (1) *the National Strategy for Flood Risks Management* and (2) *the National Strategy for Adaptation to Climate Change (part of the the National Strategy on Climate Change and Low Carbon Economic Growth, by 2020.*

(**1) The National Strategy for Flood Risks Management** is developed in accordance with the European Directive 2007/60/EC on flood risk management providing stages of implementation with deadlines for reporting to the EC. The first stage was the development of the *National Strategy for Floods Risk Management, on short, medium and long term,* approved by government decision in 2010.
The national strategy includes measures aligned with the provisions and deadlines of the EU Flood Directive such as the elaboration and implementation of the flood risks management plans – short and medium-term measures (2010-2011 & 2010-2015), population consultation and preparedness, feed-back and build-up of collective resilience to flood, and long-term measures (2010-2035). The strategy also estimates the costs for the implementation of all the measures and actions for the 2010-2035 period at a total 17,463.55 million EURO.

The Flood Risk Management Plans for each River Basin in Romania have been set out in 3 stages:
- *Preliminary evaluation of floods risk (March 2012)* – 39 significant historical events and 399 areas with significant potential of flooding (including the Danube) were identified;
- *Development of the hazard and flood risk maps (March 2014)* - using the medium risk scenario (1%) for 17,600 km of river lengths (including the Danube);
- *Development of the Flood Risk Management Plans (March 2016)* based on a *Framework methodology for Development of Flood Risk Management Plans* (*INHGA, 2016)* that included the definition of a unitary content of the plans, the establishment of flood risk management objectives and associated quantifiable indicators for all River Basin Administrations, the identification of indicators to assess the implementation progress of the proposed measures and the selection of a portfolio of major, integrated investment projects. Using the above-mentioned methodology, the INHGA elaborated a *Catalogue of potential (structural and non-structural) measures to reduce the negative impact of floods at national level* indicating the steps for the evaluation and selection of appropriate measures for the 11 River Basin Administrations (RBAs). The integrated projects are proposed by the 11 RBAs following a strategic vision the RBA level.

All projects are further centralized by the **National Administration Romanian Waters** (NARW) and with the support of the **National Institute for Hydrology and Water Management** are prioritized based on relevance and costs benefit analysis[xxviii].

The Flood Risk Management Plans consider national (strategic) objectives and operational (specific) objectives. The strategic objectives are developed in line with ICPDR recommendations:[xxix] **avoid/ prevent new risks, reduce existing risks, increase resilience, increase awareness**. The specific objectives follow the 4 categories recommended by the Flood Directive 2007/60/CE, each category with specific targets defined as follows:

- **Economic category**: minimize flood risks on transport infrastructure and economic activities; flood risk management on agricultural land.
- **Social category:** minimize the flood risks on human life and communities.
- **Environmental category:** Support reaching and preserving the good ecological status (SEB)/ good ecological potential (PEB) according with the WFD requirements; minimize the flood risks on protected areas for water intake for human consumption; minimize the flood risks on potential polluting objectives.
- **Cultural Patrimony:** minimize flood risks on cultural patrimony objectives.

The proposed measures follow 5 action categories in connection with the flood risk management cycle: *prevention, protection, awareness, preparedness, recovery***.**

Examples of measures for **national level application:**

- **Defining the legislative, organizational and technical framework for implementation of the Flood Directive:** improvement of the legislative framework, elaboration of studies, projects, programs, including those with a focus on knowledge transfer and knowledge exchange, which could support the Flood Directive implementation at a basin and national level;
- **Emergency response activities**: Improvement of the actions and cooperation of authorities involved in emergency management: implementation/ upgrade of intervention procedures; evaluation/ improvement of the Damage Assessment Procedure (create a database of damages, develop a damage assessment methodology; probability curves - damages).

Examples of measures for **basin level application:**

- **Emergency response activities:** Intervention protocols in emergency situations regarding the stabilization of critical aspect identified prior to floods (erosions, slopes slides, embankment areas / traverses / slopes / etc.); measures to limit the flooded area through secondary defense lines (subdivision dams, slopes of the transport paths, etc.); measures for water evacuation from the flooded areas.
- **Damage assessment and recovery:** provisional repairs of all types of infrastructure damaged by floods in order to secure their minimal functionality; Recovery/ Rehabilitation of damaged infrastructure and properties (including monitoring of the water quality, analysis and expert advice on disinfection of fountains and other water sources).
- Examples of measures applicable for **areas with significant potential risk for flooding**:
- **Measures for recovery of retention areas** (flood plains, humid areas, etc.).
- **Measures to improve the retention capacity** at basin level by polders and small water retention basins (for the upper area of the basin).

*(***2) The National Strategy for Adaptation to Climate Change** is part of the National Strategy on Climate Change and Low Carbon Growth by 2020. The strategy[xxx]*,* takes into consideration measurable objectives in line with the EU 2030 targets, and aims to support the protection of the environment, people and businesses against the effects of climate change, with a focus on protection against extreme events. The strategy is accompanied by a *National Action Plan on Climate Change for 2016-2020,* that includes a series of actions and measures to be taken by both government institutions/authorities and the private sector (allocating an important role to the insurance sector!), as well as an estimation of the costs and recommendations for financing sources to be used.

Mapping roles and responsibilities in the governance settings: transaction costs

How is risk assessed and by whom?

The **Ministry of Environment** is the institution responsible for the general coordination of policies, strategies and actions for climate change mitigation and adaptation. The **Ministry of Environment** coordinates the **National Commission on Climate Change,** an inter-ministerial coordination body functioning on 2 levels: technical expertise and policy expertise.

The **Ministry of Water and Forests** is the institution responsible for strategic planning, water management, hydrology, hydrogeology as well as protection, conservation and restoration of natural water resources. The MWF coordinates the ***Water Inter-Ministerial Council***, a consultative body created in 2007 that includes a secretariat for floods.

Romania has a dedicated ***risk assessment working group*** responsible for risk assessment at a national level. This working group also ensures the continuity of the estimation process and that of risk mapping. The working group consists of experts on risk assessment from central public administration (ministries), and academia and research institutions. The risks identified for Romania were evaluated within the national report **RO-RISK: Evaluation of hazards risk at national level (including climate-related risks)**. The disaster risk assessment was performed at a national level based on a unitary framework considering the impact on the population safety as well as the social, economic and environmental impacts.[xxxi] The following table shows the hazards evaluated in (left column) and the 5 types of natural hazards selected as relevant for Romania (right column):[xxxii]

Table 16. More relevant Hazard risk in Romania

Natural Hazards	Selected risks
Storms and blizzards	**1. Floods**
Floods	
Massive snowfalls	**2. Drought**
Tornadoes	
Drought	**3. Forest fires**
Extreme temperatures	
Forest fires	**4. Landslides**
Avalanches	
Landslides	**5. Earthquakes**
Earthquakes	

The specific evaluation regarding *flood risks* is performed by the **National Administration Romanian Waters** (NARW) following the procedure described at 7.2.1 above. According with the Flood Risks Management Strategy, the next steps are the elaboration of the county flood risk management plans for each of the 41 counties and the municipality of Bucharest. The main challenges ahead concern the adaptation of disaster reduction measures to local conditions, and implementing these measures in a timely manner.

How are risks mitigated? Allocation of responsibilities on DRR/M between the different actors

The strategic documents listed above are detailed in a complex set of national legislative norms regulating the water management sector as well as interconnecting it with other sectors such as agriculture, public administration, health, education, etc., as regards DRM.

The Government Decision 557/2016 is the main piece of legislation to provide for the identification of risk types and associated risks in Romania, appointing responsible authorities by type of risk and defining the areas of action of the leading responsible authorities as regards prevention,

preparedness, response and restoration / rehabilitation post event. The responsibilities of the MWF and connected institutions in the water sector are specifically defined by the Water Law[xxxiii] elaborated in 1996 and upgraded continuously to align with EU legislation and incorporate water sector developments (last change in 2017, new updates are in preparation).

The allocation of responsibilities for different hazards, associated risks and stages of intervention is presented in the table 21[xxxiv].

Table 17. allocation of responsibilities for different hazards, associated risks and stages of intervention in Romania

Type of hazards	Associated risks	Responsible authority with 1st role	Responsible authority with 2nd role	Prevention	Response (operational)		Rebuild/Rehabilitation	
					Coordination	Support	Evaluation	Restore
Thunderstorms and blizzards	Strong winds and/or massive rainfall	MWF[xxxv]	MWF	MWF; MT; MEd MRDPA; MARD MEc; MIA; MH	MIA	MARD; MIA, MH; MND; MT; Local authorities & stakeholders	MRDPA, MEF; MIA MWF; MT; MPF Local authorities	MEn; MT; MARD Local authorities, Businesses, authorized entities
	Hail stone		MARD					
Floods	Floods as a result of natural water run-off due to the precipitation/sudden snow meltdown/blockage caused by narrow and/or small bridges/ blockage caused by ice or floating materials (waste and wood material), landslides, alluviums and snow avalanches, floods caused by water run-off from slopes.	MWF	MRDPA, MIA	MWF ; MRDPA; MARD; MIA; MH MEc	MIA	MIA; MH; MND; MT MEc; MARD; MRDPA; Local authorities & stakeholders	MRDPA, MEF; MIA MWF; MARD; MPF; Local authorities	MRDPA, MWF; MEn MT; MARD; Local authorities, Businesses, authorized entities

	Floods caused by incidents accidents or damages to hydrotechnical constructions		MRDPA; ME MEc	MWF ; MRDPA; MARD; MIA; MH; MEc;MEd	MIA	MIA; MH; MND; MT; MEc; MRDPA; Local authorities & stakeholders	MRDPA; MIA MWF; MPF Local authorities	MRDPA; MWF; MEn; MT; Local authorities, Businesses, authorized entities
	Floods caused by raising groundwater level		MARD	MWF MRDPA; MARD ;MIA; MH; MEd	MIA	MIA; MH; MND; MT; MEc; MRDPA; MARD Local authorities & stakeholders	MRDPA; MIA MWF; MARD MPF; Local authorities	MRDPA; MWF; MEn; MT; MARD Local authorities, Businesses, authorized entities
	Floods caused by sea storms		MWF	MWF; MRDPA; MIA; MH	MIA	MIA; MH; MND; MT; MEc; MRDPA; Local authorities & stakeholders	MIA; MH; MND; MT; MEc; MRDPA,MEF; MPF; Local authorities & stakeholders	MRDPA; MWF; MEn; MT Local authorities, Businesses, authorized entities
Drought	Wateral	MWF	MWF	MEF; MARD; MEc; MRDPA,MEF; MIA; MH; MEd	MIA	MEc; MT;MIA MH; MARD	MRDPA,MEF MIA; MWF; MPF; MARD Local authorities	MARD Local authorities, Businesses, authorized entities
	Pedological	MARD	MARD	MWF; MARD; MEc; MRDPA,MEF; MIA, MH; MEd	MIA	MEc; MT;MIA MH; MARD	MRDPAEF; MIA; MWF; MARD Local authorities	MARD Local authorities, Businesses, authorized entities

Who carries the costs of DRM or make the investments for DRM versus who benefits from these ex-ante investments?

Pricing of flood protection infrastructure is quite complex in Romania for reasons of missing a direct relation between the waterworks to protect and the water price[xxxvi]. Main revenue sources of NARW are the contributions for using water resources (related to population and economic activities) and pricing of water services (the hydropower sector is the main client group, they also own part of the flood defence grey infrastructure). These are generally under pressure as result of changing of the economic conditions such as improvements of water infrastructure resulting in less pollution or reduced demand of water for irrigation and industrial activities. Direct revenues are used mainly for regular maintenance works and the costs for investments, intervention in case of extreme events and reconstruction/recovery in case of extraordinary losses are covered by *the state budget* (taxes, loans).

Prioritized investments benefit also of EU *financing* (European Cohesion Fund, European Fund for Regional Development, European Union Solidarity Fund). The most relevant financing program in this respect is the **Operational Program Large Infrastructure** (POIM) 2014-2020 (financing sources: EU Cohesion Fund, EU Regional Development Fund and the Romanian government). Under this program a priority axis (5) is dedicated *to promotion of adaptation to climate change, risk prevention and management* has been allocated 478.7 million Euro. This axis has 2 specific objectives with an impact on DRR:

- Reducing the effects and damages to the population caused by natural hazards aggravated by climate change (mainly floods and coastal erosion); it aims to finance actions for preventing the main climate change risks to avoid economic damages and loss of human life (5.1);
- Increasing the level of preparedness for a rapid and effective response to disaster; this aims to promote investments to enhance disaster response capacity to reduce human and material losses as well as at increasing awareness of the population and authorities about the risk of disaster occurrence (5.2).

The 5.1 line was opened at the end of 2017 and will receive applications until end of June 2019. The actions financed are structured in three categories: (A) flood risk management (investments and capacity building), (B) preventing coastal erosion, (C) preventing and protection against other categories of risks as identified by the action plan for adaptation to climate change and national evaluation. Eligible applicants for this financing line are: Ministry of Waters and Forests in partnership with other government agencies with responsibilities according with the Flood Risk Management Plans, or NGOs with expertise in implementing non-structural measures,[xxxvii] the National Administration of Meteorology, and the National Administration Romanian Waters.

The flood risk management actions financed promote the use of solutions provided by natural ecosystems for prevention actions and management of risks due to the increased occurrence of extreme events. The green measures indicated as eligible are (list not exhaustive):

- Construction / restoration of wetlands, controlled floodplains;
- Swamps, peat bogs and floodable forests;
- Creating temporary accumulations of water, polders;
- River banks restoration;
- Reconnecting and restoring floodplains;
- Reconstruction of the watercourse (reconnection of the meanders);

- Small non-permanent accumulations with dams made of local materials (ex: tree trunks downed due to hydro-meteorological phenomena, gravel, rocks);
- Plantations of bushes or arboreal species upstream river basins, in areas affected by erosion / torrents / ravines;
- Ensure lateral and longitudinal connectivity of the watercourses.

The 5.2 line is dedicated to facilitation of a rapid and efficent reaction to disasters. In its initial stages (finalized in 2017), line 5.2 funded no-regret projects, i.e. actions that involve only multi-risk activities (e.g. equipment or training for at least three types of risk, one of which is floods) in areas where there is evidence (through hazard / risk maps or statistical data) that the risks financed have a high incidence. Actions targeting only one type of risk will only be funded after finalizing the national risk assessment, based on prioritization of investments.

Green measures are also encouraged by the National Rural Development Program 2014-2020 dedicated to the agricultural sector. The program allocates 30% of the funds for environmental-green measures in accordance with the Common Agricultural Policy providing possibilities to finance natural water retention measures or invest in the improvement of the irrigation systems. For example, under Pillar II, Sub-measure 4.3: 'Investments in Agriculture' is financing projects for irrigations for the Organizations of Water Users (farmers using irrigation systems) to rehabilitate the drainage channels and secondary pumping stations of the local irrigation systems. Under Pillar I there are more dedicated options such as Measure 10, Package 5: 'Adaptation to the effects of climate change', that compensates farmers for losses of production due to impact of different cultivation technologies. The objectives are to reduce the vulnerability to the expected climate change impact on crops and to support farmers to change their current farming practices, set up more flexible crop structures and conduct less work in the field. Also, under Measure 15 - Services for environment and forestry, climate services and forest conservation – areas could be restored and transformed into so-called "Quiet Areas"; alternatively, forests can be planted with several purposes: soil erosion reduction and water management improvement, biodiversity.

Who influences the risk prevention versus who carries the damage costs in case of a disaster.

The following governmental institutions can be considered the main influencers as regards risk prevention for water-related hazards in the area of the Lower Danube:

- floods MWF (and subordinated agencies mainly NARW, NMA, ROMSILVA);
- drought MWF and MADR (National Agency for Land Management);
- sediments MWF and MT (Fluvial Administration Lower Danube).

Each implementation body has responsibilities clearly defined by legislation and is cooperating with national research institutes in their respective fields for the technical substantiation of risk prevention actions.

In case of a disaster the damage costs are covered by the state budget streamed mainly via MWF (towards NARW) and MRDPAEF (local authorities). In case of making use of the European Union Solidarity Fund (EUSF) the responsible government institution is the office of the Prime Minister who directs the funds towards the local authorities in the affected regions. In case of local (smaller impact) events, resources from the local budgets can be also mobilized directly.

