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EXECUTIVE SUMMARY

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

NAIAD focuses on the insurance value of ecosystems (IVE), i.e. "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, page 19)[1], specifically on benefits regarding water-related disaster mitigation. NAIAD aims to bring evidence of the protective roles of ecosystems, to provide integrated hazard assessment methods, to include social risk perception and preferences, and to tailor innovative business models, funding and financing strategies that allow the development of effective implementation strategies of Natural Assurance Systems, which embrace the insurance value of ecosystems.

This deliverable specifically set the path for deepening our understanding on the different funding and finance options for operationalizing the insurance value of ecosystems.

Main findings

Funding and financing mechanisms for NBS

Both funding (payment for the investment made) and financing (mustering the up-front resources needed to be repaid over time by the funding) are necessary to develop NBS for increasing society's resilience against natural hazards. Many different schemes exist for doing so, but a lack of funding and financing sources exist for the implementation of NBS for various reasons: no clear beneficiary, no interest of beneficiary in funding them, lack of financing

[1] "The insurance value of an ecosystem results from the system itself having the capacity to cope with external disturbances and includes both an estimate of the risk reduction due to the physical presence of an ecosystem (e.g. area of upstream land/number of downstream properties protected) and the capacity to sustain risk reduction (i.e. the resilience of the system)" (EC, 2015, page 19).

options, etc. The objective of WP7 in NAIAD is to propose new ways to fund and finance NBS (development of new business models). In this deliverable we present the inventory of the existing mechanisms that could be used or adapted to develop NBS projects.

The mechanisms detected with higher potential for NBS implementation, from the institutional nature of the source of money, can be public, private or a combination of both. An additional source of financing can be available conditionally, e.g. after a catastrophic event, in the form of insurance. The existing capital provision vehicles have been structured in four thematic pillars: 1) climate; 2) nature conservation, 3) disaster risk reduction, 4) infrastructure financing. At EU level of particular interest is European Commission commitment to mobilise EUR 500 bn in additional investments through the European Fund for Strategic Investments (EFSI) by 2020 and the EU´s Natural Capital Financial Facility (NCFF)), PPPs and blended finance, Payments for Ecosystem/Watershed Services, Environmental and social impact bonds, Green and climate bonds, Mitigation and habitat banking and CatBonds.

Key messages

1. The European Commission has the ability to reinforce and create harmonized linkages between Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) policies and insurance businesses at the European scale. New regulations mainstreaming and facilitating eco-DRR measures (NBS) are necessary both at European and national scale, to increase (re)insurers', public and private bodies involvement in the use of NBS for DRR and CCA. This is an opportunity to promote risk awareness and risk reduction.
2. New funding and financing schemes are available to implement NBS for DRR, like new public-private partnerships (PPPs), blended finance, payments for ecosystem/watershed services, environmental and social impact bonds, green and climate bonds, habitat banking and CatBonds. Nevertheless, further investigation is needed to formalize these schemes into clear business models that can be used by the involved actors in the implementation of NBS.
3. At EU level of particular interest is European Commission commitment to mobilise EUR 500 bn in additional investments through the European Fund for Strategic Investments by 2020 and the EU´s Natural Capital Financial Facility.

1. INTRODUCTION

A map of existing funding vehicles and financing mechanisms, as well as the current flows of money being used for the implementation of similar projects in the public and private spheres, is necessary to evaluate alternative funding and financing strategies to develop NBS for DRR. Only by identifying existing mechanisms and their potential to fund/finance NBS implementation, can existing gaps be identified for the design of alternative governance structures and business models required for the implementation of IVE.

This deliverable is focused on developing an inventory of funding and financing mechanisms, facilities and instruments for DRR and NBS available to the countries where the 9 NAIAD demos are taking place. This has been done through a literature review of international successful experiences in setting up alternative financing and funding mechanisms for nature restoration. Based on this inventory of options, an analysis of the potential of each of them will be undertaken in future steps of Work Package 7. These gaps will then be reported and taken for further research.

This deliverable is only the first step towards the ultimate goal of WP7 which is to develop a Financing Framework for NBS (for Water Security) that enables our demos and others to speed up the implementation of NBS and their shift towards Natural Assurance Schemes.

2. ANALYTICAL FRAMEWORK

In order to identify the possibilities for implementation of NBS for DRR as proposed in NAIAD, it is key to understand the funding and financing options (e.g. funds available and financing instruments), as well as the rules of the game in the public and the private financing spheres. Additionally, given the climate adaptation, green infrastructure and DRR nature of these measures it is important to understand the local relevance of climate, DRR, conservation and infrastructure finance dedicated funds.

The first level of categorization of funding and financing options is based on the institutional nature of the source of money, which can be public, private or a combination of both. Moreover, a source of financing can be available conditionally, e.g. after a catastrophic event, in the form of insurance. See Table 1 below for an overview and characteristics to take into account when analyzing potential financing modes for NBS.

For further identification of funding and financing options we have looked for existing capital provision vehicles in both the public and private spheres available for similar projects. This led us to look at four thematic pillars: 1) climate; 2) nature conservation, 3) disaster risk reduction, 4) infrastructure. The menu of options in different pillars as well as in the public and private spheres can be seen in Table 2.

This document has been organized according to the aforementioned sources of funding and thematic pillars. Although bonds are only one particular vehicle for financing public and private projects, the market of green and climate bonds has grown so rapidly recently that we have decided to have a separate section focusing on this instrument.

Table 1. Sources of funding; public, private and conditional finance.

Institutional nature of the source of money	Specific characteristics	Relationship to the financing DRR measures
Public Finance/ National Public Investment System (SNIP)(not thematic, rules of the game)	National Public Investment System procedures	Set the rules of the game on how project and project phases are financed. Who has to take the initiative, who has to endorse it and which funds and/or loans can be accessed by different actors? The system quality and transparency are good indicators for the private sector on how safe is to invest and/or participate in national tenders and projects.
	Disaster Risk Management aspects – within National Investment Systems	How risks are managed along the project cycle of infrastructure investments (where water management is relevant) and how these risks are shared with the private sector give an indication of A) which sector – public or private- is responsible for managing these risks and therefore willing to invest in DRR measures. B) Gaps within the investment system that need to solved with DRR and system understanding expertise. Besides, the distribution of DRR responsibilities between government layers and their budgeting gives an indication of the financial feasibility (and steps towards implementation) of DRR measures.
	ODA/ Dev. Cooperation and Technical assistance. (in EU terms these are Structural Funds, Life & others)	Important to identify additional sources of funds and/or strategic partners to implement and finance the proposed initiatives.
Private Finance for public goods	PPP and private initiative modalities	Understanding of these modalities and how financing and funding for each of them is arranged completes the overview of public financing options. PPP's and private initiatives are an increasingly used option by countries within their national strategies for infrastructure Investments.

	Capital Markets & Project Finance	While PPP modalities give the overview of the ways a government is open to private financing and the attractiveness of these modalities to the private sector, capital markets and their depth determine if private parties are able or not to access the loans they need to (pre)finance such projects.
Conditional Finance	Insurance	A country with an otherwise robust disaster risk management program can still be highly exposed to budgetary shocks caused by major disasters. Insurance helps ensure that governments, businesses, and people are financially protected in the event of a disaster. Knowing the options in a country gives information on the possible funds that become available after a disaster, as well as on the incentives of different actors to prevent such risks and therefore their insurance risk premiums. A number of Dutch solutions and information services are of high potential when used in combination with insurance services (e.g. Flood Index Based insurances that make use of models as well as remote sensing date to reduce time and cost of processing of claims.

Table 2. Thematic streams related to financing NBS and their relationship to DRR measures. A short explanation of each stream and why it needs to be considered in our inventory given their relationship with the financing of Eco-DRR or NBS measures is presented.

Thematic Stream	Relationship to the financing DRR measures
Climate Finance)	Climate Finance is the term given to a new set of funds and financing instruments set in place by the international community to speed up the process of implementation of climate adaptation and climate mitigation actions. Examples are concessional loans, trust funds, guarantees and other instruments that improve the financial viability of projects and/or de-risk project phases. These funds can be accessed by public but also by private actors. In the EU context these funds are different of what is called Climate Finance in the International Community, mainly aimed at developing countries. As NBS in NAIAD aim at DRR and Adaptation to Climate Change these are important sources of funding to be considered.
Infrastructure Finance	The most capital intensive NBS, which could also be considered green infra are alternatives to structural measures for DRR and therefore comparable to infrastructure investments.
Disaster Risk Reduction Finance	Many countries may have special funds for disaster risk management and disaster risk reduction. These could be for instance earmarked taxes or other public budgets for the implementation of important directives such as the Flood Risk Directive or the Water Framework Directive. An example is the water tax collected

	by Water Boards in the Netherlands. These funds may currently be used for the implementation of grey DRR measures, but could be in principle accessed for the implementation of NBS for DRR.
Conservation Finance	NBS for DRR and ecosystem conservation projects overlap to a degree. For this reason is also important to make an inventory of existing conservation finance options.