In order to build a solid financial reserve to protect Romania financially in case of extreme natural phenomena and reduce the budgetary impact on the governmental sources, the **Insurance Pool**

against Natural Disasters (PAID) was established in November 2009. PAID is an insurance-reinsurance company, with private capital, formed by the association of insurance companies for administration of the compulsory home insurance system, covering *earthquakes, floods and landslides*. PAID currently has 10 shareholders (insurance and reinsurance companies). In accordance with the law,[xxxviii] the **policy of insurance against natural disasters** covers damages to *buildings destined as dwellings* (owned by legal or natural persons and registered with tax authorities in Romania) as result of any forms of manifestation of the natural disasters above and direct or indirect effect of the occurrence of the insured risks. The premiums are established on two categories of dwellings and compensations are limited to 10,000 or 20,000 Euro accordingly.

In addition to the compulsory scheme, the local insurance sector offers optional insurance policies both for natural or legal entities. Products profiled for certain sectors such as CAR (Construction All Risks) or EAR (Erection All Risks) covering a wide variety of damages including floods. These policies are compulsory for projects financed by government or by EU sources, and can include a prevention component (they require *detailed studies and recommendations for risk reduction measures).* Currently, the auto-moto insurance has both the largest market share and the largest economic growth. However, given the diversification of economic activities and the increased occurrence of natural hazards, insurance companies have become interested in diversifying their portfolio. The main institutions identified as potential drivers for market uptake are: the **National Association of Insurance and Reinsurance Companies in Romania UNSAR** (a professional association representing the local insurance market, member of Insurance Europe), the **Romanian Actuarial Association** (professional body with over 100 members providing representation, professional standards & training) and the **Financial Supervisory Authority ASF** (the Romanian competent authority authorizing, regulating, supervising and controlling reinsurance companies, mutual undertakings, and insurance intermediaries, in or from Romania).

The insurance sector in Romania is still struggling to overcome historical conditions supporting education for understanding risks individually but also to acknowledge interdependency at community level and shifting from reliance on centralized state interventions in case of disaster to self-protection in accordance with the risk exposure. This is a long-term process with success coming in small steps. As an example, in spite of conducting sustained communication and awareness campaigns since its establishment, PAID managed to reach a national coverage of only 18.96% at the end of 2017.[xxxix]

Windows of opportunity to mainstreaming Ecosystem Services and IVE in Romania

The benefits of eco-system services become apparent when used as the tools of long-term administrative strategies. These strategies involve both informed political decisions, as well as a societal commitment to well-structured approaches to problem-solving.

Romania faces two main challenges in this area: firstly, its multilevel governance is based on a complex legal framework (with over-regulation through the secondary and tertiary levels of legislation) which impacts the DRM more generally. Secondly, a high number of stakeholders with very diverse profiles, restricted legal competencies and limited technical expertise who, as such, lack awareness of ecosystem services and their insurance potential. The generalized top-down approach fuels dependency on centralized interventions and generates a lack of the long-term vision required for an acknowledgement of the value of eco-system services. In turn, this result in a lack of focus on efficient prevention actions at a local level, a reflection of the fact that water-related risks are frequently not acknowledged as priorities by local communities.

Various **interaction and decision-making platforms** are facilitated by the legislation, however their activity is either concentrated at a strategic level or has sectorial influence (such as professional associations in the insurance sector, the associations for intracommunity development for the water utilities sector or the local action groups for the agricultural sector, etc.). Cross sectorial cooperation is encouraged by regulations and procedures, and it is supported (especially by financing streamlines) as part of an **integrated approach**. However, the diversity of administrative institutions involved, their limited responsibilities as defined by legislation, as well as the sometimes divergent interest of the sectors represented (ex: environment vs. agriculture, water management vs spatial planning, local development vs. national sectorial objectives, etc.) have a strong influence on the implementation of DRM measures efficiently and in a timely manner at a local level. In practice, while responsibilities and procedures for interventions in case of extreme events are clearly defined and functional, as regards DRM these are hindered by unclear territorial delimitations between different stakeholders.

As follows, this report presents a selection of gaps in the promotion of ecosystem services in Romania, acknowledged by strategic documents and relevant EU projects[xl] to which Romania was part of:

- A strategic approach as regards (multiannual) allocation of resources, following an evidence-based decision-making process in improving prevention, preparedness and response capacities;
- A common understanding of terms, concepts and instruments connected with ecosystem services and well defined spatial and temporal scales for ecosystem services assessment;
- Over-regulation through the secondary and tertiary levels of legislation; insufficient adaptation of the legislative framework to an up-to-date situation and persistence of obsolete legislation elements;
- Complicated procedures and bureaucracy connected with the development and implementation of any infrastructure project;
- Strength and level of development of the infrastructure and logistics for prevention, operational and response capacity: Implementing a strategic approach in selection of flood protection work (e.g. to be done locally, rather than through extensive, large infrastructure);
- Closer collaboration with the academic & scientific community, with the business community and with the NGOs, pooling experience and resources with the purpose of increasing awareness and mobilizing intervention actions;
- Continuity in actions for public awareness regarding climate change and the associated long- and short-term impacts instead of simple correlation when extreme events occur;
- International and regional collaboration to increase the knowledge and exchange of good practices;
- Promotion of innovative solutions to save costs and bring advantages for all stakeholders involved;
- Integration of climate change into public policies to attract private investments and stimulate economic and social benefits (e.g. present the climate change as an opportunity through associated policies and information campaigns in order to generate green working places and improve the efficient use of natural resources);
- Insufficient participation of local authorities in prevention activities;
- Insufficient involvement of local authorities in risk surveillance activities;
- Lack of integrated databases between stakeholders in the water sector at local level;
- The finalization of the national cadastre (until 2023) and settlement of land ownership aspects (to also stimulate the insurance sector interest and involvement in using of green infrastructure options).
-

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

The Stakeholder Mapping performed under WP 9 (task 9.3) gives a comprehensive inventory of the number and profiles of counterparts and their role in the decision making and action taking processes in the water sector in Romania. This diversity was considered by the desk research and direct interviews conducted further by the Romanian team within the NAIAD project trying to identify the main driving forces to foster the use of NBS and uptake of insurance value of ecosystem as a sustainable solution of DRR in the Lower Danube basin.

The analysis revealed that, based on historical conditions and the strategic importance of the Danube, the stakeholders largely consider *the political decision at central level* as crucial for the acknowledgement of the value of the ecosystem services. Within the complex institutional and legal setting described above the national g**overnment** remains the agent of change with the biggest potential to generate and maintain a steady course of action not only by developing and adjusting regulatory framework and action plans but also by setting the financing priorities accordingly.

ACTIONS: Evaluate differences in capacity to implement insurance value of ecosystems to highlight future opportunities for twinning, policy dialogue and knowledge exchange.

The water authorities (NARW and its basin administrations) play a major role not only as regards responsibilities for interventions but also as regards the knowledge capital and initiating the change. The river basins management plans already consider NBS as valuable priorities and highlight measures categories such as:

- **Measures for restauration of retention areas** *(e.g. the restauration of wetlands, or the creation of wetlands; the reconnection and restoration of **flood plains**, redirecting water courses, the restoration of natural lakes, and renaturation of river banks);*
- **Natural measures for water retention in urban/populated areas** (*e.g. "green gutters", channels and gutters, drainage systems, collecting and storing rainwater in large tanks for further use, permeable paving, small-scale improvements: areas of bio-retention, infiltration channels, green spaces, managed reservoirs for temporarily storing water – retention basins*);
- **Natural measures for water retention based on changing/adapting agricultural practices** (e.g. *the preservation of natural meadows, cultivation practices for soil conservation, slopes terracing, shrubs curtains, etc.)*
- **Natural measures for water retention based on changing/adapting forest management practices** *(e.g. improving forest management in floodable areas, afforestation of mountainous areas along upper courses, afforestation of areas around reservoirs)*
- **Measures for reducing water levels** (e.g. eliminating blockages/obstacles along the course, **floaters**, *ensuring the possibility of both water retention and drainage, raising the **transit** volumes on the minor riverbeds and reservoirs, measures for improving retention capacities at a national level by relocating dams).*

Such measures (transformed in success stories) becoming visible also for counterparts outside the water sector and embedded as viable development solutions at local level could be the starting point for raising the trust in NBS and reforming the current business as usual approach. Furthermore, stakeholders' education, involvement and participation should be used in a structured manner to overcome the current fragmentation in implementation of different sectorial policies at local level.

The *Secretariat General of the Government (SGG),* an institution directly subordinated to the Prime Minister, could take the lead in this direction. The Policy and Priority Coordination Directorate within SGG, dedicated to improvement of public policies development, coordination and planning at central government level, is horizontally connected with public policy units of the line ministries, and thus benefits from an already functional framework for interconnecting and synchronizing different policy objectives as well as prioritizing *prevention* on the public agenda and embracing NBS and IVE as efficient instruments to mitigate water-related risks. The institution can also facilitate including the insurance sector as a partner in thus policy dialogue, along with other relevant representatives of the business environment and civil society, to create robustness of the chosen models. A stronger knowledge sharing stream involving the academic sector could be aimed at increased awareness and education at local level to support informed participation in generating bottom-up solutions not only with a risk management purpose but within local development plans to consider social and economic co-benefits for the local communities.

The outreach could be increased using *the institution of the prefect* as government representative at the local level. Romania has 41 Prefects (one for each county and Bucharest) with responsibilities as regards operationalization of public policies in the local communities. The **Prefects** preside the county committees for emergency situations and are members of the river basin committees. They can facilitate efficient dialogue and decision making and cross sector cooperation within local conditions being at the same time a direct communication channel with the central policy unit for increased coherence of regulations and action plans also at national level.

The Danube Floodplain project proposal **submitted to the Danube Transnational Programme 2nd Call** in 2017, represents one particular window of opportunity for raising NBS higher on public agenda. The project will not only assess sustainability in provision of ecosystem services for preservation and restauration of floodplain areas along the Danube and selected tributaries but will also cooperate with other partner countries in the basin for implementation of selected NBS. Additional details are presented in the Demo characterization document. Synchronization of activities with NAIAD towards end of 2018 was discussed with the MWF and NARW and will be implemented accordingly based on project approval. The implications and sustainability of this potential model to overcome current gaps will be further researched within the consultation activities planned within the project and recommendations will be included in the policy papers aimed by NAIAD.

6.3 Institutional settings in France

The formal rules of the game: National DRR in disaster management law and institutions: the legal framework

Please see the D8.1 to have more details on the French legal framework

Reminder: The French Flood Risk Management (FRMP) was developed in 23 October 2007 by the French government and following the Flood Directive 2007/60/EC.

The French National Flood Risk Management Strategy (SNGRI) has been developed in 7 October 2014 by an inter-ministerial decree dedicated to improving knowledge and risk management trans-ministerial relations. According to (Morel et al. 2017), the national strategy for DRR is based on 7 pillars:

1. Understand and asses risk
2. Forecast and early warning systems

3. Education and risk awareness
4. Integration of the risks in land-use planning
5. Reduce vulnerability
6. Prepare and manage crisis
7. Feedbacks

And has three main objectives which are[xli]:

1. To improve safety of exposed populations;
2. To reduce the cost of flood damage;
3. To reduce the time to return to normal;

Mapping roles and responsibilities in the governance settings: transaction costs

	FLOODS
Who carries the costs	Municipalities (in the future: municipalities' community)
Who assesses the risk?	State: Prefectural authority through the DDTM (service in charge of risks and environment), assisted by private consulting companies
Who makes the investments	Municipalities (in the future: municipalities' community), partially granted by the Barnier fund, the Agence de l'eau RMC, departments and regions
Who benefits from the DRR measures?	Populations, economical sectors
Who benefits from the investments/ DRR measures?	Same question?
Who influences the risk	From the hazards side: municipalities through protection measures From the vulnerability side: State, i.e., Prefectural authority regulate land use
Who who carries the costs in case of a disaster	Insurance for small disaster, CAT NAT fund from the re-insurer CCR in case of real disaster
Current institutional gaps	CAT NAT fund functioning and financing.

how aligned are current incentives to ensure Disaster Risk Reduction	A tax on insurance premium finances the Barnier fund, enabling
how misaligned are current incentives to ensure Disaster Risk Reduction	The CAT NAT fund enable only to rebuild in the same state and does not fund building enhancement or vulnerability reduction operation which slow down vulnerability decrease The CAT NAT fund is financed by everybody, without consideration for the real local risk. It is recognized to insufficiently promote responsible behavior. It allows a great solidarity but also slow down the financial incentive to take into risk when building
Who implements the measures	Municipalities with the support of the catchment water agency (in the future: municipalities' community)

Current institutional structure dedicated to DRR/DRM

The French system for DRR is based on partnership governance between national, local public authorities, civil society and the insurance sector.

National level

The State is responsible to define the national strategy to implement flood risk management policies. Currently the highest level of institutional responsibility for DRR and DRM rests with the Ministry of Environment and the French re-insurer: the Caisse Central de Réassurance (CCR). The first, is the leader in charge of DRR policies at the national level, Flood Directives' transposition and to determine strategies. A dedicated working group, the "Conseil d'Orientation Pour la Prévention des Risques Naturels Majeurs (COPRNM: "Advisory Committee for the Prevention of Disaster Natural Risks"), has objectives to *"provide ideas and proposals in the field of prevention of natural risks*" (Decree no: 2003-728), to improve knowledge, monitoring, prevision of risks to reduce vulnerability and to provide expert analysis. This working group is also helped by the "Agence Française pour la Prévention des Catastrophes Naturelles" (AFPCN: "Association for Prevention of Natural Disasters"). The latter, CCR a State-owned company, ensures compensations in case of "natural catastrophe" disaster recognizing, by a ministerial decree, municipalities damaged by the disaster (reinsurance with an unlimited State guarantee). Globally, the French insurance sector play a role in DRR under the "catnat" mandatory coverage[xlii]. The "Direction Générale de la Prévention des Risques" (DGPR: "General Directorate for Risk Prevention") aims to identify and to assess risk to lead tailored prevention policies. In 2000, the "Mission Risques Naturels" (MRN: "Natural Risk Knowledge and Reduction") has been launch as an initiative of French insurers (by the Association of French Insurance, FFA) to improve knowledge and prevention of climate risks. Since 2011, the "Commission Mixte Inondation" (CMI: "Joint Flood Commission") represents the State, local authorities and civil society to monitor the implementation of the Flood Risk Management Plans from the COPRNM and the "Conseil National de l'Eau" (CNE: "National Water Committee"). The State ensures the public safety thanks to strong relation alongside the role of the Mayors. In 2012, the "Observatoire National des

Risques Naturels“ (ONRN: “National Observatory for Natural Hazards”) has been launched thanks to a partnership between the French State (Ministry of Environment and CCR) and the MRN, in the objective to collect and to share data on natural hazards between the different French actors involved in DRR/DRM.

At the national level, Meteo France, the National Forecasting Centre is in charge of numerical weather precipitation model and coordinates flood preparedness, prediction, alerts to the citizens.

Sub-national level

At sub-national level, the key institutional structures established for DRM are the regional departmental, communal local risk committees and individuals. There is great diversity of actors involved at different scales.

- The government agencies and institutions are represented at regional, departmental and communal levels. As has been noted above, national policy documents such as the SNGRI rightly emphasises the importance of local vulnerability and capacity in DRM, as well as providing a stakeholder structures, the “Territoires à Risques d’Inondation[xliii]” (TRI: High Flood Risk Territories).

- **At the river basin district level,** stakeholders and the State are associated within the “Plan de Gestion des Risques Inondations” (PGRI: Flood Risk Management Plan) into “basin governance” so-called “Établissement Public Territorial de Bassin” (EPTB: “Local Public River Basin Establishment”) and “Établissement Public d’Aménagement et de Gestion des Eaux” (EPAGE: “Local Public Water Management Establishment”) to clarify common objectives of the stakeholders in flood risk management. The river basin scales can use the “Programme d’Action de Prévention des Inondations” (PAPI: “Flood Prevention Actions Programs” (PAPI CASA 2013). It is a State financing through a national call for proposals in the objective to promote innovation actions for flood DRR.
- **At the regional level,** the Prefects initiated the “Plan de Prévention des Risques” (PPR: “Risk Prevention Plans”). The “Direction Régionale de l’Environnment, de l’Aménagement et du Logement” (DREAL: “Regional Directorate of Environment, Planning and Housing”) is responsible for the implementation of all flood risk management plans and for flood forecasting services. At the department scale, the “Direction Régionale et Interdépartementale de l’Environnement et de l’Énergie” (DRIEE: “Environment and Energy Regional Direction”), coordinates State flood risk management actions at the departmental scale.

- **At the department level**, the “Direction Départementale des Territoires” (DDT: Departmental Public Works Directorate), is responsible for assessing natural hazards according to local specificities and Risk Prevention Plan drafting for defining area where the building is permitted and or not. Generally, departments have crisis forces in case of droughts or floods. Locally, the municipalities are responsible in terms of urban development by working with the DDTs (land-use planning, delivering permits according to the PPR recommendations), vulnerability assessment, information to citizens, emergency services and crisis situation. Basically, municipalities and mayors are responsible to ensure providing of information on natural hazards, to maintain protective measures. Their liability can be engaged if the absence or lack of protective measures is recognized.

- **At the municipal level,** On 1st January 2018, the municipalities will have a new competence in DRR, the "GEstion des Milieux Aquatiques et de la Prévention des Inondations" (GEMAPI: "Management of Aquatic Environments and Flood Prevention"– Law n°2014-58 of the 27 January 2014) dedicated to managing protective measures, to reinforce linkages between flood prevention and river corridor environmental management (more information in: Windows of opportunity to mainstream ecosystem services and IVE in France?). To unlock this new competence, municipalities could implement a specific tax. In 2015, urban communities[xliv] have taken this new GEMAPI competence to assess, increase their knowledge on the local protective measures.

- **At the individual level**, the law on the dryness marshlands of the 16 September 1807, notably the article 33[xlv], makes property owners responsible of the banks maintenance. Property owners located and living next to waterways theoretically cannot ask the State to manage these streams. Property owners (public or private) are responsible of the management and of the implementation of protective measures on these banks. Actually, the law authorizes the State to take the responsibility to maintain and to implement protective measures.

Pre-disasters, funding protective measures & disaster risk insurance post-disaster responses : Funding protective measures and non-structural measures in France

The Barnier Fund

France has specific fund for disaster response ("Cat-Nat fund"), a similar mechanism exists for DRR activities: the "Barnier Fund".

The national-level Barnier Fund was established by law n°95-101, of the 2 February 1995; It is dedicated to finance the national policy on disaster risk reduction. This fund is dedicated to reducing vulnerability of the assets exposed to natural hazards: to local communities and homeowners. It is funded by a 12% levy on the additional premium related to natural disasters - this is linked to the compulsory extended "NatCat" coverage on all property damage insurance contracts (NatCat law passed 13th July 1982)[xlvi]. This State fund was designed to finance compensation for expropriation of property in high risk areas. To this date, this fund is used to finance 4 types of measures (L'Assurance 2015):

1. Relocation (e.g., expropriations, reduction of unworthy houses in overseas departments)
2. Temporary evacuation and resettlement for properties in high risk areas (e.g., proven high risk of landslide)
3. Measures to reduce vulnerability (e.g., studies and works on prevention or protection of communities, earthquake-proof measures, compliance of dike areas etc.)
4. Studies and regulatory acts of the State (e.g., implementation of Risk Prevention Plans and hazard maps, dedicated communication for prevention etc.).

Only municipalities having PPR in place and natural or legal person (only for companies with less than 20 employees) living/working within these municipalities and insured against natural disasters can be the beneficiaries of this fund. In principle, public or private property owners living next to waterways have to finance protective measures (Law 16/09/1807). Nevertheless, they can rely on the support of

the State through the Barnier Fund. French municipalities or natural/legal person (with RPP) can receive the minimal rate below - **¡Error! No se encuentra el origen de la referencia.**.

Table 18. Subsidies from the Barnier Fund to implement RPP's vulnerability reduction measures

For whom? *The beneficiaires*	Local authorities			Natural or legal person (individual or companies with less than 20 employees)		
For what? *The studies, works and subsidized acquisitions*	Friendly land acquisition of property exposed to a major natural risk	Friendly land acquisition of property damaged by a natural disaster	Studies, works and preventive equipment	Recognition and filling of underground cavities	Studies and works imposed by a PPR	
Level of financing? *Variable rates* [1]	**100% max.**	**€240 000/land unit max.**	**Between 25% and 50% max.**	**30% max.**	**Private house 40% max.**	**Companies 20% max.**
Risks involved?	Landslides; subsidence due to an underground cavity or due to a natural or man-made that does not result from the past of ongoing mining operation; torrential rains or fast rise;	Any risks likely to cause a disaster that may be the subject of a declaration of "natural catastrophe"	Any major natural hazards	Risks of land subsidence due to underground cavities or hinges due to natural or human origin and not resulting from the past or ongoing mining exploitation	Any risk covered by a PPR	
Which conditions? *Depending on the*	Serious threat to human lives	Assets covered by an insurance contract including the guarantee	Communities covered by a prescribed or approved PPR	Reconnaissance operation: proven dangers for buildings	Assets covered by a "multi-risk home insurance" and existing at the date of approval of the PPR if the envisaged	

nature of the risks	Acquisition expenses of properties, lower than the average cost of safeguarding and population protection Property covered by a "multi-risk home insurance" including the "natural catastrophe" guarantee	against the effects of natural disasters and their base lands (for companies with less than 20 employees) Damaged properties to more than half of their initial value excluding risk and indemnified under the "natural catastrophe" guarantee	Assets covered by a "multi-risk home insurance" if the envisaged operations concern directly the property exposed to natural hazards	and human lives Filling operation: serious threat to human lives and cost of works less than the cost of expropriation compensation	operations concern directly the property exposed to natural hazards.

1/ According to eligible transaction costs

References: Based on Ministry of Environment 2016 & www.mrn.asso.fr – adapted by IRSTEA, Nov. 2017

The Barnier Fund[xlvii] not only finances structural protective measures but also different measures such as friendly land acquisition, targeted communication to raise awareness etc. In other words, this fund finances both DRR and vulnerability reduction measures. Moreover, it is only dedicated to investment actions and not for maintenance or reconstruction in case of damage on these protective measures. There is no single management structure which provide both the project management and the financing of the maintenance works (managed locally by the General Council).

The Barnier Fund is the main and the most-well known national fund, while there are other funds/possibilities to finance protection measures.

The other ways to finance DRR

Programme 181, Risk Prevention

At the French State level, the DGPR relies on local services, the DGPR allocates budgetary and human resources necessary for the DREAL, DEAL, DRIEE (to carry out the missions which are of the prevention of risks) under the **"Programme 181, Risk prevention"**. It is another source to finance DRR, in addition to the Barnier Fund. This Programme 181 is practically implemented within the DREAL, DEAL and DRIEE which are the "Budget Opérationnels de Programme" (BOP: Programme's

Operational Budgets). Each regional programme's operational budget is under the responsibility of the CEO of the DGPR (Ministry of Environment). The Regional and/or Catchment Prefect[xlviii] elaborates the assessment of the credits needed within the BOP (actions and financial needs). Locally, the "Direction Départementale de la Cohésion Sociale et de la Protection des Populations" (DDCSPP: "Departmental Direction of Social Cohesion and Protection of Populations") and the DDT are the operational units of the regional BOP. The Programme 181 finances projects based on its available credits and thanks to two financial mechanisms[xlix]: payment appropriation and commitment authorization[l].

This Programme 181 focuses on four priorities which are[li] based on the National Sustainable Development Strategy (security, safety, public health and environmental protection) (Rabault 2014):

1. Prevention of technological risks and industrial pollutions
2. Prevention of natural and hydraulic disasters
3. Nuclear safety and radiation protection
4. Risk prevention related to former mining sites

The 2017 budget of the Programme 181 is €229.62 million (which is 2.4% of the total annual budget of the Ministry of Ecology) [lii]. The table below highlights the repartition of the budget within the four actions - **¡Error! No se encuentra el origen de la referencia.**.

Table 19. Repartition of the Programme 181 budget within the four actions

Action	Amount in commitment authorization (€)	Amount in payment appropriation (€)	This action represents % of the programme credits (%)
Prevention of technological risks and industrial pollutions	€104.68 million	€89.45 million	43.6%
Prevention of natural and hydraulic disasters	~€40 million		16.6%
Nuclear safety and radiation protection	€57.8 million	€62.8 million	24.1%
Risk prevention related to former mining sites	~€38 million		15.8%

References: www.senat.fr/commission/fin/pjlf2014/np/np10a/np10a4.html, visited on Nov. 8, 2017

Basically, the French State can also provide additional subsidies to finance DRR within the frame of national labels (e.g., Plan Rapide de Submersions), through national projects financed by "Fonds Unique Interministériel" (FUI: Unique Interministerial Funds), by the global dotation of "Fonds de Compensation de la Taxe sur la Valeur Ajoutée" (FCTVA: Functioning or the VAT Compensation Funds) which reimburse two years later, the VAT paid by the "Établissement Public de Coopération Intercommunale" (EPCI: "Public Establishment of Intermunicipality cooperation") on their investments expenses (CEPRI 2017).

The sub-national level and its involvement in finance of DRR

French Regions and Departments are also involved in the financing of DRR measures, through investments expenses dedicated to DRR (non)-structural measures. It is a voluntary competence for regions and departments. These investment expenses budgets dedicated to DRR are voted every year and in every region (Provence-Alpes-Cote d'Azur 2010) and within the actions financed under the State-Region Planning Contract or thanks to their intervention credits or European funds they managed[liii]. The Departments provide support to the communities.

Locally, municipalities and mayors are responsible for communal DRR, they can rely on subsidies to implement it. If the municipalities are public owner of the protective measures ("maitre d'ouvrage"), they pay for implementation and maintenance. Nevertheless, in France, this municipal role will change. Indeed, EPCI or urban communities thanks to their new GEMAPI competences will be responsible of the financing, maintenance and monitoring of the protective measures based on their own tax revenue – please see below Windows of opportunity to mainstream ecosystem services and IVE in France?.

EPCIs define a "framework convention" between the State represented by the Regional Prefect, the department, the EPCI itself and the municipalities within the concerned EPCI. This convention defines the financial engagement of each partner in DRR (PAPI CASA 2013).

Water Agencies can punctually finance protective measures or financial aids dedicated to studies on the knowledge improvement on flood risks, to finance protective measures linking protection/restoration of the ecosystem and risk prevention (flood expansion fields, preservation of wetlands, control of urban/rural runoff, prevention of accidental pollution on industrial sites). Water Agencies also finance studies necessary in the context of the new GEMAPI competences for EPCIs (Eau Seine Normandie 2016).

The example of "river contracts" highlights the arrangement between municipalities, water agencies and the State to finance global management of river, lake or groundwater tables.

To examplify the different sources of funding and the different institutions involved in the French DRR, the

below synthesizes the 2014-2019 financing plan of the "Communauté d'Agglomération Sophia-Antipolis" (CASA: "Urban Community Sophia-Antipolis") EPCI, within which the Brague DEMO is

Flood protection plan CASA urban community 2014-2019 (PAPI CASA 2013, p.5): catchments of the Brague & Loup & small coastal streams

Scale	**French State**	**French State**	**Region**	**Department**	**Urban community**	**Region water agency**	**Municipalities**	
Topics	Etat BOP 181	Etat FPRN	Région PACA	CG 06	CASA	Agence de l'eau	Maîtres d'ouvrage	TOTAL
Management	1,4%	0,0%	0,3%	0,0%	1,8%	0,0%	0,0%	3,4%
Increase hazard knowledge and risk awareness	0,2%	0,3%	0,7%	0,0%	0,6%	0,0%	0,0%	1,8%
Monitoring & forecast	0,0%	1,0%	0,6%	0,1%	0,4%	0,0%	0,0%	2,1%
Alert & crisis managment	0,0%	0,0%	0,1%	0,0%	0,2%	0,0%	0,0%	0,3%
Risk awareness in urban planning	0,0%	1,0%	0,1%	0,0%	0,1%	0,0%	0,0%	1,1%
Vulnerability reduction	0,0%	33,1%	1,9%	1,5%	3,2%	0,0%	3,1%	42,8%
Flood buffering	0,0%	18,1%	0,1%	3,6%	7,2%	0,0%	7,3%	36,3%
Protection structure managment	0,0%	5,2%	2,3%	1,2%	0,1%	0,9%	2,4%	12,2%
Total	1,6%	58,8%	6,1%	6,4%	13,3%	1,0%	12,8%	**~11.6M€**

located in addition to other rivers. In that case, the main source of funding is the French State through the Barnier Funds (58.8%), followed by the CASA Urban Community (13.3%) and then by the municipalities (12.8%). Investments are made for vulnerability reduction especially (42.8%) and for flood buffering (36.3%).

Table 20. Flood protection plan CASA Urban Community, Brague DEMO (adapted from PAPI CASA, 2013)

Flood protection plan CASA urban community 2014-2019 (PAPI CASA 2013, p.5): catchments of the Brague & Loup & small coastal streams

Scale	**French State**	**French State**	**Region**	**Department**	**Urban community**	**Region water agency**	**Municipalities**	
Topics	Etat BOP 181	Etat FPRN	Région PACA	CG 06	CASA	Agence de l'eau	Maîtres d'ouvrage	TOTAL
Management	1,4%	0,0%	0,3%	0,0%	1,8%	0,0%	0,0%	3,4%
Increase hazard knowledge and risk awareness	0,2%	0,3%	0,7%	0,0%	0,6%	0,0%	0,0%	1,8%
Monitoring & forecast	0,0%	1,0%	0,6%	0,1%	0,4%	0,0%	0,0%	2,1%
Alert & crisis managment	0,0%	0,0%	0,1%	0,0%	0,2%	0,0%	0,0%	0,3%
Risk awareness in urban planning	0,0%	1,0%	0,1%	0,0%	0,1%	0,0%	0,0%	1,1%
Vulnerability reduction	0,0%	33,1%	1,9%	1,5%	3,2%	0,0%	3,1%	42,8%
Flood buffering	0,0%	18,1%	0,1%	3,6%	7,2%	0,0%	7,3%	36,3%
Protection structure managment	0,0%	5,2%	2,3%	1,2%	0,1%	0,9%	2,4%	12,2%
Total	1,6%	58,8%	6,1%	6,4%	13,3%	1,0%	12,8%	**~11.6M€**

As seen before, the numerous sources of financing are dedicated to implement (non)structural protective measures. Nevertheless, the Barnier fund, Regions and the EU do not finance expenses related to maintenance and monitoring requirements (first and third rows).

Windows of opportunity to mainstream ecosystem services and IVE in France?

Policy framework & institutions: the new GEMAPI competences

"NBS are co-benefits solutions well adapted to support public environmental policies like the new 2018 GEMAPI competences for municipalities[liv]*".* GEMAPI (Law n° 2014-58 of the 27 January 2014,

articles 56 to 59) forces local communities (namely municipalities and inter-communities (EPCIs)) to mix management of aquatic ecosystems and flood prevention in the land-use planning. The new competences GEMAPI[lv] is defined by four paragraphs (1°, 2°, 5°, 8°) of the article L.211-7 of the Environment Code):

1. 1°, Catchment management or a part of hydrographic catchment
2. 2°, Management and development of waterways, canal, lake and the access to these areas
3. 5°, Defences against floods and sea
4. 8°, Protection, restoration of areas, aquatic ecosystems, wetlands and riparian forests

Thanks to the GEMAPI, mayors will have new juridical and financial tools to undertake these competences notably to manage protective measures and ecosystems. Ecosystem management is maximized for DRR uptake in each scale of stakeholders involved in DRM (policymakers, land use managers), under the territorial solidarity within the up/downstream relations. GEMAPI fosters municipalities to cooperate through to the creation of EPCIs.

First step, in the implementation of the GEMAPI competences is that urban communities have to make a review of the current protective measures in place in their territories. Second step, is to define owners and managers of these defences measures. Third step, definition of the state, responsible of the maintenance and of the monitoring. The idea is to make the communities aware of the relations between upstream and downstream catchments, by using both engineering and ecological measures.