2.1 Funding versus financing – two different challenges

It is important to highlight here the difference between funding and financing. On the one hand, funding refers to the question of who ultimately will pay for the investments made. Funding can come from three generic sources: taxes, tariffs and transfers. Financing on the other hand refers to mustering the up-front resources needed to be repaid over time by the funding. Financing can make use of a variety of instruments such as grants, direct subsidies, tax incentives, loans (such as bonds), and others. Funding and financing mechanisms can be both public and private or revenue a mix of the two for a specific project.

Blended finance brings the option to mix and blend these different options and public and private flows of capital, and can help in mobilizing private financing for Climate Adaptation. Blended finance is defined by the OECD (2015) as "the strategic use of development finance and philanthropic funds to mobilize private capital flows to emerging and frontier markets".

Accordingly, in our inventory we make a difference between "funds" and "financing instruments", both of which could be channeled to the end beneficiaries through specific Financing Facilities.

2.2 Business Models

Although there may be an increasing amount of capital available for financing of NBS and DRR measures, the key question remains on how to generate revenues from these projects to pay back for these investments. Here is where business models play a role.

According to the literature a business model describes the rationale of how an organization creates, delivers, and captures *value* (economic, social, cultural, or other forms of value). The process of business model construction is part of *business strategy*. The essence is that it defines the manner a business enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit. A business model reflects management's hypothesis about what customers want, how they want it, and how an enterprise can organize to best meet those needs, get paid for doing so, and make a profit".

In some cases, we may not need to make ecosystems producers of revenues generated directly or indirectly. However, if we can represent income that is linked to ecosystems — even

indirectly — we may be able to accelerate investments in IVE. Thus, to develop bankable climate adaptation and NBS projects we need to design business models that allow us, in at least some cases, to capture the positive externalities of these projects and convert them in to revenue streams for investors. Business models embrace both institutional/organizational and financial matters and may use a combination of funding (revenue generating activities) and financing mechanisms.

Business models are not to be confused with "making the business case" — arguing that a project is "investable" for a certain actor. Such a project is not necessarily bankable. All public sector investments require a business case. Again according to the literature a business case captures the reasoning for initiating a project or task. The logic of the business case is that, whenever resources such as money or effort are consumed, they should be in support of a specific business need. Business cases are created to help decision-makers ensure that the proposed initiative will have value and relative priority compared to alternative initiatives, that the firm's (or government) dedicated resources are invested on the highest value opportunities. For the performance of initiatives to be monitored objectively --objectives and benefits need to be laid out in the business case. The analysis of a business case includes: a cash flow statement (that is, estimated net present value or NPV), costs, benefits, a risk assessment, strategic options, and opportunity costs.

Public sector projects are also required to justify their need through a business case. For the public sector the business case of the so-called "preferred strategy" (to achieve a certain level of service required for society well-functioning) is typically argued in terms of a cost–benefit analysis, which may include both financial and non-financial costs and benefits.

3. METHODOLOGY

Exploring various options for financing NBS has been based on the framework depicted in Tables 1 and 2 and Figure 1. Firstly, we conducted a literature review on the basis of which we have built a first draft typology of funds and financing instruments that make part of each pillar in the private and public spheres.

Secondly, based on this menu of options we undertook research to identify which of these funds and financing mechanisms – including Financing Facilities- are present on each of the 8 countries where our Demo's are located. When possible we started to document each of these funds and financing instruments according to a series of factors that will allow us to make a first estimation of their potential for the implementation of NBS and which analysis will be carried out further for future deliverables.

Thirdly, after having the inventory of options available in all four pillars, plus conditional financing in the public and private spheres; we have gone further to analyze the potential they have for the implementation of NBS based on the magnitudes of money flows they signify as well as whether their investment criteria and "evidence" requirements are in line with the profile of NBS projects. If these funds and financing mechanisms have already been used to implement NBS, one may argue that such instruments seem of high potential. When no green infrastructure or NBS has been funded in the past, a further analysis of the decision and investment criteria used per instrument or by the financing facility is required to estimate its potential.

Fourthly, based on this evaluation; we identify the gaps that need to be bridged. These gaps could be bridged either with the development of "new financing instruments" or else by shaping NBS projects differently or developing additional evidence for these projects to meet the investment criteria of existing funding and investment options. The key focus here is what criteria financial flows are using, so how this would have to change to include NBS.

This methodology for the identification of financing opportunities builds on the methodology developed for the Dutch Disaster Reduction in 2016 and tested in DRR missions in Peru, Ecuador and Costa Rica (Altamirano *et al.,* 2016).

4. RESULTS: INVENTORY AND REVIEW OF ALTERNATIVE FINANCING PILLARS AND MECHANISMS

The resulting inventory of Funding and Financing options is presented in Figure 1 and the different instruments identified in each of the sections and their potential to finance NBS are presented in the following sections.

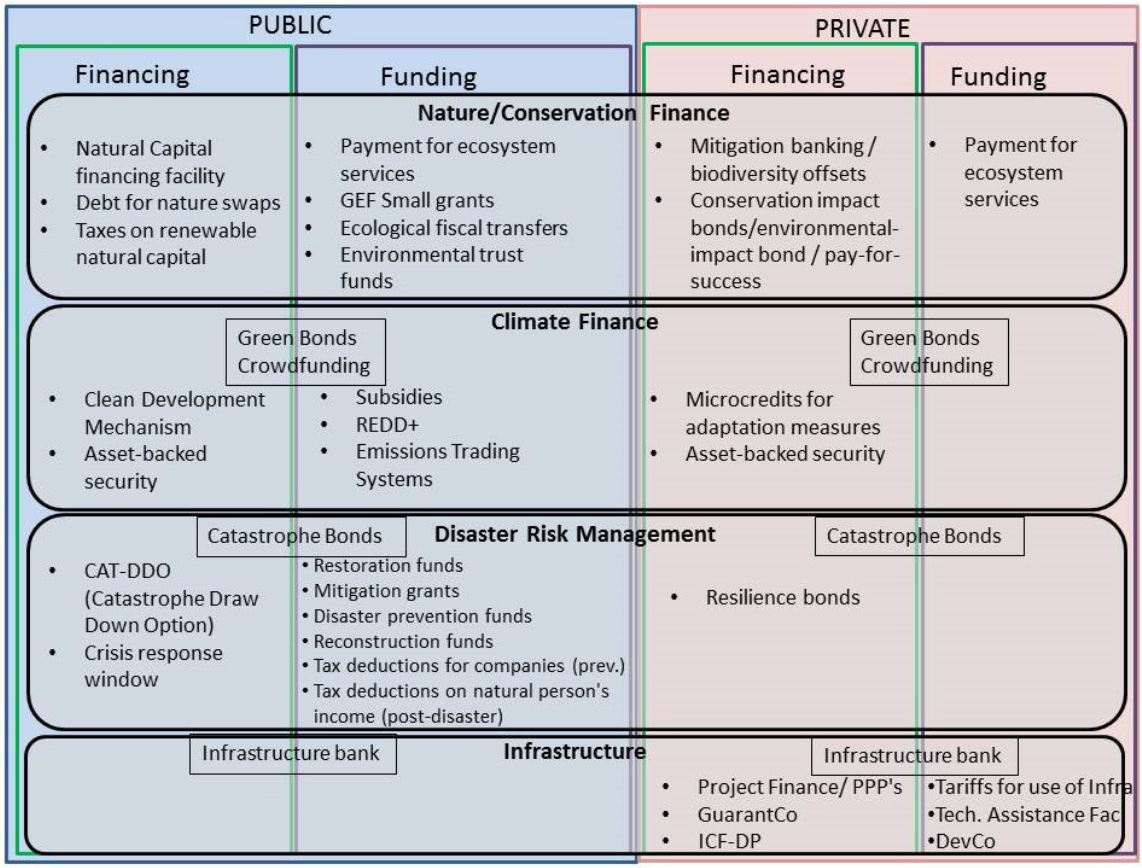

Figure 1. Mapping of the funding and financing options both in the public and private spheres available for NBS projects for DRR.