To practically implement it, municipalities or EPCIs[lvi] can implement a (facultative) tax (so-called "Tax for the management of aquatic areas and floods prevention"[lvii]) of maximum €40/year/inhabitant living within the municipality or EPCI. On the practical aspect, municipalities and EPCIs can delegate all or part of their GEMAPI competences, for all or part of their territories to a joint association. Moreover, this joint association can transfer some of its competences to EPTB responsible of the coordination of actions and to EPAGE responsible of the operational actions (CEPRI 2017).

In addition to the different sources of DRR-financing, GEMAPI proposes new financial such as banks loans and the €40-tax because in 1st January 2020, departments and regions will not be juridically or financially allowed to act under GEMAPI, this competence have been deleted by the Law NOTRe. Nevertheless, after 2020 departments and regions will be allowed to finance communal "maitrise d'ouvrage" operations (Law CGCT, article L.1111-10).

The window of opportunity is open in France to reinforce linkages between NBS and DRR, as exemplify the involvement of the Water Agencies in GEMAPI, as support to propose new river management based on NBS (Eau 2015). GEMAPI changes the actors' intervention in protective measures management by trying to better define the role of each actor in this management (CEPRI 2017 p. 17). The interlocking of numerous actors within GEMAPI can be a force to mainstream ES and IVE at all scales and into the policy framework. This will work only if the role of each partner is well defined to avoid overlapping or gaps. Even if it is sometimes very complex to know and to understand the role of each stakeholder in DRR.

Public private partnerships (PPPs) in DRR

The literature highlights the importance of PPP for DRR and for ES management (Stern 2006, European Commission 2011, 2015, IPCC 2014a, Aerts and Mysiak 2016, Cohen-Shacham et al. 2016,

Golnaraghi et al. 2016). It was the core topic of the ENHANCE project, to enhance society's resilience to natural disasters through multi-sector partnership. Creation of PPPs dedicated to strengthening mechanisms for improving DRR. DRM is an opportunity to be taken to foster integration of ES/IVE in DRR. PPPs can cover numerous sectors of DRR/DRM such as data exchange, financing mechanisms (incentives or investments), communication to raise awareness and recovery processes. *"A new paradigm for disaster risk governance will include the private sector"* (UNISDR 2016 p. 4). UNISDR has already proposed five visions of PPPs in DRR to mainstream interrelation between public and private sectors. Reports related to NBS and to the IVE are often published by consortium of public and private partners. Indeed, PPPs can be used to continue/instore researches for capturing the capacity of ES to reduce risks (data and information), (Dow et al. 2013, Colgan et al. 2017) and to divide the costs of maintenance, financing between the partners.

In France, the current system is based on PPP governance and multi-stakeholder commitments. As example, private companies collaborate with public entities in disaster management plan (e.g., Axa and the EPTB Seine Grands Lacs[lviii]). The French system for prevention is based on a well-developed PPP, the private sector engaged itself to communicate on natural hazards to raise awareness: the ONRN is based on a national PPP agreement. It is an open source platform for sharing national DRR information and knowledge (Nussbaum and Pigeon 2015). This platform could be used for the co-production of knowledge on ecosystem services (target #3).

Moreover, according to the mandatory insurance coverage for natural catastrophe, the private insurance sector is directly involved in DRR notably through communication on natural hazards to raise awareness and through the 12%-additional premium dedicated to fund the "CatNat" fund and Barnier Fund[lix].

During interviews performed with the French insurance sector on this question on integration of NBS/IVE standards in PPP that strengthen DRR some key elements were highlighted.

- First, the current French PPP system can be a basis to integrate NBS/IVE.
- Second, as the French insurance sector already work with private companies and charities for implementation of theft and automobile preventions, with model can be a basis to work with ecological engineering companies and charities, NGOs to implement NBS/IVE in DRR (target #5).
- Third, focusing on incentivise implementation of NBS in the insurance sector, this it could be a window of opportunity but due to the current mandatory and solidarity insurance scheme, it would be difficult to implement it or to incentivize homeowner for risk prevention measures' implementation (there is no risk-based premiums).

Barnier Fund, could be used to finance ES in DRR?

During interviews performed with the French insurance sector on this question of the different sources of funding for DRR and NBS, the importance of the Barnier Fund has been highlighted, as there is no fund dedicated for NBS specifically in France.

Barnier Fund is the main, the most well-known fund in France and dedicated to finance grey protective measures, which is at the antipode of the NAIAD's objectives (target #3). This fund could potentially be used to finance green/hybrid protective measures or to reimburse investments made

by local authorities or natural or legal persons. Barnier Fund is unlocked when a PPR is prescribed or approved, it would be a way to integrate NBS into those PPR (as a mandatory requirement). Another idea to mainstream NBS/IVE is that is the Barnier Fund is used for expropriation of property located in high risk area, it could be possible to change the use of this area by implementing NBS (financed by the Barnier Fund and maintenance and monitoring costs supported by the private sector (insurance companies)) (targets #3, 8).

Nevertheless, currently there are lot of discussions on the pros and cons on the ways the fund is used (the fund finances numerous actions). Indeed, according to some actors, NBS have multiple benefits thus, it would be more relevant to create a dedicated fund (target #8).

Financing national ES through the global market, the green bonds and French innovation

France, as leader of the Paris Agreement and the COP 21, want to keep its position on green bond markets. It was a real demonstration of the French actors' commitment and expertise to cope with climate change. Credit Agricole exemplifies the French leadership in climate investments within the COP 21 objectives, $1.1bn were placed in green bonds in 2016. French green bonds are especially dedicated to transport. Many French actors have adapted their portfolios to climate change (Paris Europlace 2015). Hitherto, France is the leader in green finance, had the first position of the origin issuing country of green bonds, at the end of 2015, this represents +10% of the issuance through a great variety of issuers (Figure 6). France has its own label, the "Transition Énergétique et Écologie pour le Climat" (TEEC: "Energetic Transition and Ecology for the Climate") launched in 2016 by the government (Ministry of Environment) and based on the Climate Bonds Initiative' standards and linked to the article 173 of the Law on Energetic and Ecological Transition. This label recompenses the French green funds for their long-term green investment strategies (such as: CM-CIC Green Bonds, InfraGreen III, Axa World Funds Planet Bonds, HGA Obligations Vertes ISR and Sycomore Eco Solutions[lx]).

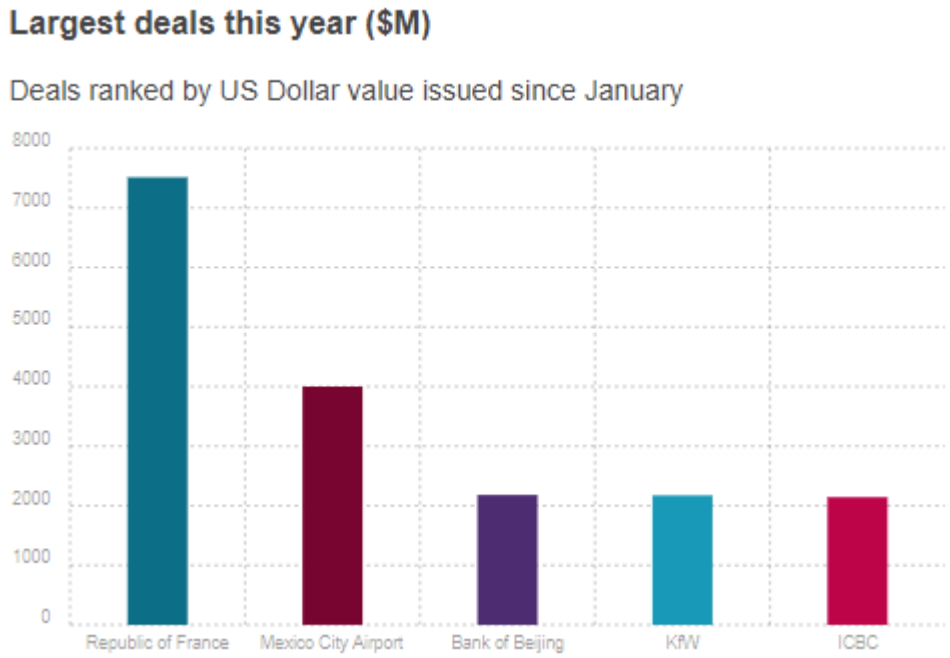

Figure 6: France, leader in green bond issuances, www.greenbonddata.org, visited on Nov. 10, 2017

This clarification of the green bond market functioning participates to better understand the current involvement of several reports to define the framework for NBS to access to this market. To enter in this market, NBS need to meet these two conditions – according to (Colgan et al. 2017):

1. A revenue source to repay the bond buyers
2. A set of performance standards to demonstrate flood risk reduction goals

The two French DEMOs cases can be strong toolkit to support communication campaigns, co-production of knowledge on the impact of NBS on floods and droughts. Based on the current French well-developed communication on prevention and can make the case for mainstreaming ES and IVE.

7 Institutional gaps against IVE operationalization

NAIAD project tries to clarify the potential institutional gaps against the IVE/NBS operationalization. IVE/NBS need to be institutionalized by institutions "champions" for supports. Despite their great diversity, institutions play a key role in IVE/NBS mainstreaming with impact on social/policy acceptance.

Hereby a list of the main issues - valuable through Europe - to be overcome for a practical IVE/NBS implementation.

- **Terminology and definition**: one gap could be the issue of the definition of the terms IVE/NBS which also impact the vision to implement these concepts. To overcome it same definition and same global vision are needed.

- **Existing policies and overlapping**: lack of strategic coordination between DRR and ecosystem services, NBS and IVE. DRR, NBS and IVE overlap and interact within numerous policies such as laws on biodiversity, spatial planning, environmental management, economy, climate change adaptation and DRR policy frameworks etc. (Munang et al. 2013, Lo 2016). This requires more interaction between the science-policy interface.

- **Existing institutions and overlap/dispersion**: As seen before, policy aspects are often covered by different laws and thus by different governmental ministerial or department units. One gap is the lack of coordination due to division of responsibilities, in addition to the lack of (inter)institutional exchanges. Clarification of the role of each institution is needed as a fit for purpose with future climate change and natural catastrophe challenges. It is a challenge for governmental institutions to make change in management (reluctance from some institutions to be reorganized may emerge). National institutions are guidance, recommendations and resources providers. From the EU level point of view, proposal for institutional harmonisation is a complex issue due to the different institutional organisation between Member States. Nevertheless, catchment scale management is a common EU organisation and could be a basis to operationalize harmonised-IVE implementation (Sudmeier-Rieux 2013). Another point could be the establishment and strengthening of collaboration between ministries (within

themselves too) and other relevant stakehodlers (e.g., PPP) to enhance implementation of IVE and to reduce institutional fragmentation of information/knowledge (Lo 2016, OECD 2017).

- **Financial aspects**: *"It can be difficult for politicians to prioritize costly flood protection measures"* (Sorensen et al. 2017 p. 37). The main gap to institutionalise and to operationalize the IVE/NBS, is the investment issue. Indeed, IVE/NBS require long-term investments given long-term and multiple benefits (to human and to nature) which are difficult to be seen by policyholders. Moreover, due to the diversity of policies, institutions financial resources could be maladjusted and badly distributed (Kettunen et al. 2014). The (OECD 2017) recommends definition of sufficient institutional capacities (e.g., cooperation, coordination, risk assessment, risk awareness, pricing, risk transfer etc.) for the disaster risk assessment. Another issue is the monetization of nature which is very critically regarded (Wamsler and Pauleit 2015).

Nevertheless, more than these different gaps, there are also infancy-examples of institutional IVE operationalisation and mainstreaming in Europe. (Wamsler and Pauleit 2015) exemplify mainstreaming of ES in Sweden and Germany which is considered as *"paving the way to climate change adaptation"* and that NBS/ES *"is widely advocated as a DRR"*. As described above, the authors highlight the need for changes in organizational structures (interdisciplinarity and inter-departmental linkages) to avoid policy fragmentation. According to these authors, municipalities are the key institution to mainstream NBS/ES. Radulecu et al. (2017) demonstrate that Romania starts to integrate ES in DRR with the example of re-naturalization of the river banks.

Neuhold (2017) and Sudmeier-Rieux (2013) highlight the importance of the EU level as guider for DRR implementation, such as the Directives' impacting role (notable the Floods Directive). During IVE interviews, someone proposes the idea to create an "IVE Directive" to mainstream eco-DRR.

In the objective to better understand the European diversity on the different topics mentioned above, the Table 1 summarizes how it is organized at the EU level and the current gaps to operationalize the IVE/NBS.

Table 1: Summarized table

Ex-ante			**Ex-post**	
PROTECTION/PREPAREDNESS DRR			*RECOVERY*	*CURRENTLY*
Who pays protective measures?	**Who benefits?**	**Who influences the risk?**	**Who pays in case of disaster?**	**Gaps**
-Government & other levels involved in this topic	-Citizens -Businesses -All infrastructures	-Government & other levels involved in this topic	-Government (ad-hoc e.g., Denmark, Netherlands or compensation based on governmental	-Terminology and definition -Existing policies and overlapping

-Private sector (e.g., in UK)	-Other stakeholders engaged in DRR (e.g., financial institutions, insurance companies)	budget e.g., Poland, Italy, Slovenia) -Institutionalized form of compensation (Spain, France, Romania) -Risk pooling (e.g., in UK) -Insurance companies (e.g., Sweden, Germany, UK)	-Existing institutions and overlapping/dispersed -Financial aspects

This section on institutional gaps highlights challenges limiting operationalization of the NBS within the different institutions (Thistlethwaite and Minano 2016). The current leitmotiv is to said that the opportunity to mainstream eco-based approaches for DRR, into private sector (insurance sector) activities should not be missed: as an innovative risk management (Surminski et al. 2015, Lo 2016).

8 Conclusions: Windows of opportunity to mainstreaming Ecosystem Services and IVE

This report includes a baseline study on policy and institutional incentives for the mainstreaming of ecosystem services for risk reduction and the potential Insurance Value of Ecosystems. It follows on previous reports elaborated during the project and takes the effort further in order to select those policy and institutional arrangements that may be usefull for the implementation of NBS in our DEMO countries. To do so, we analyze institutional layers at international, European and national level.

At international level frameworks such as Sendai or Agenda 2030 set up a path for a holistic approach to disaster resilience, providing useful indicators and criteria to monitor achievements while strengthening governance and allowing coherence among different policies and sectors. The main barrier at the moment is the complex framework for reporting, done at member state level, the incentive however is how a co-benefits approach from the adoption of NBS could help comply with Agenda 2030

- lack of effective regulatory and fiscal incentives to attract private investments on brownfields
- lack of knowledge/capacity of staff & human resources in municipalities dedicated to implementation mechanisms for unlocking development on brownfield land – e.g. EU funding, blending various financing instruments;
- nature-based solutions are not high on agenda of urban authorities due to low awareness of its social and economic benefits (i.e. positive effect on people's health, reduction of flood risk, air quality, urban biodiversity, public health and well-being).

At European level we distinguish between Strategies and Directives. The first provide policy frameworks and advice while the second are to be incorporated into national laws. Rules, as incentives can provide the rules of the game and can shift the whole system as levers for action/iaction/conflict/cooperation.

From the Urban Agenda, Adaptation Strategy, Green Infrastructure strategy, it is concluded that Member States and regions need to start to draft spatial development policies that consider how Nature-Based Solutions should be integrated into broader urban land use planning. Introducing and developing these concepts require, in many cases, employing innovative tools and policy approaches, like e.g. developing incentive-based and financial instruments able to support effective spatial and urban policies. In terms of funding. It is already acknowledge that the implementation of NBS solutions results "in many benefits for the environment, economy and society, and they offer an opportunity to turn challenges that urban areas face into innovation opportunities. Nature based solutions may contribute to sustainable urbanisation and improving well-being in urban areas, including restoration of degraded ecosystems, urban regeneration and adaptation to climate change. For instance, to reduce pollution and increase liveability in cities, networks of green areas and waterfronts in cities are important due to the ecosystem services that they provide and should thus be preserved".

For the NAIAD cities it is recommended to promote the inclusion in the Covenant of Mayors initiative, in the Mayors Adapt specially, in order to gain connections and mainstream CC adaptation through NBS.