Potential modalities for financing and funding are categorized according to their type of ownership, which can originate either in the public (government owned) or private (owned by individuals or groups) sector. Subsequently, instruments have been distinguished based on their usage, either for financing or funding, or a combination of both (see section 2.1 for the difference between funding and financing). In addition, instruments have been grouped according to four thematic pillars, based on the type of projects that are typically financed by these instruments: climate finance, nature conservation finance, disaster risk reduction finance and infrastructure finance.

Within this framework a type of resource that has been identified for implementing NBS can be placed according to its characteristics. It should be noted that certain options can be placed in multiple categories. For example, a bond that is issued by a private entity using public resources to reduce interest rates would be a public-private financing instrument. Likewise, a

city utility (a public entity) may work with a commercial bank to issue a bond to be purchased by private investors. The typological category where this bond fits in table 2 depends on the projects financed, which can cover multiple objectives.

4.1 Public Finance

This section will look at public finance at EU level funding and the local level, while the national level will be explored in more depth in the coming deliverables.

4.1.1 Public finance instruments

In general, one could catalogue the different "public" climate finance instruments in several categories, such as presented in Figure 2. An important indirect way to support climate projects without directly involving transfers of money is via de-risking instruments such as guarantees.

Figure 2 below shows the various types of public instruments and mechanisms that are used to provide funding to various types of activities. Firstly the category of public support mechanisms is distinguished, which entails actions that are mostly policy oriented, such as setting standards, quotas or repealing support for a certain sector. Besides that, it focuses on project level assistance, for example in the form of grants or subsidies. Grants can be implemented directly in a region or country, e.g. in order to finance elements of the public good such as parks or streets. Subsidies are often implemented after an actor or entity makes a request based on qualifications for this subsidy, e.g. a student asking for compensation to pay a tuition fee.

The second category that is listed is public financing instruments, which focuses on methods that can be used by the government to engage in financing activities, either as recipient or donor. Governments can lend money to specific projects as funder, can grant money as donor, or can issue bonds to borrow money from the market. Furthermore, it can set up funds that give out loans or provide loans that have concessional characteristics in order to stimulate certain activities.

Furthermore, the government can invest directly in capital, e.g. in semi-state owned firms such as railway companies. Another category is de-risking instruments, which are instruments that require more financial engineering such as guarantees or insurance. Guarantees can be given to (partially) cover market transactions, when a government wants to stimulate such transactions. Insurance can be used to cover nation or region-wide incidents for which the market does not want to insure, e.g. flood insurance in the Netherlands.

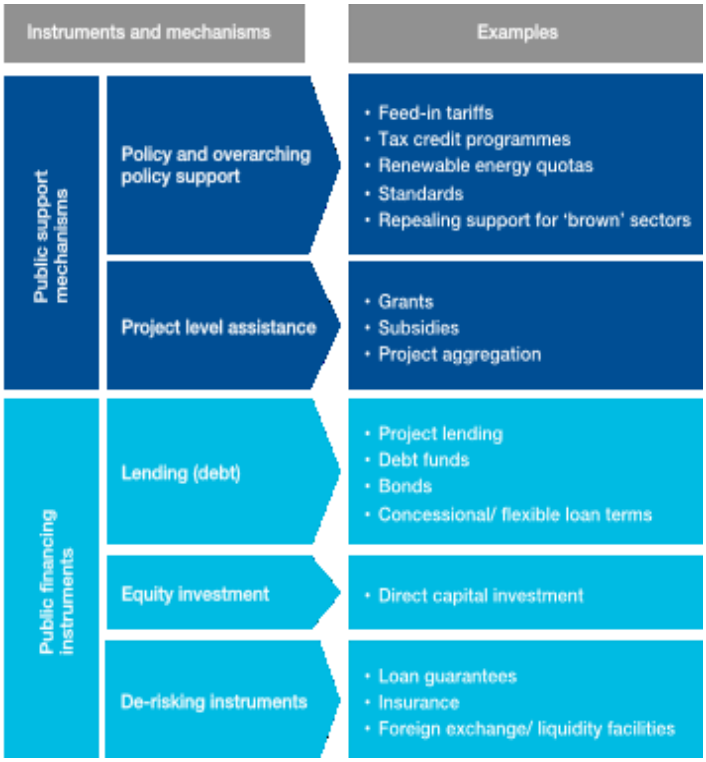

Figure 2. Public finance instruments and mechanisms. Source: *World Economic Forum* (2013: 19).

4.1.2 Subsidies

A subsidy can be defined as "a benefit given to an individual, business or institution, usually by the government. It is usually in the form of a cash payment or a tax reduction. The subsidy is typically given to remove some type of burden, and it is often considered to be in the overall interest of the public, given to promote a social good or an economic policy" (Investopedia, 2018a).

Subsidies in the form of cash could for example be for property owners that want to change their land use from agriculture to a natural area, but do not want to lose the income provided by agriculture. In the Netherlands such a regulation exists named the 'quality impulse for nature and landscape management'. Projects that qualify under this regulation can get funding for developing or conserving new natural areas (RVO, 2018).

A subsidy in the form of a tax reduction, or fiscal advantage, can also be found in the Netherlands, called the 'regulation for green projects'. Investors in green projects or green

bonds do not need to pay equity tax until 58.000 euro and get a tax reduction of 0.7% of the value of their investments in green projects. This can stimulate investors to provide funds for green projects.

4.1.3 EU ESIF Funds and the MSF2020

Several EU financing instruments support European policies and actions, which are designed as European Structural and Investment Funds (ESIF): the three cohesion policy funds (i.e. the European Regional Development Fund (ERDF), the Cohesion Fund (CF) and the European Social Fund (ESF), the European Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF). In terms of ESF funding and NBS for the insurance value of ecosystems, the regulatory justification to dedicate funds falls for investments falling under TO 6(d) – protecting and restoring biodiversity and soil and promoting ecosystem services, including through Natura 2000 and green infrastructure (The Global Commission on the economy and climate, 2016).

The European Structural and Investment Funds (the Cohesion funds) - are 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).

What is also important is that the European Commission in 2016 made a "policy push" by committing to mobilise EUR 500 bn in additional investments through the European Fund for Strategic Investments (EFSI) by 2020. This Investment is targeted to several strategic sectors which include water, other infrastructure, agriculture, and the promotion of future-oriented initiatives, such as the circular economy and specifically climate mitigation and adaptation.

The EU has also aimed to coordinate the use of these funds through Thematic Objectives (TOs). TO 5 relates directly to adaptation: "Promoting climate change adaptation, risk prevention and management". However, as the EU states "all the other TOs also have climate action potentials. Mainstreaming aims to ensure that such potentials are identified, assessed and included in each programme". For two funds, the EAFRD and the EMFF, there are sector-relevant Union Priorities (UP). In the case of the ERDF there a minimum share spending on TOs 1 to 4. It does not include 5 (adaptation and risk) but there is an ex-ante conditionality on risk prevention and risk management, more specifically "on the existence of national or regional risk assessments for disaster management, taking into account climate change adaptation. This is conditionality on the funding disbursed to ensure that there is a risk assessment for

identifying cost-efficient and effective climate change adaptation actions. A series of Factsheets exist on how to mainstream climate change action in each of the funds (EU, 2015).

In terms of trends, despite the overall target of 20% spending on targeted climate change projects, the target is likely to be even more ambitious for the second stage of EFSI 2.022, where the EU Commission has proposed a quantitative goal (40%). According to the EU "Outreach activities at the highest level will promote forward looking proposals not just for the climate target but to ensure uptake of broader sustainable growth projects. In addition, the new proposal will make it easier to combine with other major funding sources such as European Structural and Investment Funds to support sustainable growth in several sectors across the EU".

The review of the Multiannual Financial Framework for post 2020 is currently being discussed as this document is being prepared. Discussions and documents indicate that the level of ambition for the whole post 2020 MFF in relation to climate action as stated earlier will increase. For example, a report by E3G as part of the consultation process commented on the enormous opportunity to use the new revised MSF as leverage for deep change around focused missions on climate action and a more strategic approach looking for synergies across policies (Campillos & Cook 2017). Another report on the new climate economy with a section on sustainable infrastructure (NCE, 2016) considers green infrastructure as an important element of sustainable infrastructure. In April 2017 a new report was released on *Mainstreaming adaptation into the ESIF 2014-2020* used as basis of this review an in depth analysis of all expenditure across EU funds (COWI, 2017).

In terms of financing, it was the EU itself via the EIB that created the first "green bonds". Also important is that the EC launched its own EU´s Natural Capital Financial Facility (NCFF). The NCFF according to the EU "is a new instrument financed by the European Investment Bank (EIB) and the European Commission to provide loans and investments in funds to support projects which promote the conservation of natural capital through loans, including adaptation to climate change, in the Member States". The total budget for the Facility amounts to €100 – 125 million for 2014-2017. The European Commission contributes €50 million as a guarantee for the investments and finances a € 10 million support facility.

The NCFF according to its objectives will finance projects on: payment for ecosystem services (PES), projects involving payment or compensation for the benefits provided by ecosystems, Green infrastructure (GI projects), biodiversity offsets, conservation and Innovative pro-biodiversity and adaptation businesses (EIB, 2015).

4.1.4 Local financing: financing urban adaptation to climate change

Local financing has been identified in several events and many actors as a major driver and enabler for innovation and change. In the recent 10th Anniversary of the Covenant of Mayors held in Brussels, a new infographic[2] together with a new report by the EEA (2017) were released on financing urban climate change adaptation (EEA, 2017). Also an urban adaptation tool[3] to help guide cities on the type of financing available for projects, since cities have often identified financing as a barrier to initiating and implementing adaptation action. *Mayors adapt* is helping cities see how adaptation funding could come from the combination of several sources and where this tool can help provide knowledge of available funding opportunities. For example, explore the full range of innovative funding options like green bonds and crowdfunding, alongside normal funding. The report includes case studies that analyse how 11 cities across Europe are developing, funding and implementing urban adaptation measures. *Mayors adapt* however also identifies the need for co-financing from own city budgets and the important of mainstreaming adaptation into urban planning.

4.2 Private Finance

Before going into the review of the different private finance options it is important to explain several key concepts and differences.

4.2.1 Investors vs. financiers

The difference between investing and financing can be linked to the three types of cash flow activities; operating, investing and financing. Investing relates to activities that involve purchasing a certain asset, resulting in ownership of this asset. An investment can be defined as "an asset or item acquired with the goal of generating income or appreciation. In an economic sense, an investment is the purchase of goods that are not consumed today but are used in the future to create wealth. In finance, an investment is a monetary asset purchased with the idea that the asset will provide income in the future or will later be sold at a higher price for a profit" (Investopedia, 2018b).

A financier does not acquire ownership of an asset, but provides resources to another entity in order to receive a return later on in time, e.g. through a loan. Financiers usually have higher priority than investors in case an entity goes bankrupt.

4.2.2 Project vs corporate finance

[2] Infographic on Financing urban adaptation to climate change
[3] https://climate-adapt.eea.europa.eu/knowledge/tools/urban-ast/step-1-4

Corporate finance covers a wide range of activities that are undertaken in order to run a corporation, e.g. issuing loans or selling stocks. Project finance includes the range of activities that are performed in order to finance a specific project, such as building a new facility. As with corporate finance, funds can be attracted either in the form of debt or equity. The difference between both financing modes lies in the scope of returns and repayment for which investors are eligible.

The returns of project financing are based on the cash flows generated through the project. As such, projects are off-balance-sheet, e.g. through a special purpose vehicle. Therefore, lenders repayment can only stem from project returns or assets that have been developed for the project and used as collateral. Contrarily, the return and repayment of corporate finance is based on the entire balance sheet of a company, including numerous business operations. Therefore, the repayment can affect various sections of a company. On the other hand, returns will also be affected by a larger share of activities, rather than a single project as with project finance.

4.2.3 Private finance instruments

Depending on the source of capital behind the different instruments already reviewed one could classify private finance instruments according to their source (e.g. institutional investors versus banks) and according to the type of financing product: loan, equity, bonds, and so forth (Figure 3).

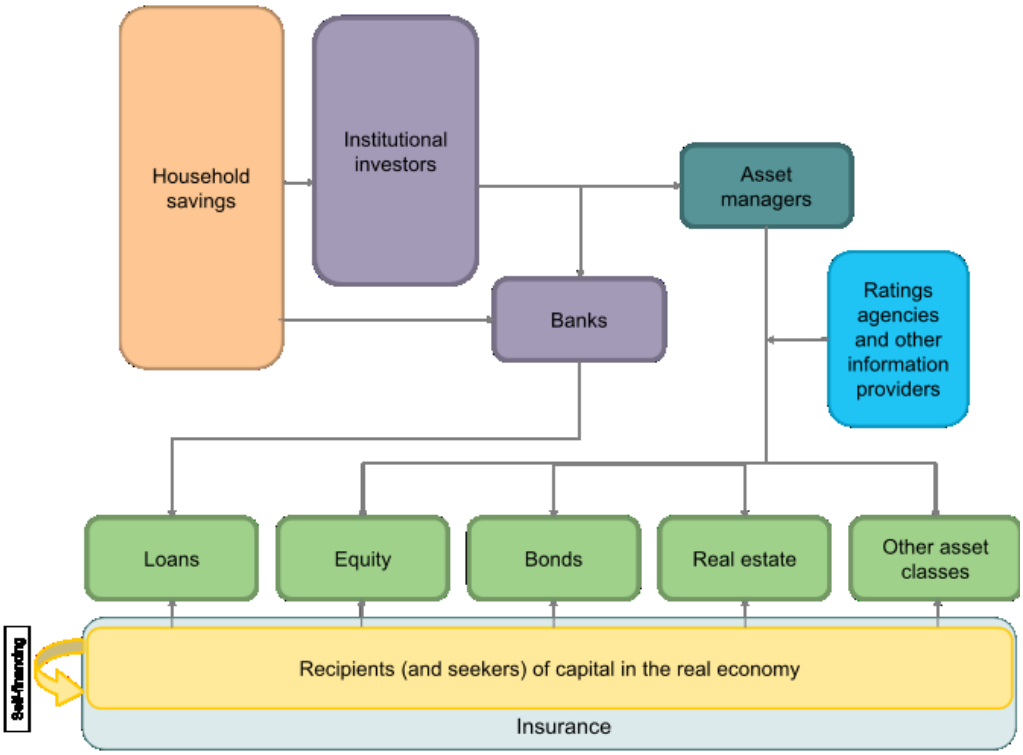

Figure 3. Source: UN (2015: 10).

4.2.4 PPP (public-private-partnerships)

The PPP Knowledge Lab defines a PPP as "a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance".

PPPs enable knowledge, expertise and financing to be pooled. The private sector's efficient, market-oriented approach can be coupled with enabling conditions set by the government.

PPPS can be an attractive implementation mode for an NBS, since it enables a combination of public and private investment to acquire public and private benefits, which can be a typical characteristic of an NBS. However, their application to the financing of NBS involves several key challenges; being the first the need to have clear performance indicators on which to base payments from public client to private agent. These challenges will be further explored in future WP7 deliverables.

4.2.5 Impact investing

Impact investments are investments made into companies, organizations, projects and funds with the intention to generate social and environmental impact alongside a financial return. Impact investments can be made in both emerging and developed markets and target a range of returns from below market to market rate, depending on investors' strategic goals[4].

The market size of sustainable, responsible and impact investing in the United States in 2016 is $8.72 trillion, or one-fifth of all investment under professional management[5].

Impact investments can be performed by various actors, e.g. development banks and social impact funds. Their sources of funding can be private, public or a mix of both. Impact investing can be relevant for NBS due to the social and environmental returns provided by NBS. Furthermore, several development banks focus explicitly on financing adaptation measures. For more information on impact investing, see following section on “Environmental and social impact bonds”.

4.2.6 Blended finance

Blended finance entails combining public and private sources of funding, e.g., through a concessional loan. Blended finance often employs public funding sources intended to leverage private sources. Since allocating private resources to projects with public private benefits such as NBS has several challenges:

1. Returns are too low for the level of real or perceived risk.
2. Local markets often do not function efficiently, with local financial markets in developing economies particularly weak.
3. Private investors have knowledge and capability gaps, which impede their understanding of the investment opportunities in often unfamiliar territories.
4. Private investors have limited mandates and incentives to invest in sectors or markets with high development impact.
5. Local and global investment climates are challenging, including poor regulatory and legal frameworks (OECD, 2015).

[4] https://thegiin.org/impact-investing/need-to-know/
[5] https://www.ussif.org/sribasics

Blended finance can also be in the form of credit enhancement. A credit enhancement is a method whereby a company attempts to improve its debt or credit worthiness. Through credit enhancement, the lender is provided with reassurance that the borrower will honor the obligation through additional collateral, insurance, or a third-party guarantee.