The Common Agricultural Policy also represents an incentive towards the mainstreaming of Ecosystem Services of Nature Based Solutions. However, adequate coordination between policies, regulations and community funds is essential so that the ones (Cohesion, PAC) do not hinder or prevent compliance with the others (DMA). This coordination concerns the Commission itself in the first place.

In both WFD and Floods Directive, ecosystems services are not explicitly mentioned but the references and links are obvious. The Directive requires the floods and river management plans to take into account relevant aspects such as costs and benefits. The Directive furthermore stipulates that international action plans should undergo a cost-benefit analysis. In both cases, integration of ecosystem service considerations could allow systematic analysis and communication of relevant costs and benefits. A systematic consideration of ecosystem services in both the WFD and the FD will support the required coordination of the implementation of the two directives.

There is no drought policy as such in the EU. Droughts are covered under the WFD's objective of guaranteeing access to good quality and sufficient quantity of water while ensuring a good status of water bodies. In addition, droughts are specifically targeted by a series of drought management plans that have a non-permanent character. More studies are needed to establish the link between NBS and risk for droughts.

In Europe, beneficiaries of structural defences are the citizens, to protect human lives and their properties. Which is different from whom can receive subsidies to finance protective measures (beneficiaries of subsidies. The involvement of the insurance industry in DRR can impact data and information exchange to incentivize risk awareness or to guide decision-making. Thanks to new financial instruments against disaster such as the "resilience bonds", the insurance industry is now connected to governmental institutions. However, some reports suggest that there is very little evidence of insurance schemes actually inducing risk-reducing behaviours (though the theoretical potential is widely acknowledged). Further research will be carried out during the Project.

The analysis in Spain, Romania and France, shows that there are efforts being made at policy level and roles distributed between different institutions and organizations, that help mainstreaming of IVE, but more effort and coordination will be needed. In the three countries a selection of gaps and incentives in the promotion of ecosystem services and incentives has been identified.

In France, the interlocking of numerous actors within GEMAPI can be a force to mainstream ES and IVE at all scales and into the policy framework. This will work only if the role of each partner is well defined to avoid overlapping or gaps. Even if it is sometimes very complex to know and to understand the role of each stakeholder in DRR. Romania faces two main challenges: firstly, its multilevel governance is based on a complex legal framework (with over-regulation through the secondary and tertiary levels of legislation) which impacts the DRM more generally. Secondly, a high number of stakeholders with very diverse profiles, restricted legal competencies and limited technical expertise who, as such, lack awareness of ecosystem services and their insurance potential. In Spain, the adoption of WFS and Floods Directive, and other conservation related plans are opening the floor for NBS however more efforts on drought preparedness and adaptation to climate change should be done.

Different gaps have been identified:

- difficulty to understand the concepts (NBS, IVE…) which can in turn hinder their development and adoption;
- lack of coordination between policies;
- lack of coordination between agencies and institutions;
- the financial aspects on how to implement cost-effective measures, how to invest, how to monetize nature and how to calculate the value of ecosystem services.

The section on institutional gaps highlighted challenges limiting operationalization of the NBS within the different institutions (Thistlethwaite and Minano 2016). The current leitmotiv is to said that the opportunity to mainstream eco-based approaches for DRR, into private sector (insurance sector) activities should not be missed: as an innovative risk management (Surminski et al. 2015, Lo 2016)

Bibliography

Aerts, Jeroen, and Jaroslav Mysiak. 2016. Novel Multi-Sector Partnerships in Disaster Risk Management - Results of the ENHANCE project. . EU FP7 project ENHANCE.

Bell, Carmen. 2013. Insurance Europe response to the European Commission's Green Paper on Insurance of Natural and Man-made Disasters. . Insurance Europe.

Botzen, W.J.W, and Van der J.C.J.M Bergh. 2008. Insurance Against Climate Change and Flooding in the Netherlands: Present, Future, and Comparison with Other Countries. Risk Analysis, Vol. 28, No. 2.

CEPRI. 2017. Les ouvrages de protection contre les inondations S'organiser pour exercer la compétence GEMAPI et répondre aux exigences de la réglementation issue du décret du 12 mai 2015. . Centre Européen de Prévention du Risque d'Inondation.

Coase, R. 1960. The Problem of Social Cost. Journal of Law and Economics, The University of Chicago Press, Vol. 3 (Oct., 1960): 1–44.

Cohen-Shacham, E., G. Walters, C. Janzen, and Maginnis S. 2016. Nature-based Solutions to address global societal challenges. . IUCN.

Cohn, Carolyn. 2017. Mangroves, coral reefs could cut flood insurance premiums: Lloyd's. Reuters.

Colgan, C. S., M. W. Beck, and S. Narayan. 2017. Financing Natural Infrastructure for Coastal Flood Damage Reduction. . Lloyd's Tercentenary Research Foundation.

Collinson, S., 2003, 'Power, Livelihoods and Conflict: Case Studies in Political Economy Analysis for Humanitarian Action', Overseas Development Institute, London http://www.odi.org.uk/resources/download/241.pdf

DFID, 2009, 'Political Economy Analysis - How to Note: A DFID Practice Paper', Department for International Development, London http://www.odi.org.uk/events/2009/07/23/1929-dfid-note-political-economy-analysis.pdf

Dow, S. Re, Shell, Unilever, and T. N. Conservancy. 2013. The Case for Green Infrastructure - Joint-Industry White Paper. . Dow, Swiss Re, Shell, Unilever, The Nature Conservancy.

Eau, Agence de l. 2015. Pour une nouvelle gestion des rivières, les actions à l'heure de la GEMAPI. . Agence de l'Eau Bassins Rhône-Méditerranée et Corse.

Eau Seine Normandie. 2016. Les actions de l'agence de l'eau Seine-Normandie dans le domaine des inondations. . Agence de l'Eau,.

European Commission. 2011. Our life insurance, our natural capital: an EU biodiversity strategy to 2020. European Commission.

European Commission (2013): Green Infrastructure (GI) — Enhancing Europe's Natural Capital.

European Commission. 2013. Greenpaper on the insurance of natural and man-made disasters. . European Commission.

European Commission. 2015. Towards an EU Reserach and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities. . European Commission,.

European Commission. 2016. Flood risk management has improved in Germany. Science for Environment Policy.

European Commission. 2016. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Next steps for a sustainable European future European action for sustainability {SWD(2016) 390 final} COM (2016) 739 final Strasbourg, 22.11.2016

European Court of Auditors. 2016. *Making cross-compliance more effective and achieving simplification remains challenging*. Special Report.

European Parliament. 2017. European Union Solidarity Fund. . European Parliament,.

Flood Management, Associated Programme on. 2012. Flood proofing. . Associated Programme on Flood Management.

Golnaraghi, Maryam, Swenja Surminski, and Kai-Uwe Schanz. 2016. An Integrated Approach to Managing Extreme Events and Climate Risks - Towards a Concerted Public-Private Approach - With recommendations to harness potential contributions of the insurance industry. . The Geneva Association.

Hart, K., Buckwell, A. and Baldock, D. 2016. Learning the lessons of the Greening of the CAP. A report for the UK Land Use Policy Group in collaboration with the European Nature Conservation Agencies Network, Institute for European Environmental Policy, London.

Hudson, Paul. 2015. Implication of risk based insurance premiums for flood preparedness and affordability of coverage. Thematic Session: automatic and planned adaptation to climate change European Association of Environmental and Resource Economists 21st Annual Conference. . Helsinki, Finland.

Insurance Europe. 2012. How insurance works. . Insurance Europe,.

IPCC. 2014a. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Page 688 (B. et al., Ed.). . Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC. 2014b. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Page 1132 (R. K. P. Core Writing Team and L. A. Meyer, Eds.). . Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jachetti, Federico, and Mary Picard. 2012. Law and Regulation for the Reduction of Risk from Natural Disasters in Italy. . International Federation of Red Cross and Red Crescent Societies.

Jorissen, Richard, Erik Kraaij, and Ellen Tromp. 2016. Dutch flood protection policy and measures based on risk assessment. E3S Web of Conferences.

Kettunen, Marianne., ten Patrick. Brink, Evelyn Underwood, and Anna Salomaa. 2014. Policy needs and opportunities for operationalising the concept of ecosystem services - Report in the context of EU FP7 OPERAs project. . OPERA (Operational Potential of Ecosystem Research Applications).

Kirbyshire, Amy, Emma Lovell, Rebecca Nadin, Erin Roberts, Thomas Tanner, and Lena Weingärtner. 2017. A review of literature, debates and blogs on resilience,. . ODI,.

La Calle, A. (2009). «La adaptación española de la Directiva marco del agua». (Fundación Nueva Cultura del Agua. Panel Científico – Técnico de seguimiento de la Política de. Aguas. Convenio Universidad de Sevilla – Ministerio de Medio Ambiente).

L'Assurance, Fédération Française de. 2015. Livre Blanc pour une meilleure prévention et protection contre les aléas naturels. . FFA,.

Le Quesne, Felicity, Jennifern Tollmann, Matthias Range, Kehinde Balogun, Michael Zissener, Daniela Bohl, Maxime Souvignet, Sandra Schuster, S. Zwick, J. Phillips, Branko Wehnert, and Soenke Kreft. 2017. The role of insurance in integrated disaster & climate risk management: evidence and lessons learned. . MCII, United Nations University and GIZ,.

Lo, V. 2016. Synthesis Report on Experiences with Ecosystem-Based Approaches to Climate Change Adaptation and Disaster Risk Reduction. . Technical Series, Secretariat of the Convention on Biological Diversity,.

MAPAMA, 2015.

Matczak, P., J. Lewandowski, A. Choryński, M. Szwed, and Z. W. Kundzewicz. 2016. Analysing and evaluating flood risk governance in Poland Looking for strategic planning in a country in transition. . Star Flood.

Maynard, T. 2017. Future Cities: Building infrastructure resilience. . Lloyd's of London.

Morel, Mathieu, Bérangère Basin, and Emmanuel Vullierme. 2017. French national policy for flood risk management. La Houille Blanche,.

Munang, Richard, Ibrahim Thiaw, Keith Alverson, Jian Liu, and Zhen Han. 2013. The role of ecosystem services in climate change adaptation and disaster risk reduction. Current Opinion in Environmental Sustainability - Science.

Neuhold, Clemens. 2017. Flood Risk Management in the European Union. La Houille Blanche,.

NRDC. 2017. Seeking higher ground: how to break the cycle of repeated flooding with climate-smart flood insurance reforms. . NRDC,.

Nussbaum, Roland, and Patrick Pigeon. 2015. A national Public-Private Partnership (PPP) platform for risk data sharing to stimulate DRR participative governance in France. . UNISDR,.

OECD. 2017. Recommendation on Disaster Risk Financing Strategies. . OECD.

OECD/G20, 2012. Disaster Risk Assessment and Risk Financing. A G20/OECD methodological framework.

PAPI CASA . 2013. Convention - Cadre relative au programme d'actions de prévention des inondations du bassin versant du Loup, de la Brague et des vallons cotiers pour les années 2014 a 2019. . Etat Français, and Région PACA, and CG06 and CASA, and local municipalities,.

Paris Europlace. 2015. Green bonds, l'engagement et l'expertise des acteurs français. . Paris Europlace.

Poland, Government of. 2013. Answers of the Government of Poland on the questions included in the document: Green Paper on the insurance of natural and man-made disasters. . Government of Poland,.

Polski, M.M., and Ostrom, E. 1999. An institusional framework for policy analysis and design, Paper on Workshop in Political Theory and Policy Analysis Departmen of Political Science, Indiana University.

Provence-Alpes-Cote d'Azur, Chambre Régionale des Comptes de. 2010. Rapport d'observations définitives sur la gestion par la Région Provence-Alpes-Côte d'Azur des inondations survenues dans le département du Var les 15 et 16 juin 2010. . Chambre Régionale des Comptes de Provence-Alpes-Cote d'Azur,.

Rabault, Valérie. 2014. Rapport, Annexe n°14, Ecologie, Développment et Mobilité Durables Prévention des risques. . Assemblée Nationale,.

Radulecu, Daniela, Mirel Bogdan Ion, Ramona Dumitrache, and Cristian Eugen Barbu. 2017. Flood risk management objectives and Romanian catalogue of potential measures for flood prevention, protection and mitigation. La Houille Blanche.

Rebound. 2017. A guide for public-sector resilience bond sponsorship,. . Re:focus and Rebound.

Rentschler, Jun, and T. Tanner. 2015. Unlocking the "Triple Dividend' of Resilience" Why investing in disaster risk management pays off. . Overseas Development Institute (ODI), International Bank for Reconstruction and Development, International Development Association or The World Bank.

Rijkswaterstaat. 2011. Water management in the Netherlands,. . Ministry of Infrastructure and the Environment.

Sorensen, Carlo, M. Jebens, and Thorsten Piontkowitz. 2017. Danish risk management plans of the EU floods directive. La Houille Blanche.

Stein, U., Ozerol, G., J. Tröltzsch, R. Landgrebe, A. Szendrenyi, R. Vidaurre (2016) *European Drought and Water Scarcity Policies*. in H. Bressers et al. (eds.), Governance for Drought Resilience.

Stern, Nicholas. 2006. Stern Review: The Economics of Climate change. . World Bank, OECD, EBRD, IADB, and UNEP (IPCC),.

Sudmeier-Rieux, Karen. 2013. Ecosystem approach to disaster risk reduction - Basic concepts and recommendations to governments, with a special focus on Europe. . European and Mediterranean Major Hazards Agreement (EUR-OPA).

Surminski, S., J. Aerts, Wouter Botzen, Paul Hudson, Jaroslav Mysiak, and Pérez-Blanco. 2015. Reflections on the current debate on how to link flood insurance and disaster risk reduction in the European Union. Natural Hazards.

Surminski, Swenja. 2017. Fit for Purpose and Fit for the Future? An Evaluation of the UK's New Flood Reinsurance Pool. . Resources for the future.

Tanner, Thomas, Swenja Surminski, Emily Wilkinson, Robert Reid, Jun Rentschler, and Sumati Rajput. 2015. The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management. Global Facility for Disaster Reduction and Recovery (GFDRR) at the World Bank and Overseas Development Institute (ODI).

Thistlethwaite, Jason, and Andrea Minano. 2016. Managing Climate Change Risk In Coastal Canadian Communities through Sustainable Insurance. Policy Brief No. 93. . Policy Brief.

UNISDR. 2015. Disaster risk reduction and resilience in the 2030 agenda for sustainable development. Reflection paper, United Nations Office for Disaster Risk Reduction, UNISDR.

UNISDR. 2016. Disaster risk reduction private sector partnership. UNISDR.

Wamsler, Christine, and Stephan Pauleit. 2015. Making headway in climate policy mainstreaming and ecosystem-based adaptation: two pioneering countries, different pathways, one goal. Climatic Change,.

Wilkinson, E. 2012. Transforming disaster risk management: a political economy approach. ODI Background Note Series, Overseas Development Institute, London

Williamson, O. 2000. The New Institutional Economics: Take Stock, Looking Ahead. Journal of Economic Literature 38(3):595-613.

Young, O.R. (2002). The Institutional Dimensions of Environmental Change: Fit, Interplay,and Scale. Massachusetts University of Technology.

Annex 1. SENDAI : targets and terminology

Table xx: Sendai Targets and Proposed Indicators (source: UNISDR, 2017)

Target A: Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015.	A-1 Number of deaths and missing persons attributed to disasters, per 100,000 population. A-2 Number of deaths attributed to disasters, per 100,000 population. A-3 Number of missing persons attributed to disasters, per 100,000 population.
Target B: Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015	B-1 Number of directly affected people attributed to disasters, per 100,000 population. B-2 Number of injured or ill people attributed to disasters, per 100,000 population. B-3 Number of people whose damaged dwellings were attributed to disasters. B-4 Number of people whose destroyed dwellings were attributed to disasters. B-5 Number of people whose livelihoods were disrupted or destroyed, attributed to disasters.
Target C: Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030	C-1 Direct economic loss attributed to disasters in relation to global gross domestic product. (compound indicator) C-2 Direct agricultural loss attributed to disasters Agriculture is understood to include the crops, livestock, fisheries, apiculture, aquaculture and forest sectors as well as associated facilities and infrastructure. C-3 Direct economic loss to all other damaged or destroyed productive assets attributed to disasters. Productive assets would be disaggregated by economic sector, including services, according to standard international classifications. Countries would report against those economic sectors relevant to their economies. This would be described in the associated metadata. C-4 Direct economic loss in the housing sector attributed to disasters. Data would be disaggregated according to damaged and destroyed dwellings. C-5 Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters. The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant C-6 Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.
Target D: Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030	D-1 Damage to critical infrastructure attributed to disasters. (compound indicator) D-2 Number of destroyed or damaged health facilities attributed to disasters. D-3 Number of destroyed or damaged educational facilities attributed to disasters. D-4 Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters. The decision regarding those elements of critical infrastructure to be included in the calculation will be left to the

	Member States and described in the accompanying metadata. Protective infrastructure and green infrastructure should be included where relevant. D-5 Number of disruptions to basic services attributed to disasters. (compound indicator) D-6 Number of disruptions to educational services attributed to disasters. D-7 Number of disruptions to health services attributed to disasters. D-8 Number of disruptions to other basic services attributed to disasters. The decision regarding those elements of basic services to be included in the calculation will be left to the Member States and described in the accompanying metadata.

Also in terms of terminology, Sendai can offer guidance on the concepts of both infrastructure and basoc services to be incorporated into our analytical framework of IVE policy frames.

Key terms[lxi] LOSSES	
Economic Loss :	Total economic impact that consists of direct economic loss and indirect economic loss.
Direct economic loss :	the monetary value of total or partial destruction of physical assets existing in the affected area. Direct economic loss is nearly equivalent to physical damage. Direct economic losses usually happen during the event or within the first few hours after the event and are often assessed soon after the event to estimate recovery cost and claim insurance payments. These are tangible and relatively easy to measure.
Indirect economic loss :	a decline in economic value added as a consequence of direct economic loss and/or human and environmental impacts. Indirect economic loss includes micro-economic impacts (e.g. revenue declines owing to business interruption, impacts on natural assets, loss of revenue or income due to missing assets, interruptions to transportation networks, supply chains or temporary unemployment) and macroeconomic impacts (e.g. price increases, increases in government debt, negative impact on stock market prices, and decline in GDP). Indirect losses can occur inside or outside of the hazard area and often with a time lag. As a result, they may be intangible or difficult to measure.
Replacement cost :	The cost of replacing damaged assets with materials of like kind and quality. *Annotations : This includes both private and public assets. Replacement is not necessarily an exact duplicate of the subject but serves the same purpose or function as the original (please note this does not consider building back better).*
Metadata:	a set of data that describes, provides context and gives information about other data. In the context of the Sendai Framework Targets and Indicators, Metadata provides the additional information about the number, list, type and description of the elements (Productive Assets and Infrastructure elements) for which Member States are collecting data and estimating losses. Additionally, Metadata will also be used to provide additional information about the described items themselves (like typical size, or average number of employees) and the country (with data such as population, GDP, total number of households, etc.) that provide the required context for the indicators (notably economic loss and livelihoods) to be successfully estimated. *Annotations : Metadata has been proposed for a number of knowledge domains, most notably for geographic and spatial information, but there are also many standards and de-facto proposals for many other areas such as health, documentation, internet registry, government records, statistical data and many other*.

Key terms INFRASTRUCTURE	
Critical infrastructure	The physical structures, facilities, networks and other assets which provide services that are essential to the social and economic functioning of a community or society

Protective Infrastructure:	The set of build elements designed to protect human life and societal assets from different hazards, including inter alia floods, flash floods, landslides, tsunamis, earthquakes, wind and storm surges.Examples of protective infrastructure include: • Flood protection walls and river defences • Drainage systems and ground reinforcement elements for landslide prevention • Canals, dams, dykes and other water regulation mechanisms • Coastal defenses for storm surge and tsunami • Cyclone and tornado shelter systems • Hazard monitoring and early warning systems infrastructure
Green Infrastructure:	Green infrastructure is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation, and management of wet weather impacts that provides many community benefits. While single-purpose gray storm water infrastructure—conventional piped drainage and water treatment systems—is designed to move urban storm water away from the built environment, green infrastructure reduces and treats storm water at its source while delivering environmental, social, and economic benefits. Some of the elements that constitute Green Infrastructure are: • Parks and green areas • Rain gardens • Underground water infiltration trenches and storage systems • Regional storm water reservoirs • Coastal protection mangrove systems • Urban tree canopy

Key terms SERVICES	
Basic services:	Services that are needed for all of society to function effectively or appropriately. Examples of basic services include water supply, sanitation, health care, and education.They also include services provided by critical infrastructure such as electricity, telecommunications, transport, and waste management that are needed for all of society to function. For this indicator, disruption, interruption or lower quality of basic services is proposed to be measured for the following public services: **(note : we have only included water and sewerage basic services definition below)**
Sewerage system:	sanitation and sanitary sewage systems and collection and treatment of solid waste.
Water supply:	drinking water supply system (water outlets, water treatment plants, aqueducts and canals which carry drinking water, storage tanks.) Information and Communication Technology (ICT) system: plants and telephone networks (telecommunication network), radio and television stations, post offices and public information offices, internet services, radio telephones and mobile phones

Annex 2. Adaptation Strategy

Table 1. Adaptation Strategy Indicators and country scores.

STEP	AREA	INDICATORS	SP	UK	FR	SLO	DK	NT	RU
Step A: Preparing the ground for adaptation	***Coordination structure***	A central administration body officially in charge of adaptation policy making							
		Horizontal (i.e. sectoral) coordination mechanisms exist within the governance system, with division of responsibilities							
		Vertical (i.e. across levels of administration) coordination mechanisms exist within the governance system, enabling lower levels of administration to influence policy making.							
	Stakeholders' involvement in policy development	A dedicated process is in place to facilitate stakeholders' involvement in the preparation of adaptation policies							
		Transboundary cooperation is planned to address common challenges with relevant countries							
Step B: Assessing risks and vulnerabilities to climate change	***Current and projected climate change***	Observation systems are in place to monitor climate change, extreme climate events and their impacts							
		Scenarios and projections are used to assess the economic, social and environmental impacts of climate change, taking into account geographical specificities and best available science (e.g. in response to revised IPCC assessments)Yes / In progress / No (e.g. in response to revised IPCC assessments)							
		Sound climate risks/vulnerability assessments for priority vulnerable sectors are undertaken to support adaptation decision making.							
		Climate risks/vulnerability assessments take transboundary risks into account, when relevant							
	Knowledge gaps	Work is being carried out to identify, prioritise and address the knowledge gaps							
	Knowledge transfer	Adaptation relevant data and information is available to all stakeholders, including policy makers							
		Capacity building activities take place; education and training materials on climate change adaptation concepts and practices are available and disseminated							
Step C: Identifying adaptation options	***Identification of adaptation options***	Adaptation options address the sectoral risks identified in 3c, the geographical specificities identified in 3b and follow best practices in similar contexts							
		The selection of priority adaptation options is based on robust methods (e.g. multi-criteria analyses, stakeholders' consultation, etc.) and consistent with existing decision-making frameworks							
		Mechanisms are in place to coordinate disaster risk management and climate change adaptation and to ensure coherence between the two policies							
	Funding resources identified and allocated	Funding is available to increase climate resilience in vulnerable sectors and for cross-cutting adaptation action							

Step D: Implementing adaptation action	***Mainstreaming adaptation in planning processes***	Consideration of climate change adaptation has been included in the national frameworks for environmental impact assessments							
		Prevention/preparedness strategies in place under national disaster risk management plans take into account climate change impacts and projections							
		Key land use, spatial planning, urban planning and maritime spatial planning policies take into account the impacts of climate change							
		National policy instruments promote adaptation at sectoral level, in line with national priorities and in areas where adaptation is mainstreamed in EU policies							
		Adaptation is mainstreamed in insurance or alternative policy instruments, where relevant, to provide incentives for investments in risk prevention							
	Implementing adaptation	Adaptation policies and measures are implemented, e.g. as defined in action plans or sectoral policy documents							
		Cooperation mechanisms in place to foster and support adaptation at relevant scales (e.g. local, subnational)							
		Procedures or guidelines are available to assess the potential impact of climate change on major projects or programmes, and facilitate the choice of alternative options, e.g. green infrastructure							
		There are processes for stakeholders' involvement in the implementation of adaptation policies and measures.							
Step E: Monitoring and evaluation of adaptation activities	***Monitoring and reporting***	NAS/NAP implementation is monitored and the results of the monitoring are disseminated							
		The integration of climate change adaptation in sectoral policies is monitored and the results of the monitoring are disseminated							
		Regional-, sub-national or local action is monitored and the results of the monitoring are disseminated							
	Evaluation	A periodic review of the national adaptation strategy and action plans is planned							
		Stakeholders are involved in the assessment, evaluation and review of national adaptation policy							

Table 2. Key criteria to evaluate EU Adaptation Strategy

Key criteria	**Explanation of how to assess key criteria**
Relevance	Relevance of the Objectives (1,2 and 3) respond to needs at EU, and international Relevance of strategy to different stakehodlers at different levels
Effectiveness	Objectives 1,2 and 3 achieved ? (period 2013-2016) If 8 actions contributed to achieve objectives ? Drivers and barriers to strategt Effects of strategy ?
Efficiency	Resources adeuate and proportionate for actions How do stakeholders view monitoring burden of adaptation strategy (and actions)
Coherence	Fit of Adptatoon strategy with EU policies and laws With international initiatives

	At national or regional level Gaps and incosistencies
EU added value	Of acting at EU level ?

Table 21. Results from the Adaptation Strategy scorecard as it relates to Insurance and prevention.

Adaptation is mainstreamed in insurance or alternative policy instruments, where relevant, to provide incentives for investments in risk prevention	
Netherlands	In the context of floods and dike failure, insurers studied the effect of climate change in cooperation with KNMI[lxii], which led to the conclusion that premiums would become more expensive and insurers should aim at prevention measures among their clients. Although the government is bound by law to compensate large-scale events, no evidence was found that this compensation is accompanied by incentives for adaptation on the local level. [lxiiilxiv] .In February 14, 2017 a first Adaptation Dialogue with the Insurance sector took place and included more than 50 participants. This dialogue was organised by the Union of Insurance Companies, the Dutch National Bank (De Nederlandsche Bank) and the project team NAS. Focusing at intense rainfall, flooding from rivers or the sea, hail and storm. A working group will be formed to make proposals for further steps. The record of this meeting is added.
Denmark	There is clear awareness of the role to be played by insurance: insurance is mentioned in the NAS, and is well covered by the Danish adaptation portal where a search returns more than 450 references on "insurance". Many insurance companies offer a discount if you invest in risk prevention at your property. If the damage is done, you can apply for compensation from the Danish Storm Council[41]. The Danish Storm Council handles cases concerning three types of natural catastrophes: storm surge, flooding from waterways and lakes and windfall. The trade organization Insurance has collected a variety of data and information on climate damage to their homepage on climate change adaptation. Insurance[lxv] is also included as a dedicated web-page on the Danish adaptation portal. Overall little evidence available to confirm if adaptation has been effectively mainstreamed in insurance policy instruments.
RUMANIA	The 2016-2030 strategy mentions the need to mainstream climate chance adaptation in this sector and the action plan sets out a list of measures in this regard, but so far, no evidence could be found that adaptation is mainstreamed in insurance policies or alternative policy instruments to provide incentives for investments in risk prevention.
UK	Adaptation is not yet mainstreamed into insurance or other policy instruments incentivising investments in risk prevention, but the NAP contains significant elements that will facilitate integration in the short term. On incentives, one of the key declared drivers of the NAP is that, while it is important for the government to help remove barriers to action, policy should be developed in such a way that does not crowd out private investment in adaptation and keeps a clear focus on cost-effectiveness. Flood insurance is recognized as a key tool to help households and private businesses manage the potential consequences of extreme events linked to climate change. According to this, the government is committed to ensuring the continued availability and affordability of flood insurance to high risk households, and one of the NAP actions with this aim is securing new arrangements for flood insurance beyond 2013, which was followed up by a number of recommendations in review of the NAP progress by ASC in 2015., including future strategies and recommendaitons on Flood Re, the recent public private initiative that became operational[lxvi]. Flood Re is an important instrument, but not convincingly considered to incentivise adaptation. As part of Flood Re's transition plan, there are proposals to encourage

	households to better protect their properties so that the chance of needing to make a claim is reduced. The aim is to allow insurance to remain available and affordable without the need for ongoing subsidies"[lxvii].
SPAIN	Adaptation is currently not mainstreamed in insurance or alternative policy instruments, to provide incentives for investments in risk prevention, with the exception of some risk signalling capacity of insurance in the agricultural sector. A framework agreement exists with the agriculture authorities and universities, which comprehends the plan to work on the potential integration of climate change in the Spanish Agricultural Insurance System. Further action on the topic is planned in WP3. WP3 also includes the insurance sector as one of the targets for the period 2014-2020, with 5 activities planned that would provide the foundations for full integration of adaptation in the sector. In terms of private property, so far the only effective action in place is the close collaboration with Compensation Consortium's Extraordinary Risks Cover, in order to assess the impacts of climate change on the insurance of extreme events.
FRANCE	The French system has a long history of investigating the role of insurance in risk management, includes a public mechanism to avoid social exclusion and adverseselection phenomena in the natural catastrophe insurance market: the Bureau Central de Tarification (BCT). It provides insurance to those that cannot obtain it through regular market venues, for either availability or affordability reasons. No indication of other types of public-private cooperation for the financing of adaptation action could be found. The reinforcement of insurance as a tool to face climate change was one of the objectives of the NAP, together with the provision of other incentives for investments. The mid-term evaluation of 2013, however, concluded that it was too early to consider that insurance objectives have been met, given the complexity of the issue, and noted that there are significant works still to be implemented to introduce the consideration of resilience to climate change into public investments, and to identify financial resources to finance adaptation. The 2015 evaluation addresses the trade-off between solidarity and incentives to adaptation action (CGEDD, 2015, p. 83), notes that new mechanisms have been introduced in the forestry sector to remove some climate risks from solidarity mechanisms and encourage private insurance, in order to improve incentives to action, and suggests that this should be adopted more widely.
SLOVENIA	Currently, adaptation is not being mainstreamed in insurance policies or alternative policy instruments to provide incentives for investments in risk prevention.
POLAND	No evidence was found on adaptation being mainstreamed in insurance or alternative policy instruments in Poland.

Prevention/preparedness strategies in place under national disaster risk management plans take into account climate change impacts and projections	
NETHERLANDS	The KNMI provided downscaled climate scenarios for the Netherlands in 2006 and updated 2014 scenarios for the NAS of 2016[lxviii]. Scenarios are available for the climatological (30-years) periods centred at 2030, 2050 and 2085. A new set of climate scenarios for the Netherlands and related products will be published in 2021, aligned with the sixth assessment cycle of IPCC in order to deliver state-of-the-art climate information. Attention will be paid to observed trends, projection of sea level rise, extreme precipitation, future weather and urban climate information. The scenarios contain a broad scale of climate variables, from long-term annual average, to the frequency and intensity of climate/weather extremes.