4.2.7 Crowdfunding

Crowdfunding is the use of small amounts of capital from many individuals to finance a new business venture. Crowdfunding makes use of the easy accessibility of vast networks of people through social media and crowdfunding websites to bring investors and entrepreneurs together, and has the potential to increase entrepreneurship by expanding the pool of investors from whom funds can be raised beyond the traditional circle of owners, relatives and venture capitalists (Investopedia, 2018c).

The largest such crowd-funding platform in the international development field, Kiva.org, has channeled over US$ 400 million from about 900,000 microlenders (most likely mainly from OECD countries, although there is no statistics available on their nationality) through about 190 affiliated field partners (with the majority being microfinance institutions) to over a million micro-borrowers in developing countries (ECBI, 2013).

Several limitations apply to crowdfunding, which can complicate the funding of NBS; loan size, maturity and risk aversion, and the constraints of crowdfunding in terms of overall funding size, risks for the crowd-lenders (for instance, foreign exchange), and the hitherto limited focus on climate change. Furthermore, there's no guarantee about the quality of the investment or the ecosystem value.

4.2.8 Microcredits

Microfinance, also called microcredit, is a type of banking service that is provided to unemployed or low-income individuals or groups who otherwise have no other access to financial services, such as subsistence farmers. While institutions participating in the area of microfinance are most often associated with lending (microloans can be anywhere from $100 to $25,000), many offer additional services, including bank accounts and micro-insurance products, and provide financial and business education. Ultimately, the goal of microfinance is to give impoverished people an opportunity to become self-sufficient (Investopedia, 2018d).

Microcredits could be particularly relevant for financing small-scale NBS, e.g. on household level.

4.3 Conditional financing for reconstruction: insurance and CatBonds

When natural disaster strikes, governmental resources could be insufficient to address disaster costs for recovery and have adverse impacts on economy. Recovery and reconstruction vary widely, depending on assets, hazards and damaged sectors. Sufficient governmental resources and/or innovative financing sources are necessary to ensure society resilience and decrease exposure to disasters. Governmental funding gaps are bridged through risk transfer mechanisms, such as insurance and other innovative financing instruments, such as catastrophe bonds.

4.3.1 Insurance in recovery process, a governmental choice

Natural disasters generated large damage costs and impact largely governmental finance. Governments' contingent liability is challenged by the objective to mitigate financial losses in a cost effective manner. The reviewed literature highlighted the numerous governmental' policy choices to ensure timely relief, reallocation and reconstruction, such as national funds, taxes, mandatory/voluntary/semi-voluntary market-based insurance schemes, parametric insurance, micro-insurance for developing countries, national pools, State as insurer of last resort, etc. The ASEAN2012_DisasterFinancingInsurance report recommends the establishment of a national disaster fund for recovery/reconstruction, the development of a disaster risk financing and insurance strategies and the promotion of public-private partnerships for catastrophe risk insurance. On the same way, WBG2016_InsuranceFinancingReconstruction, defines three option for countries to finance reconstruction:

1. Relying on domestic financing.
2. Financing reconstruction by re-allocation of public funds.
3. Taking disaster risk insurance.

Natural hazards insurance is seen as a way to share financing burden keeping governmental reserves and increasing national financing resilience: *"with insurance in place, the direct costs of the rebuild are met without the need to raise taxes or reallocate expenditures*" (p4). *"in practice for a 1:25 cyclone this would see the public capital rebuilt at the end of the thirst year following the disaster in the case there is no insurance coverage and a year earlier if insurance is in place" (*WBG2016_InsuranceFinancingReconstruction). In other words, according to ADBI2018_DisasterInsuranceLowIncome, disaster risk insurance provides socio-economic post-disaster supports, particularly necessary for low/middle income countries. The reviewed literature argued that insurance ensure rapid rebuild by avoiding to raise or increase taxes and provide expertise on reconstruction part. Nevertheless, insurance is not a panacea, thus,

insurance coverage could be limited by low penetration rate notably due to lack of risk awareness, lack of public engagement, non-well defined insurance schemes, and lack of demand for insurance or too high premiums.

To better understand the insurance role in reconstruction part, the 11 NAIAD countries are taken as examples (from the Country Fact Sheet and Milestone 4, Chapter 3.2.2).

Voluntary insurance schemes

- 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.

- 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 will rely on a compensation based on their policy. In case of earthquake event, the European Solidarity Fund is unlocked, the State distributes this money to the citizens.

- Slovenia

The Slovenian citizens rely on the post-disaster State fund that provides compensation. This compensation is unlocked only if the losses exceed 0.03% of the national budget income per year (Law on the Elimination of Consequences of Natural Disasters). In Slovenia, all who are affected by a natural disaster event have the possibility of compensation regardless of their insurance coverage situation. However, the current Slovenian risk management is characterized by a high degree of uncertainty as victims cannot rely on sufficient governmental compensation (if the losses do not exceed 0.03% of the budget).

Semi Voluntary insurance schemes

- 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 and only if they have made the request to the DSC. The claims adjuster assesses the cost of the damages;

send the assessment to the private insurance companies which refund the money to the policyholders. 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.

- Sweden

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

- Poland

In case of natural hazard, the compensation is divided into two elements: a private insurance which insure the insured in case of disaster listed in the policy and an ad-hoc compensation from the State and regardless the insurance coverage situation.

- The United-Kingdom

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

If high flood risk homes are insured under Flood Re scheme, the compensation will be provided by Flood Re, through the private insurers and to the policyholders of high risk home.

- The Netherlands

In 1998, the Dutch government has accepted a new law, which provides the government the possibility to grant compensation to citizens in case of national disasters. The ex-post-disaster and ad-hoc reimbursement is organized in the "Wet Tegemoetkoming Schade bij rampen" (WTS, Calamities Compensation Act, CCA). This is not a fund, it is a "State reimbursement" that provides compensation in case of major disasters (defined in the Article 1, Security Regional Act[6]), like floods and earthquakes (considering these disasters as uninsurable risks). The WTS is only dedicated to dike protected areas and not accessible for insured people. This compensation is unlocked only after a decision of the Ministry of Home Affairs by Royal Decree

[6] Law Security Regions, http://www.wetten.overheid.nl/BWBR0027466/2017-06-10

on whether the disaster qualifies for this compensation (Law to compensate damage in case of disasters[7]). Storm damages are excluded from the WTS. The maximum State aid that can be provided through the WTS is €450,000,000 per year. The State compensates the losses through the WTS which is funded by general tax money (it is not a specific tax because it is not a fund). However, the current Dutch risk management is characterized by a high degree of uncertainty, as victims cannot rely on well-defined criteria to assess damages and the amount of compensation.

To date, it is possible for homeowners, tenants and businesses to be flood-insured on a voluntary basis by private insurers under "Neerlandse[8]" (underwriters of the Lloyds and reinsured by the private market). Premiums are risk-based according to the dike-ring area. Policy holders are eligible for a discount of 5% in return for taking (four) protective measures[9] (Surminski *et al.,* 2015 p. 18). Storm-risk insurance is an optional coverage, an extension of the property policy (fire, thefts etc.). As mentioned above, if Dutch citizens are insured by private companies, the WTS compensation is not accessible. Thus, in case of a disaster, the private insurance sector offers security of compensation; the WTS does not (uncertainties to know if the damage will be recognized as "disaster" and on the amount of compensation provided by the State).

Mandatory insurance schemes

In France and in Spain the Cat Nat coverage is mandatory for everyone who has a damage insurance. But the damage insurance is not mandatory. Thus, in the overseas territories, only a part of the population has Cat Nat coverage. In Spain, when you get a loan to buy a house, the bank forces you to pay for a house insurance. In Romania, NatCat coverage is mandatory for everyone otherwise, it is punishable from 100 to 500 lei (€20 - €100).

- France

In France there are two types of natural hazards:

- Covered by classical insurance products: windstorms, hail, snow
- Covered by the Cat Nat scheme: floods, droughts, storm surge, earthquakes, cyclonic winds etc.

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[7] Law to compensate damage in case of disasters, http:// www.wetten.overheid.nl/BWBR0009637/2016-01-01

[8] Neerlandse, http://www.neerlandse.nl

[9] The four protective measures are: 1/installing electrical equipment above the ground flood level; 2/installing the central heating installation above the ground floor level; 3/having flood shields available; 4/having a water resistant flood on the ground floor level (tiles);

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 (Law of the 13th July 1982) "Cat Nat", the "CatNat" compensation is unlocked (deductibles are fixed by the law). The "Cat Nat" insurance premium is based a ratio of 12% based on the damage insurance premium.