	The available climate models are quite elaborate, especially from a geographical point of view[lxix]. In-depth description of specifications and justification of the construction of the latest scenarios can be found in the KNMI library.[lxx]
DENMARK	Systematic warning systems[lxxi] of extreme weather events are in place and being used by the Danish authorities and population.. Preparedness provisions are made in the National Preparedness Plan which keeps abreast of climate induced disaster risks by way of the National Risk Profile for Denmark. The most recent version of the National Risk Profile was published in January 2017. There is however no evidence how projected future climate extremes are factored in disaster risk management plans.
FRANCE	This indicator has the assessment options "yes" and "no." However, some future risks are being considered in current French disaster risk management plans. Risk is considered in coastal planning through the July 2011 guidelines for storm surge risk zoning, including future sea level rise. Heat waves risks, which frequency and intensity will increased in the future, are included in the "Heatwave Plan" at national and local level. For other risks, it remains unclear whether future risks are being considered in disaster risk management plans.
RUMANIA	The General Inspectorate for Emergency Situations (GIES) implemented the RO-RISK "Support to fulfil the ex-ante conditionality 5.1. – risk assessment at national level" project, whose aim was to develop a common risk assessment methodology.[lxxii] The methodology aims at developing an integrated approach of (natural, biological, technological) risk assessment and its objective is both to assure a common framework for sectoral risk assessment, and to provide information regarding the types of risks on the Romanian territory, by its application to all these risks. On the basis of this methodology, risk assessments were carried out for 10 risks, including floods, drought, forest fires and landslides. Climate projections were taken into consideration for the assessments regarding drought and forest fires.[lxxiii] The risk assessments will be followed by the preparation of risk management plans at sectoral level.
UK	The Civil Contingencies Act, from 2004, has not been modified to address the effects of climate change, but other disaster risk related frameworks have been revised to integrate them. The Health and Social Care Act (2012) focuses on local planning and decision-making for setting and delivering local health priorities. Some basic tools include the Joint Strategic Needs Assessments (JSNAs) and subsequent strategies produced by health and wellbeing boards. The Statutory guidance on JSNAs and JHWSs produced by the Department of Health demands to consider the impacts of climate change when preparing them. Two key risks identified for the UK are specifically addressed through national frameworks. The Heatwave Plan for England (2004) was revised in 2014 to better address the risks of climate change, including preparedness, alert and readiness. It has continued to be reviewed every year since 2014. The Flood and Water Management Act 2010 demands the preparation of national and local strategies for flood risk management, which have to consider the risks of climate change. The National Flood and Coastal Erosion Risk Management Strategy includes long-term planning, avoidance of inappropriate development in high risk areas, improved flood management infrastructure, increased public awareness and improved flood detection/warning. The NAP also comprehends several measures to reduce risks, complementary to the main DRM regulations, to reduce climate risks, including spatial planning (see 8c), housing design, or the maintenance of performance of flood defences in the light of climate change impacts within the UK National Infrastructure Plan.
SPAIN	The civil protection mechanism does not integrate climate projections in its plans. WP3, adopted in December 2013, calls for coordination with the department in charge of civil protection and emergencies (Ministry of Interior), but this has not been implemented yet. The OECC has, however, influenced some policies related to disaster risk reduction and management, by mainstreaming adaptation into some key policies and planning documents such as Regulation 903/2010, for the evaluation and management of flood risks, or the Plans for drought situations.

FRANCE	This indicator has the assessment options "yes" and "no." However, some future risks are being considered in current French disaster risk management plans. Risk is considered in coastal planning through the July 2011 guidelines for storm surge risk zoning, including future sea level rise. Heat waves risks, which frequency and intensity will increased in the future, are included in the "Heatwave Plan" at national and local level. For other risks, it remains unclear whether future risks are being considered in disaster risk management plans.
SLOVENIA	In the new disaster risk assessments, which was prepared in 2016, impacts of climate change have been take into account. The new new disaster risk management plans are currently still under preparation.
POLAND	Projections of future climate impacts, and the extent to which climate change is currently affecting climate risks, are not incorporated in the Polish National Risk Management Plan[35].

Annex 3: Selected SDG Goals covered by NAIAD and Indicators that could be used

(Source: Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (E/CN.3/2016/2/Rev.1), Annex IV)

Final list of proposed Sustainable Development Goal indicators*

Sustainable Development Goal indicators should be disaggregated, where relevant, by income, sex, age, race, ethnicity, migratory status, disability and geographic location, or other characteristics, in accordance with the Fundamental Principles of Official Statistics (General Assembly resolution 68/261).

Goals and targets (from the 2030 Agenda)	*Indicators*
Goal 1. End poverty in all its forms everywhere	
1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Proportion of population living below the national poverty line, by sex and age 1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	1.4.1 Proportion of population living in households with access to basic services 1.4.2 Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	1.5.1 Number of deaths, missing persons and persons affected by disaster per 100,000 people[a] 1.5.2 Direct disaster economic loss in relation to global gross domestic product (GDP)[a] 1.5.3 Number of countries with national and local disaster risk reduction strategies[a]
1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions	1.a.1 Proportion of resources allocated by the government directly to poverty reduction programmes 1.a.2 Proportion of total government spending on essential services (education, health and social protection)
1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions	1.b.1 Proportion of government recurrent and capital spending to sectors that disproportionately benefit women, the poor and vulnerable groups
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size
	2.3.2 Average income of small-scale food producers, by sex and indigenous status
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	2.4.1 Proportion of agricultural area under productive and sustainable agriculture
2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	2.5.1 Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities
	2.5.2 Proportion of local breeds classified as being at risk, not-at-risk or at unknown level of risk of extinction
2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	2.a.1 The agriculture orientation index for government expenditures
	2.a.2 Total official flows (official development assistance plus other official flows) to the agriculture sector
2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round	2.b.1 Producer Support Estimate
	2.b.2 Agricultural export subsidies
2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility	2.c.1 Indicator of food price anomalies
Goal 6. Ensure availability and sustainable management of water and sanitation for all	
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated
	6.3.2 Proportion of bodies of water with good ambient water quality
6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time
	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0-100) 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan
6.b Support and strengthen the participation of local communities in improving water and sanitation management	6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	8.1.1 Annual growth rate of real GDP per capita
8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	8.2.1 Annual growth rate of real GDP per employed person
8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	8.3.1 Proportion of informal employment in non-agriculture employment, by sex
8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	8.4.1 Material footprint, material footprint per capita, and material footprint per GDP 8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.1 Average hourly earnings of female and male employees, by occupation, age and persons with disabilities 8.5.2 Unemployment rate, by sex, age and persons with disabilities
8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	8.6.1 Proportion of youth (aged 15-24 years) not in education, employment or training
8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.1 Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status 8.8.2 Increase in national compliance of labour rights (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status

8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	8.9.1 Tourism direct GDP as a proportion of total GDP and in growth rate 8.9.2 Number of jobs in tourism industries as a proportion of total jobs and growth rate of jobs, by sex
8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all	8.10.1 Number of commercial bank branches and automated teller machines (ATMs) per 100,000 adults 8.10.2 Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider
8.b By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization	8.b.1 Total government spending in social protection and employment programmes as a proportion of the national budgets and GDP
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.1 Proportion of the rural population who live within 2 km of an all-season road 9.1.2 Passenger and freight volumes, by mode of transport
9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries	9.2.1 Manufacturing value added as a proportion of GDP and per capita 9.2.2 Manufacturing employment as a proportion of total employment
9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets	9.3.1 Proportion of small-scale industries in total industry value added 9.3.2 Proportion of small-scale industries with a loan or line of credit
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 CO_2 emission per unit of value added
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1 Research and development expenditure as a proportion of GDP 9.5.2 Researchers (in full-time equivalent) per million inhabitants
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States	9.a.1 Total official international support (official development assistance plus other official flows) to infrastructure
9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	9.b.1 Proportion of medium and high-tech industry value added in total value added

9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	9.c.1 Proportion of population covered by a mobile network, by technology
Goal 10. Reduce inequality within and among countries	
10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population
10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	10.2.1 Proportion of people living below 50 per cent of median income, by age, sex and persons with disabilities
10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard	10.3.1 Proportion of the population reporting having personally felt discriminated against or harassed within the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law
10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	10.4.1 Labour share of GDP, comprising wages and social protection transfers
10.5 Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations	10.5.1 Financial Soundness Indicators
10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions	10.6.1 Proportion of members and voting rights of developing countries in international organizations
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	11.3.1 Ratio of land consumption rate to population growth rate 11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1 Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector and sponsorship)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.1 Number of deaths, missing persons and persons affected by disaster per 100,000 people[a] 11.5.2 Direct disaster economic loss in relation to global GDP, including disaster damage to critical infrastructure and disruption of basic services[a]

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities 11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities 11.7.2 Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	11.a.1 Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels	11.b.1 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030[a] 11.b.2 Number of countries with national and local disaster risk reduction strategies[a]
Goal 12. Ensure sustainable consumption and production patterns	
12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	12.1.1 Number of countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or a target into national policies
12.2 By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1 Material footprint, material footprint per capita, and material footprint per GDP 12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	12.3.1 Global food loss index
12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	12.5.1 National recycling rate, tons of material recycled
12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	12.6.1 Number of companies publishing sustainability reports
12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities	12.7.1 Number of countries implementing sustainable public procurement policies and action plans
12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment

12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	12.b.1 Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools
12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities	12.c.1 Amount of fossil-fuel subsidies per unit of GDP (production and consumption) and as a proportion of total national expenditure on fossil fuels
Goal 13. Take urgent action to combat climate change and its impacts[b]	
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1 Number of countries with national and local disaster risk reduction strategies[a] 13.1.2 Number of deaths, missing persons and persons affected by disaster per 100,000 people[a]
13.2 Integrate climate change measures into national policies, strategies and planning	13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula 13.3.2 Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions
13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	13.b.1 Number of least developed countries and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	15.3.1 Proportion of land that is degraded over total land area
15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Coverage by protected areas of important sites for mountain biodiversity
	15.4.2 Mountain Green Cover Index
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red List Index
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed	15.6.1 Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020
15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	15.a.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	15.b.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
	16.5.1 Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by those public officials, during the previous 12 months
16.5 Substantially reduce corruption and bribery in all their forms	16.5.2 Proportion of businesses that had at least one contact with a public official and that paid a bribe to a public official, or were asked for a bribe by those public officials during the previous 12 months
	16.6.1 Primary government expenditures as a proportion of original approved budget, by sector (or by budget codes or similar)
16.6 Develop effective, accountable and transparent institutions at all levels	16.6.2 Proportion of the population satisfied with their last experience of public services
16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels	16.7.1 Proportions of positions (by sex, age, persons with disabilities and population groups) in public institutions (national and local legislatures,

	public service, and judiciary) compared to national distributions
	16.7.2 Proportion of population who believe decision-making is inclusive and responsive, by sex, age, disability and population group
16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements	16.10.1 Number of verified cases of killing, kidnapping, enforced disappearance, arbitrary detention and torture of journalists, associated media personnel, trade unionists and human rights advocates in the previous 12 months 16.10.2 Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	
Finance	
17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	17.1.1 Total government revenue as a proportion of GDP, by source 17.1.2 Proportion of domestic budget funded by domestic taxes
17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress	17.4.1 Debt service as a proportion of exports of goods and services
17.5 Adopt and implement investment promotion regimes for least developed countries	17.5.1 Number of countries that adopt and implement investment promotion regimes for least developed countries
Technology	
17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	17.6.1 Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation
	17.6.2 Fixed Internet broadband subscriptions per 100 inhabitants, by speed
17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	17.7.1 Total amount of approved funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies
17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	17.8.1 Proportion of individuals using the Internet
Capacity-building	
17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation	17.9.1 Dollar value of financial and technical assistance (including through North-South, South-South and triangular cooperation) committed to developing countries
Trade	

17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda	17.10.1 Worldwide weighted tariff-average
Systemic issues	
Policy and institutional coherence	
17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence	17.13.1 Macroeconomic Dashboard
17.14 Enhance policy coherence for sustainable development	17.14.1 Number of countries with mechanisms in place to enhance policy coherence of sustainable development
17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development	17.15.1 Extent of use of country-owned results frameworks and planning tools by providers of development cooperation
Multi-stakeholder partnerships	
17.16 Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries	17.16.1 Number of countries reporting progress in multi-stakeholder development effectiveness monitoring frameworks that support the achievement of the sustainable development goals
17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	17.17.1 Amount of United States dollars committed to public-private and civil society partnerships
Data, monitoring and accountability	
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	17.18.1 Proportion of sustainable development indicators produced at the national level with full disaggregation when relevant to the target, in accordance with the Fundamental Principles of Official Statistics 17.18.2 Number of countries that have national statistical legislation that complies with the Fundamental Principles of Official Statistics 17.18.3 Number of countries with a national statistical plan that is fully funded and under implementation, by source of funding
17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries	17.19.1 Dollar value of all resources made available to strengthen statistical capacity in developing countries 17.19.2 Proportion of countries that (a) have conducted at least one population and housing census in the last 10 years; and (b) have achieved 100 per cent birth registration and 80 per cent death registration

* As contained in **Annex IV** of the **Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (E/CN.3/2016/2/Rev.1)** and agreed upon, as a practical starting point at the 47th session of the United Nations Statistical Commision held in March 2016.
[*a*] An open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction established by the General Assembly (resolution 69/284) is developing a set of indicators to measure global progress in the implementation of the Sendai Framework. These indicators will eventually reflect the agreements on the Sendai Framework indicators.

[b] Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

[c] Taking into account ongoing World Trade Organization negotiations, the Doha Development Agenda and the Hong Kong ministerial mandate.

Annex 4: Data bases and tools for NBS related to Urban Areas

Relevant databses and projects for NAIAD urban areas to build upon

Assessment frame	**Mapping and Assessment of Ecosystems and their Services** (MAES): The **fourth MAES report on urban green infrastructure** provides **guidance for mapping and assessing urban ecosystems and urban Green infrastructure** and includes an indicator framework to assess the condition of urban ecosystems and services, which is used at European, Member State and local level. **Mapping and assessing urban ecosystems and their services** (JRC. D. 3. – Land Resources)
Urban Data	Global human settlement layer. (JRC.E.1 - Disaster Risk Management)
	Urban Data Platform. (JRC.B.3 -Territorial Development)
Land use (ESPON)	Comparative Analysis of Territorial Governance and Spatial Planning Systems in Europe ReSSI – Regional strategies for sustainable and inclusive territorial development – Regional interplay and EU dialogue Thinking and Planning in Areas of Territorial Cooperation SPIMA – Spatial dynamics and strategic planning in metropolitan areas
Relevant EU projects	**ARTS** Accelerating sustainable transitions with NBS **BRIDGE** sustainaBle uRban plannIng Decision support accountinG for urban mEtabolism **SUME** Sustainable Urban Metabolism for Europe
	EnRoute (Enhancing Resilience of urban ecosystems through green infrastructure). Web Site: http://oppla.eu/enroute (JRC. D. 3. - Land Resources) **EnRoute**: ***'Enhancing Resilience of urban ecosystems through green infrastructure'*** EnRoute is a project of the European Commission (DG ENV and JRC) in the framework of the EU Biodiversity Strategy and the Green Infrastructure Strategy. EnRoute provides scientific knowledge of how urban ecosystems can support urban planning at different stages of policy and for various spatial scales and how to help policy-making for sustainable cities. It aims to promote the application of urban green infrastructure at local level and delivers guidance on the creation, management and governance of urban green infrastructure. Importantly, it illustrates how collaboration between and across different policy levels can lead to concrete green infrastructure policy setting.
	GREEN SURGE Green Infrastructure and Urban Biodiversity for Sustainable Urban Development and the Green Economy
	TURAS Transitioning towards Urban Resilience and Sustainability **1.** Reducing Land Consumption "Tag" Fiscal policy in Sofia to balance the cost of Urban Sprawl **2. Urban sprawl "tag "** **3. Lack of Green spaces "tag"**: Green Confort Zones in challenging urban hotspots **4. Tools and instruments** STIMULATING SUSTAINABLE URBAN DEVELOPMENT THROUGH TH**E IMPLEMENTATION**

List of tools and methods that could be of relevance to NAIAD urban demos

Green cities	Green city beta version tool	Green city Tool : A new tool for cities: The Commission is defining a set of environmental criteria that can be used by cities, amongst other things, as a basis for assessing their environmental performance. The Commission has developed an urban environment self-assessment tool that is now ready for testing. To try the beta-version of the tool
TURAS	Fiscal and regulatory instruments	Stimulating sustainable urban development through the **implementation of new fiscal and regulatory**
Opennnes	Urban Plannng and NBS	**OpenOpenNESS Policy Brief: NBS in Urban Planning**
Green Surge	Strategies	advanced urban green infrastructure planning and implementation Innovative Approaches and Strategies from European Cities
OPERAS	Applications ecosystem research	Operational Potential of Ecosystem Research Applications
TESS		http://cordis.europa.eu/publication/rcn/15309_en.html