The Cat Nat coverage is mandatory for all the damage insurance contract (motor, non-motor) but the damage insurance is not mandatory. In the France Metropolitan, nearly 100% of the population has a Cat Nat coverage. In the overseas territories, the diffusion rate is significantly lower (~50%).

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 compensate/indemnify the insured after three months following the date of remittance of the claims adjusters' assessment. 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 has a large diffusion rate in France, everyone is covered in case of disaster, with an exception for the overseas territories.

The insurance companies can choose to be reinsured by CCR (French public reinsurer proposing State Guarantee and unlimited coverage) or by the private market. Some insurance companies also make the choice to have no reinsurance for Cat Nat losses.

- Spain

If a natural hazard strikes, and this hazard is recognised as an "extraordinary hazard" - according to the list fixed by the Consorcio de Compensacion de Seguros (CCS) - 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 hazard", 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).

- Romania

In case of earthquake, flood and landslide events, compensations are done through the PAID scheme and based on the Type A (insured sum of €20.000) or Type B houses (insured sum of €10.000). Within the PAID, 1,678,816 policies are issued which represent 18.8% coverage

ratio[10]. 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.

4.3.2 Catastrophe bonds market, financial instrument dedicated to disaster assistance and reconstruction

Cat bonds have been developed after hurricane Andrew in 1992 to finance natural hazard damages. So-called "cat bonds" are financial instruments dedicated to covering against more extreme events and are issued by insurers, reinsurers and bankers (i.e. European Bank for Reconstruction and Development). They are linked to Insurance-linked securities (ILS), which are financial instruments sold to investors whose value is affected by an insured loss event. Catbonds increased insurance capacity, notably for developing countries which have limited penetration rate of market-based insurance, by funding reconstruction, emergency relief, disaster preparedness and insurance protection. From an investor point of view, catbonds are a way to portfolio diversification. Cat bonds are dedicated especially for four basic trigger types (Edesess, 2014):

- Indemnity trigger (covers actual excess claims aid).
- Industry loss trigger (coverage based on whole industry losses in the extreme event).
- Parametric trigger (coverage based on exceedance of specified natural parameters).
- Modelled trigger (coverage based on claims estimated by a computer model).

They are particularly relevant for transferring risk in developing countries, the international community plays the role of reinsurer of last resort (McSharry, 2014). This market is very attractive because of its long-term investment features. Cat bonds are very useful for disaster risk reduction because, *"cat bonds buyers have an incentive to reduce risk in order to reduce the price paid for the bonds"* (Colgan *et al*., 2017 p. 18).

How does the cat bond issuance work? In case of disaster or not:

- In case of no disaster occur during the years defined in the contract: investors who have purchased bond are reimburse of the initial bet plus advantageous rates.
- If a disaster strikes during the years defined in the contract: investors who have issued bonds "really lost" their money, the society who have issued the bond can keep the

[10] Romanian DEMO, data end of October 2017.

investors' moneys to repair damages. It is a real advantage because the society already has all the money needed (it is not a loan).

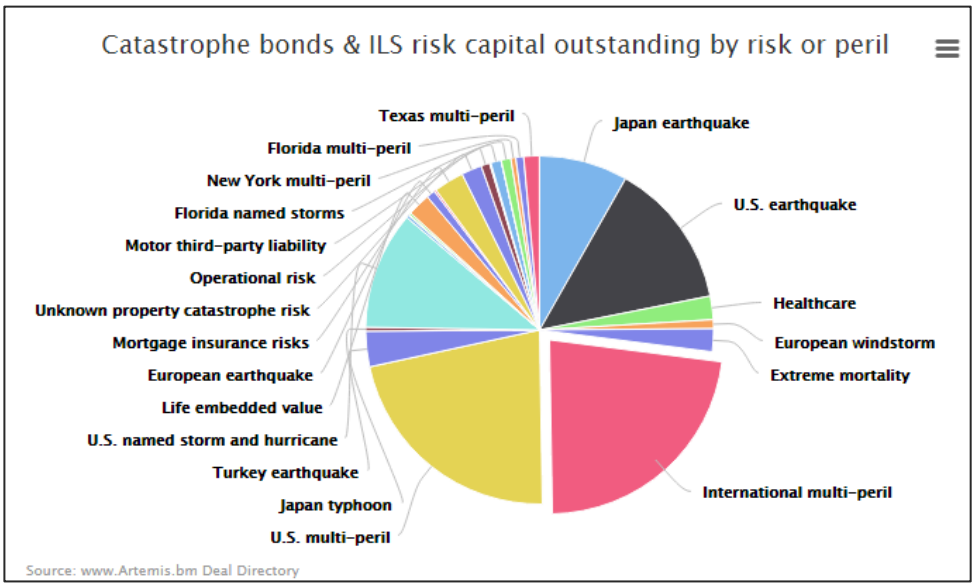

Figure 4. Catbonds are designed to specific risks, it is a limit of this market? www.arthemis.com

To this date (19/06/2017), 2017 Cat Bond issuance are at $8.71bn[11]. Cat bonds seem less used than green or climate bonds, certainly because of a market limited by its features, it is written only for specific events in specific locations (Porrini and Schwarze, 2011) – as demonstrated the figure 4.

4.4 Climate finance instruments

Climate finance is finance for activities targeted at adapting to climate change and reducing the rate of climate change (i.e., climate mitigation) through the reduction or sequestration of greenhouse gas emissions, including support for policy, technology development, capacity building, technology transfer and financing.

Instruments and channels: Many types of financing and policy measures for encouraging Climate Adaptation, including: a) direct public finance, b) co-finance of public and private finance, c) risk mitigation by the public for private investment, and d) incentives to low carbon

[11] www.arthemis.com, this website references all Cat bond issued.

investment including emission trading, tax incentives, removal of negative incentives (subsidies) and regulation for in-efficient investment.

The various types of climate finance identified that are applicable to the EU region are listed and described below.

4.4.1 Emission Trading System

The EU emissions trading system (EU ETS) is a market instrument used by the EU to reduce greenhouse gas emissions and achieve its climate targets in a cost-effective manner. It sets a cap on emissions for a range of large point sources, including power plants and industrial installations, as well as flights within the borders of the EU.

Trading in emission allowances ('emissions trading') refers to trade in emissions capacity, the right to emit certain volumes of greenhouse gases. Because these allowances are both bought and sold, greenhouse gas emissions are allocated a price (DEA, 2018).

Member states each receive a specific share of the total allowances, which can be auctioned if not needed by a member state. From 2013 to 2015, Member States auctioned almost 2 billion allowances amounting to EUR 11.7 billion in revenues.

Member States agreed that at least half of these revenues should be used for climate action inside or outside the EU. Member States mainly financed domestic actions in the field of cross-cutting activities (39% of the revenues going to domestic action), renewable energies (32%) and energy efficiency (18%). This could provide potential for funding NBS since adaptation actions can also be included in cross-cutting activities (Maximiser, 2016).

Potential: perhaps there are NBS that capture a lot of CO2, which would generate revenues by being able to sell more emission credits. Such a 'cap and trade' system can be applied to other types of emissions that are polluting the environment, reducing NBS capacity (e.g. eutrophication).

4.4.2 Resilience bonds

Resilience bonds could offer dual insurance and resilience benefits for disaster-risk prone cities. Firstly, a resilience bond could provide financial protection via catastrophe insurance for a city or public utility. In addition, as cities or utilities invest in protective infrastructure, like seawalls or flood barriers, they could capture the insurance savings or reduction in costs from one year to the next for projects that reduce economic losses from disasters during the term of such bond. An analogy is a life insurance policy offering rebates for actions that lessen health risks, such as quitting smoking or exercising regularly (Swiss re, 2018). Financiers receive a return on the capital they provide to resilience bond issuers.

4.4.3 Clean Development Mechanism

The CDM allows greenhouse gas emission–reduction projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one ton of CO2. These CERs can be traded and sold and used by industrialized countries to a meet a part of their emission reduction targets under the Kyoto Protocol.

The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction limitation targets (UNFCC, 2018). The estimated value of clean energy projects financed through the CDM between 2002 and 2008 is 95 billion $ (Maxwell, 2010). The potential for financing NBS seems limited since the CDM focuses primarily on projects that result in CO2 reductions, although some forms of NBS can achieve mitigation benefits, such as so-called blue carbon, which is the use of aquatic and marine ecosystems to capture and/or sequester carbon. While organizations such as the Ramsar Convention, Conservation International, and IUCN have worked to developed guidelines (Herr *et al*., 2011) for implementing blue carbon, these efforts remain quite preliminary. In the future, water-related NBS may be an important mechanism under the CDM for climate mitigation.

Limitation: in developing countries.

4.4.4 REDD+

Reducing emissions from deforestation and forest degradation (REDD+) is a mechanism developed by Parties to the United Nations Framework Convention on Climate Change (UNREDD, 2018). It creates a financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. Developing countries would receive results-based payments for results-based actions. REDD+ goes beyond simply deforestation and forest degradation and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (UNREDD, 2018).

The total contributions of donors to the REDD+ fund is currently over 290 million US$ (UNDP, 2018a) The potential to finance NBS seems apparent in those NBS that relate to (conserving) forest cover, since REDD+ can finance sustainable forest management, However, eligibility of REDD+ funds is limited to developing countries. Moreover, the REDD+ system has not worked economically and is heavily subsidized by the donor community; as a valuation system and as a financial system for ecosystems, REDD+ has not proven to be effective or sustainable (Phelps

et al., 2011) without considerable aid. In addition, climate adaptation and water and disaster management are not well addressed within the REDD+ framework.

Limitation: EU countries not eligible to REDD funds for NBS.

4.5 Conservation finance

Conservation finance is based on generating funds, or managing these funds for natural resource conservation (water, land, etc.) (Clark, 2007), or as Huwyler *et al*. (2014) state these are "mechanisms for investing in an ecosystem, directly or through intermediaries, that aim to conserve the values of the ecosystem for the long-term.

The money raised can come from a range of sources (private, public, non-governmental, philanthropic or even citizens e.g. through crowdsourcing). For example, according to Huwyler *et al*. (2014) private investors like pension funds, philanthropists, institutional investors and retail investors could potentially provide up to $300 billion per year for ecosystem conservation. In 2014 it was estimated that the flows were around $54 billion from private funds, showing the potential for growth.

In addition, the funding can come in different types like grants, loans, tax incentives, or the creation of markets like, as we will describe below, water funds or habitat banking. In terms of range of projects these vary in scale from national schemes, like e.g. the Costa Rica PSA, to regional or even local.

This section will focus on two types of conservation finance: payments for ecosystem services/watershed services and water funds, and habitat/mitigation banking. Each one will be defined and then analysed in terms of how these work, how these are funded and how these are financed.

4.5.1 Payments for Ecosystem

Ecosystem services are grouped into four main categories: 1. Provisioning services (the products obtained from ecosystems such as food and fresh water); 2. Regulating services (the benefits obtained from the regulation of ecosystem processes such as air quality and pollination); 3. Cultural services (the non-material benefits that people obtain such as spiritual enrichment, recreation and aesthetic experiences) that directly affect people; and 4. The supporting services needed to maintain the other services (such as photosynthesis and nutrient recycling). The provision of such services might require communities living in the proximity of the ecosystem to undertake or not to undertake certain activities. To complete these tasks in the absence of regulatory provision, the communities need a financial incentive. A Payment for Ecosystem Services (PES) mechanism governs these payments. In other words PES involves a series of payments to land or other natural resource owners in return for a

guaranteed flow of ecosystem services or certain actions likely to enhance their provision over-and-above what would otherwise be provided in the absence of payment (UNDP, 2018b). PES systems are a relatively new concept, dating back only to the early 1990s (Salzman *et al.*, 2018). Given the amount of academic attention to PES, relatively few PES systems have actually been formally implemented (Salzman *et al.*, 2018). With reference to water, TNC (The Nature Conservancy) has developed large-scale applications of so-called "water funds" in recent years, which are a freshwater-centric approach to PES (Abell *et al.*, 2017). Disaster issues are usually not a prominent feature of water-related PES.

Payment for Ecosystem Services (PES) according to the UNDP (2018c) is a financing mechanism that can support the conservation and expansion of ecosystems. These market transactions occur because a beneficiary or user of an ecosystem service pays directly or indirectly to the provider of that service. The idea is that whoever preserves or maintains an ecosystem service is paid for doing so (Grima *et al.*, 2016). The exchange therefore is for payments in return for a guaranteed flow of ecosystem services or certain actions likely to enhance their provision over-and-above what would otherwise be provided in the absence of payment (i.e. these payments are both conditional on performance and additional to normal activities). PES formalizes transactions (up to the creation of a market), between economic actors that preserve and enhance ecosystem services and economic actors that benefit from the same.

PES can be labelled according to their geographical scale (local, regional and global), the structure of the compensation (direct and indirect / public and private), for the type of ecosystem (forests, wetlands, etc.) protected, or the types of ecosystem services the payment is provided for.

4.5.2 Water funds

A water fund is a specific type of payment for ecosystem services, in this case for water-related services such as sediment transport, fisheries, or water treatment or delivery. It is a PES scheme targeting the delivery of hydrological services, where each scheme is contextually defined with its own finance schemes, payment rules, stakeholders, type of activities implemented and legal and institutional arrangements. The focus is however on water since these are funds designed to protect and preserve water for all users in a catchment. A clearly defined source water area—the land where rain and snow fall that is used by those living in the source area and downstream in larger communities (Goldmann-Benner *et al.*, 2012).

In terms of how PES and water funds work, in all these cases the key is to identify the stakeholders and who benefits, and thus who will pay. There are however a number of choices, and different examples in PES and Water funds, from private to NGOS, where a hydroelectric company paid an NGO to maintain the upstream catchment in good condition in

Costa Rica "La Esperanza case" to private to private where for example Nestle company paid farmers to farm in a particular way to protect the water source of its natural spring water. What is important is to differentiate when the payments are direct (like in the case of Nestle) or when these payments are indirect, like when these are paid through e.g. general taxes, like to an extent the intermediation of the public authority in Costa Rica's Payment for Environmental Services Programme (PSA). Similarly, Mexico implements "water reserves" at a basin scale throughout the country through national subsidies that represent a PES approach to environmental flows (Salinas-Rodríguez *et al*., 2018). TNC has implemented water funds in a wide variety of countries globally (Abell *et al*., 2017). In general, climate change and DRR considerations are almost completely absent from PES systems generally and water funds in particular; PES systems work best with assumptions of climate stationarity.

The best-known type of water funds are based on downstream water users such as cities, utilities, and industries pay into a fund, which then pays upstream landowners to use their land in a more eco-friendly way. The money flows for the ecosystems services of maintaining a clean, reliable supply of water throughout the year, as well as protecting ecosystems around the watershed and securing alternative livelihoods for upstream residents.

It is important to stress, although this will not be analysed here that there are different ways of paying (in terms of monitoring but also when payments are triggered e.g. automatically, etc.). Thus, in terms of when to pay and verification, there are several choices. For example:

- Outputs or results-based payment - monitoring and verification (e.g. changes in quality of water or reduced risk of flooding).
- Disburse payments based on the modification of a certain practice.
- Activities that can be directly monitored and linked to a specific action of an individual and therefore trigger a payment.

In terms of who pays, in the case of Payment for ecosystem services (and water funds as a type of PES), there are a range of alternatives like funding coming from the general budget, seed funds, project funding or user pays models.

In the case of general budget, a PES -like taxation can exist with special-purpose taxes and fees targeting the tourism, water, electricity, transport and extractives sectors (i.e. the implied beneficiaries). According to UNDP (2018c) for example, Costa Rica financed its programme

with the resources generated from gasoline taxes. Meanwhile in the case of Vietnam prices are regulated for "hydropower generators (20 VND/KWH), clean water suppliers (20 VND/m3), tourist service providers (1-2 per cent of revenues) with more than US$150 million (2016) in the total value of contracts[12].

There are at least three ways to pay for water funds[13]:

- In the case of seed funds like the FONAG in Ecuador, the aim is to create an endowment to ensure the long-term viability of the fund. Here the defining characteristic is a trust fund financial model that is governed independently to ensure long- term benefits (some for up to 80 years). These water funds are more than a financial model: they are an institutional, financial and biophysical mechanism that link water services users to providers through payments. Water funds share the following criteria: (1) multiple water service users or user groups, (2) payments that support implementation of watershed best-management practices and conservation, and (3) a board of directors with stakeholder representation that decides how to spend the revenue.

- In the case of specific project funding, the funding is arranged to address one or more issues in the watershed.

- In the case of sustained finance, money comes from monthly payments via water tariffs paid by users (business and community) to pay for specific ecosystem goods and services via the projects and compensation.

These investments come from different organizations or individuals in the catchment or even beyond the catchment like government level, investors, etc.