Annex 5. Green Infrastructure

Table 122. Baseline on green infrastructure references

TOPIC ON GI	DETAILED REFERENCE
Online reference database, conferences and glossary on GI	a library of relevant documents in BISE online information on green infrastructure. Conferences (here) to assist in the preparation and implementation of the Green Infrastructure Strategy Glossary document with key terms and definitions
Green Infrastructure (general)	*Supporting the Implementation of Green Infrastructure (2015)* Information and recommendations on how to promote GI, build capacity for its deployment, improve information exchange, assess related technical standards and innovation opportunities, and explore opportunities for a Trans-European Network for Green Infrastructure (TEN-G). More information and country factsheets in Annex 1: Country factsheets: DE, DK, ES, IT, LT, MT, PL, PT, RO, SI
Thematic- sectorial policies	Green Infrastructure and water Green Infrastructure and rural abandonment Green Infrastructure and health Integrating nature & biodiversity and land use data (February 2012, GeoVille Group) Analysis of current data gaps in assessing of the state of biodiversity in Europe and provision of a processed database combining all existing data collections together with chosen biodiversity indicators based on the exploration of land use data for biodiversity, ecosystem services and green infrastructure. Recommendations on biodiversity data policy in support of a gap analysis relevant to the EU 2020 Biodiversity Strategy.
Thematic- climate change	Green Infrastructure and climate adaptation Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe(November 2011, Ecologic and Oxford Environmental Change Institute) Based on a database of 161 applicable projects, five in-depth case studies, targeted interviews with European Commission officials and a literature review, this study aims to address current knowledge gaps regarding the uptake and implementation of ecosystem-based approaches and thereby gain a better understanding of their role and potential in climate change adaptation and mitigation in Europe.
Socio-economic	Economic and Social Benefits of Environmental Protection and Resource Efficiency related to the European Semester (February 2014, RPA) Information on the potential financial, economic and social impacts of floods, how green infrastructure can mitigate flood risk and valuable data on floods for all 28 EU Member States in annex.
Project design	The Multifunctionality of Green Infrastructure (March 2012, Science for Environment Policy) Overview of the various potential functions of green infrastructure, (defining features, performance, comparable costs and benefits, issues surrounding indicators and multi-level evaluation, ...) with a particular focus on four types of functions: ecosystems and biodiversity protection, provision of ecosystem services, benefits to human health and wellbeing and development of a green economy and of sustainable land and water management. Green Infrastructure Implementation and Efficiency (December 2011, IEEP) Identification and evaluation of current policy initiatives supporting green infrastructure initiatives across Europe, with seven in-depth case studies on thematic issues: ecological networks, multi-functional use of (1) farmlands and forests, and (2)

	coastal areas, freshwater and wetlands management and restoration, urban green infrastructure, grey infrastructure mitigation and green infrastructure mapping for spatial planning. Overview of the evidence and indicators of improved ecosystem resilience, quantified impacts on ecosystems and their services, resulting socio-economic and health benefits and compares these benefits with costs. Assessment of four different policy scenarios for the implementation of green infrastructure in Europe.
Funding and Finance	Green Infrastructure and finance Design, implementation and cost elements of Green Infrastructure projects (December 2011, Ecologic and GHK) Definition, identification and evaluation of a set of European green infrastructure projects and initiatives, with information on design and implementation processes, potential to respond to multiple objectives and estimates of cost and benefits. Assessment of the potential of current EU policies and available funding instruments to promote green infrastructure projects and provide for the capacities and planning needed to develop and implement these projects,with recommendations for policy-makers. **Guide to Multi-Benefit Cohesion Policy Investments in Nature & Green Infrastructure** This guide underlines the crucial interconnections which exist between nature, society and the economy. In particular it shows that investments in nature, biodiversity and green infrastructure are relevant for cohesion policy. Further, it emphasises how investments of the ERDF and Cohesion Fund in nature and green infrastructure can actually contribute to several policy objectives and deliver multiple benefits, in particular socio-economic development. And eventually it assists authorities and stakeholders with practical recommendations to improve the delivery of the co-funded programmes and projects.

i Insurance value of ecosystems: the value of the sustained capacity of ecosystems to maintain their functioning and production of benefits despite any disturbance; the value of the sustained capacity of ecosystems to reduce risks to human society caused by e.g. climate change related excess precipitation, temperature or by natural disasters (EC 2015).

ii Nature based solutions: solutions that are inspired or supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. "Nature-based solutions are actions which are inspired by, supported by or copied from nature. They have tremendous potential to be energy and resource-efficient and resilient to change, but to be successful they must be adapted to local conditions. Many nature-based solutions result in multiple co-benefits for health, the economy, society and the environment, and thus they can represent more efficient and cost-effective solutions than more traditional approaches. NBS do not have clear boundaries and may intersect with other policy areas, such as eco-innovation and the bio-economy." (EC 2015).

iii The original aim was to look at all the demo countries. However this analysis was much more exhaustive than originally planned and it was considered better to undertake a more in depth analysis of three countries, and leave the full comparative analysis for the next deliverable.

[iv] At the moment this quantification cannot be made on "euros" saved (damage costs reduction) due to the lack of evidence in a systematised way.

[v] Transaction costs are the costs of collecting information, bargaining, communicating, decision making, and enforcing contracts between individuals, norms and the state (Coase, 1960).

[vi] announcements and special initiatives include both national and local governments, and parliamentarians, and complement the official government statements made at the Open-ended Intergovernmental Preparatory Committee meetings and the WCDRR commitments.

[vii] UNISDR (2017) Technical Guidance for Monitoring and Reporting on Progress in Achieving the Global Targets of the Sendai Framework for Disaster Risk Reduction: Collection of Technical Notes on Data and Methodology https://www.preventionweb.net/files/54970_techguidancefdigitalhr.pdf

[viii] United Nations Office for Disaster Risk Reduction (UNISDR) [2 February 2017] http://preventionweb.net/go/505

[ix] *Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change

[x] The Communication on "Next steps of a sustainable European Future, and European Action for Sustainability clearly states in the introduction that "To preserve our natural capital it is crucial to accelerate the transitions to a low carbon, climate resiliente, resource efficient and circular economy. For these challenges to become opportunities fr new business, new jobs and a strong engagement win research and innovation is needed (SWD (2016) 390 Final; p.2).

[xi] UN World urbanization prospects, New York,2014.

[xii] http://urbanwateragenda2030.eu/

[xiii] Climate change, impacts and vulnerability in Europe 2016 – EEA, 2017

[xiv] "a matter of convincing decision maker (public and private) to put their money on NBS instead of investing in more traditional solutions". Equally it points to how these NBS solutions should "be designed together with local communities (citizens, associations, investors, etc.) who will be the one who co-fund, co-mantain, use these solutions" (p.10)

[xv] Nature based solutions into policy, regulations, project planning, financing and at the same time exploring how a compactness approach can be systematically integrated into urban planning, taking into account also social acceptance of this approach and structural and physical constraints due to the presence of existing infrastructures, buildings and urban activities (p.10) (SUL-NBS, 2017)

[xvi] Due to different methodologies of collecting data, there are different data available which are not always appropriately comparable as well as harmonized. Therefore, we would like to explore state of art in different administrative levels to find appropriate models and instruments for urban sprawl monitoring.
[xvii] The language effect usually brings obstacles while comparing data and implementing policies that consider concepts that are not applicable to all realities and territories, among others. Thus the partnership should also pay attention to the need of standardization/uniformization of vocabulary.
[xviii] Farmers with arable land exceeding 15 ha must ensure that at least 5% of their land is an ecological focus área. Ecological focus areas may include, for example, fallow land, landscape features, afforested areas, terraces, hedges/wooded strips or nitrogen fixing crops such as clover and alfalfa which help to improve soil organic matter
[xix] http://ec.europa.eu/environment/nature/ecosystems/strategy/index_en.htm
[xx] The elements of the strategy are defined in the Commission staff working document Technical information on Green Infrastructure (GI) Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Green Infrastructure (GI) — Enhancing Europe's Natural Capital. COM (2013)
[xxi] http://ec.europa.eu/transport/sites/transport/files/2016-12-permitting-facilitating-ten-t.pdf
[xxii] http://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm
[xxiii] www.biodiversity.europa.eu/countries, visited on Nov., 2017 - the idea is to gather and to monitor the implementation of Green Infrastructure within the EU Member States according to a template of eight points (1/national policy setting and initiatives ; 2/mainstreaming green infrastructure ; 3/regional policies and implementation ; 4/financing green infrastructure; 5/challenges and opportunities for GI development; 6/knowledge base; 7/further resources and publications; 8/list of consulted references;
[xxiv] On 16 December 2015, the Environmental Council adopted Conclusions on the mid-term review of the EU Biodiversity Strategy to 2020. On 2 February 2016, the European Parliament adopted a Resolution on the mid-term review of the EU Biodiversity Strategy to 2020.
[xxv] http://ec.europa.eu/environment/nature/legislation/fitness_check/action_plan/index_en.htm
[xxvi] The Plan is complemented by detailed factsheets providing more information on each of the 15 actions.
[xxvii] The EUSF (2002), with an annual budget of €500 million, is dedicated to help European Member States or other candidate member country to recover after flood, earthquake and forest fire events _EUSF. The fund is unlocked only in these three cases:

1. Major disaster: if the total damage exceeds €3 billion of 0.6% of GNI of the country
2. Regional disaster: if the total damage exceeds 1.5% of regional GDP
3. Last case: in cases where an eligible State is affected by the same disaster as a neighbouring eligible country

Currently, a reform to link the EUSF to the EU objectives regarding climate change and DRR is under consideration for future development.
[xxviii] *Aspects of the Methodological Approach used in Developing Flood Risk Management Plans (*D.RĂDULESCU, I.FLORESCU, T. GEORGESCU, E. GODEANU, A MAGETZ- INHGA Conference 2017
[xxix] *ICPDR, 2014b.*
[xxx] elaborated with the support of the World Bank and approved by the *Government Decision 739/2016*
[xxxi] The selection of hazards as well as the entire process of risk assessment was developed based on the Decision No 1313/2013/EU of the European Parliament and of the Council, of 17 December 2013 on a Union Civil Protection Mechanism.
[xxxii] Country Report National Risk Assessment RO-RISK (SIPOCA code: 30, co-financed under EFS through the Operational Program Administrative Capacity 2014 – 2020) in accordance with the Decision No 1313/2013/EU of the European Parliament and of the Council, of 17 December 2013 on a Union Civil Protection Mechanism.
[xxxiii] Law 107/1996
[xxxiv] Law 577/2016
[xxxv] Abbreviations according with Government structure January 2018: Men-Ministry of Energy, MPF- Ministry of Public Finance, MT- Ministry of Transport, MH- Ministry of Health, MIA- Ministry of Internal Affairs, MWF-Ministry of Waters and Forests, MARD -Ministry of Agriculture and Rural Development, MND-Ministry of National Defence, MEd- Ministry of Education, MRDPA-Ministry of Regional Development and Public Administration, MEc- Ministry of Economy

[xxxvi] Cost recovery model related to flood protection Romania, final report, Partners for Water for NARW, 2014 (VanDikeManagement, Ecorys, VNG, BDG)
[xxxvii] Non-structural measures as defined by the guide exclude the setup of permanent "grey" infrastructure focusing on green infrastructure as well as any other type of measure aimed at reduction of flood risk such as: controlling the use of minor river beds, elaborating plans to reduce flood risk, introducing insurance, warning and alarm systems, informing the public, etc.
[xxxviii] Law 260/2008
[xxxix] https://www.paidromania.ro/harta-pad
[xl] Listed in the Annex XX Selection Of Relevant Projects Involving Value Of Ecosystems Services in Romania
[xli] http://www.ecologique-solidaire.gouv.fr/prevention-des-inondations#e4, visited on Nov. 10, 2017
[xlii] French Insurance Code, Article L.125-1
[xliii] Grenelle II Law n°2010-788 of the 12 July 2010 & Decree n°2011-227 of the 2 March 2011
[xliv] Urban communities are so-called Public Inter-municipality Cooperation Establishments with own-source tax revenue (EPCI).
[xlv] www.legifrance.gouv.fr/affichTexte.do?cidTexte=LEGITEXT000006074249&dateTexte=20081027, visited on Nov. 10, 2017
[xlvi] Nb: to have more details please see D7.1
[xlvii] The accounting and financing management of the "Barnier Fund" is ensured by the CCR.
[xlviii] So-called RBOP, Responsible of the Programme's Operation Budget
[xlix] These two types of financing are required by the French National Law on Finances (LOLF) n°2001-692
[l] Simply, commitment authorizations are an engagement of expenses on several years. Payment appropriations are the upper limit of the expenses that may be scheduled or paid during the year to cover commitments contracted within the commitment authorizations. To know more: www.economie.gouv.fr/cedef/quelle-difference-entre-autorisation-dengagement-et-credit-paiement, visited on Nov. 9, 2017
[li] www.senat.fr/commission/fin/pjlf2014/np/np10a/np10a4.html, visited on Nov. 8, 2017
[lii] www.senat.fr/rap/a16-145-2/a16-145-20.html#toc16, visited on Nov. 8, 2017
[liii] European Development Fund, Agricultural European Fund for rural development and the LIFE Programme.
[liv] Freddy REY, IRSTEA, www.theconservation.com/dans-la-lutte-contre-les-inondations-le-genie-vegetal-marque-des-points-83653, visited on Nov. 9, 2017
[lv] www.sudouest.fr/2016/02/03/inondations-l-entretien-des-digues-incombera-bientot-aux-communes-2262771-4971.php, visited on Nov. 9, 2017
[lvi] Joint association, EPAGE and EPTB cannot implement this tax even if they have competences under GEMAPI.
[lvii] Based on the Law MAPTAM, article 1530 bis of the General Tax Code.
[lviii] www.seinegrandslacs.fr/blog-hydro-solidaire/eu-sequena-partenariat-axa-entreprises-et-leptb-seine-grands-lacs, visited on Nov. 10, 2017
[lix] Nevertheless, this mandatory coverage for natural catastrophes can create risk aversion and lack to foster people to be interested in risk knowledge and protective measures.
[lx] www.novethic.fr/le-label-teec.html, visited on Nov. 10, 2017
[lxi] 4. Applicable Definitions and Terminology Unless stated otherwise, key terms are those defined in the "Recommendations of the Open-ended Intergovernmental Expert Working Group on Terminology related to disaster risk reduction".
[lxii] https://www.verzekeraars.nl/actueel/nieuwsberichten/Documents/2015/April/Klimaatverandering%20%20en %20schadelast.pdf
[lxiii] http://wetten.overheid.nl/BWBR0009637/2016-01-01.
[lxiv] http://wetten.overheid.nl/BWBR0009637/2016-01-01.
[lxv] Insurance on the Danish adaptation portal: http://www.klimatilpasning.dk/sektorer/forsikring.aspx
lxvi See pages 13, 14 and 18: https://www.theccc.org.uk/wpcontent/uploads/2015/10/DECC_CCC_Adaptation.pdf
lxvii See page 87: https://www.theccc.org.uk/wp-content/uploads/2016/09/Scottish-Climate-ChangeAdaptation-Programme-An-independent-assessment-CCC-September-2016.pdf
[lxviii] http://www.climatescenarios.nl/
[lxix] http://climate-adapt.eea.europa.eu/countries-regions/countries/netherlands

[lxx] http://www.klimaatscenarios.nl/brochures/images/KNMI14_Klimaatscenarios_folder_EN_2015.pdf
[lxxi] Danish Emergency Management Agency (in Danish: "Beredskabsstyrelsen"): www.brs.dk 41
http://www.danishstormcouncil.dk/Menu/About-The-Danish-Storm-Council/What-is-the-Danish-Storm-Council
[lxxii] Country report 5.1 Conditionality Romania 2016, deliverable of the "National Risk Assessment – RO RISK", available at: https://www.igsu.ro/documente/RO-RISK/Raport_Final_de_tara.pdf; Metodologia de evaluare a riscurilor și de integrare a evaluărilor de risc sectoriale, https://www.igsu.ro/documente/RO-RISK/Metodologia%20de%20evaluare%20unitara%20a%20riscurilor%20-%20versiune%20finala.pdf
[lxxiii] Country report 5.1 Conditionality Romania 2016, deliverable of the "National Risk Assessment – RO RISK", available at: https://www.igsu.ro/documente/RO-RISK/Raport_Final_de_tara.pdf