4.5.3 Environmental and social impact bonds

At their core, these instruments allow private investors to fund a certain social and/or environmental intervention and earn a return based on its success. The major innovation, in addition to filling a funding gap for budget-constrained government entities, is that these financings shift the social spending paradigm, allowing governments to pay for results instead of services. This ultimately shifts the risk of a successful intervention from tax payers to private

[12]https://www.undp.org/content/sdfinance/en/home/solutions/payments-for-ecosystem-services.html
[13] https://www.coca-colacompany.com/stories/water-funds-effective-solution-global-water-challenges

investors, who are compensated for this risk. However, these bonds, while operating over fixed periods of time, do not offer fixed rates of return; the returns depend on whether intended outcomes are reached. The first Social Impact Bond was launched by Social Finance UK in September 2010 to fund a prisoner-rehabilitation program (CFN, 2016).

Environmental impact bonds have been explored much less frequently but may become more important in the future.

An environmental impact bond was employed in Washington DC, the DC Water Environmental Impact Bond, which is a tax-exempt bond issuance where a portion of the payment to investors is dependent on the outcomes of the intervention. DC Water will be installing and testing green infrastructure designed to reduce stormwater runoff into DC's sewer system. The idea is that the acres of new green space will absorb stormwater, which will reduce the flow of stormwater into the existing sewer system. Reducing stormwater flow into DC sewers is impactful because when the system receives too much stormwater and overflows, a combination of the stormwater and sewage bypasses treatment plants and goes straight into the Potomac and other waterways, causing major water quality and environmental issues for local residents (CASE, 2017).

4.5.4 Habitat banking

Habitat banking is widely used in regulatory frameworks and functions as a system of credits and debits devised to ensure that ecological loss, especially to wetlands and streams resulting from various development works, is compensated for by the preservation and restoration of wetlands, natural habitats, streams, etc. in other areas so that there is no net loss to the environment. To mitigate means to reduce the severity of something, in this case, the damage caused to the environment (Investopedia, 2018e).

Habitat banking is also known as mitigation banking, where mitigation does not refer to climate mitigation (e.g., the reduction or sequestration of greenhouse gases) but the reduction or transfer of damages or risks, especially in an ecological sense.

Habitat banking can be used to develop natural areas, which can take the form of NBS. However, it will occur at the expense of nature loss elsewhere in the region. Furthermore, there will be no freedom in designing an NBS according to the infrastructural needs that are apparent, since this instrument is used to compensate for the same type of nature that was lost elsewhere. Nonetheless, the type of nature compensated could fit in a larger scheme of NBS or complement NBS.

A habitat banking scheme is also a market where however the focus is on biodiversity. Here credits from actions that benefit biodiversity and can be counted as outcomes can be

purchased to offset the debit from environmental damage. Credits can be produced in advance of, and without ex-ante links to, the debits they compensate for, and stored over time (UNDP, 2018a).

4.6 Green and Climate Bond financing

Bonds are loans that are offered to the public for investment rather than through loans issued by commercial banks, though sometimes banks are involved in managing some of the transaction processes associated with a bond issuance. Bonds have been a critical mechanism for funding infrastructure investments for well over a century, particularly for large or riskier investments that might not appeal or that might overextend commercial banks. The global bonds market is about 2 trillion USD, while the green bonds market in 2018 should reach about 200 billion USD.

Green bonds were created as an investment category in 2007 by the European Investment Bank (EIB) and adopted shortly after by the World Bank. Although generally grouped together under the term green bonds, the green and climate bonds markets have subtle differences though they have essentially blended together over time. Here, they will be treated together. Intended to highlight investments that had an environmental benefit (including greenhouse gas reductions, offsets, or sequestration), green bonds are not otherwise different than other bonds. The green or climate component serves as a label for investors, assuming that some authority such as the EIB had verified the soundness of the investment and the environmental claims. Climate bonds more specifically refer to climate-related benefits.

The green bonds market remained dominated by issuances arranged by development banks, often for public sector projects, for some years, and loans amounted to only a few billion USD annually. As an investment category, green bonds remained a niche market, with limited impact until about 2013, when issuances tripled to around $10 billion, after commercial finance and corporate institutions began promoting the market. These trends continued and expanded to $86.1 billion in 2016 and surpassed $100 billion in 2017. Projections suggest total issuance will pass $200 billion in 2018 or 2019.

While the market pool has grown rapidly, some investors have expressed concern that the credibility of these new bonds as environmental investments may be questionable with the new categories of issues. How green are green bonds, and could the exposure of ineffective investments cause a collapse or systemic risk within the market category?

The need for open and independent standards was identified recently by a number of non-governmental organizations (NGOs) working with sustainability issues in the finance and investor communities. Water was shown to be a gap area, since freshwater resources are often relatively hidden to investors, who may not readily see water embedded within energy,

agriculture, and urban projects − much less how the water within one project may affect other issues and systems within the same basin.

In mid-2014, a consortium of NGOs − Ceres, Climate Bonds Initiative, World Resources Institute, CDP (formerly the Carbon Disclosure Project), the Stockholm International Water Institute (SIWI), and the Alliance for Global Water Adaptation (AGWA) − coordinated the development of criteria to score the quality of water-related investments for their relevance to climate mitigation and climate adaptation. Together, they organized a series of technical and industry working groups, which defined scoring criteria for issuers and verifiers to provide investor confidence in climate bonds.

These criteria effectively score the climate resilience and climate adaptive potential of these bonds in addition to their environmental impact. These issues remain well understood by engineers, scientists, and resource managers. But the level of even basic awareness among investor and finance groups is far more limited. Phase 1 of the work targeted traditional “grey” water infrastructure investments, with the exclusion of hydropower, and was launched in October 2016. More broadly, the risk of greenwashing for nature-based solutions − investments in green and hybrid infrastructure − are very high. No science-based standard for such investments exists, much less the ability to certify that the ecosystems involved will themselves endure and be resilient to climate impacts.

Recognizing this gap, the Rockefeller Foundation provided support in 2016 to develop phase 2 criteria to evaluate and qualify nature-based solutions (NBS) for water investments. NBS investments depend explicitly on the use of ecosystems to provide grey infrastructure-like services, such as through so-called natural or green and hybrid infrastructure. Such services could include storm-water and flood protection through riparian ecosystems, water treatment in wetlands, and water storage in aquifers. These additional criteria were launched in May 2018. Together, both phases evaluate the climate mitigation impact, and the ability of the investment to contribute to climate change adaptation.

In May 2016, the San Francisco Public Utilities Commission (SFPUC) in California, United States, issued the world’s first certified green bond for water, for $240 million. A second bond for $259 million was issued by the SFPUC in December 2016, while a third for roughly $450 million is in process for 2018. All of these bonds are certified under the Climate Bonds Standard, an investor screening tool that specifies the criteria that must be met for bonds to be labelled “green” or earmarked for funding water-related low-carbon initiatives.

In July 2017, the City of Cape Town issued South Africa’s first certified green bond for 1 billion South African rand. In September 2017, the China Development Bank (CDB), a state-owned policy bank, announced that it will issue green bonds for 5 billion yuan to raise funds for water

resource protection along the Yangtze River Economic Belt, the *China Daily* newspaper reported.

The successful issuance and sale of these and other bonds against the Standard represents a vivid shift in investor awareness. To date, more than $1 billion have been issued against the grey criteria − a number that is expected to be rapidly achieved with the integrated nature-based solutions criteria as well.

In a European context, the EC has adopted the so-called Green Bonds Principles developed and promoted by the Climate Bonds Initiative for all green bond issuances in the EU. These principles describe the need to demonstrate use of proceeds and transparency in financing in order to promote credibility with investors and in the larger green bonds market. The EC has also expressed the desire to adopt the sectorial guidelines developed under the aegis of the climate Bonds Initiative, which means that the Water Infrastructure Criteria should become widely used and implemented in the EU. Other regions are following suit - China, for instance, is following the same pathway.

5. ANALYSIS OF GAPS AND EMERGENT TRENDS IN FINANCING AND FUNDING NBS FOR CCA (CC ADAPTATION) AND DRR

The most important gap to solve is the need to develop new business models for NBS for DRR and Climate Adaptation. There is a lack of business models and ways to structure these projects that allows that the many ecosystem services they provide and all the economic benefits they generate (due to the different DRR and other functions they generate) could be internalized in the project and captured as money flows that allow for the repayment of different financing options such as bonds of different types.

Another gap identified is capturing and demonstrating public value of NBS, so that insurance companies and investors are in a better situation to finance them.

6. CONCLUSIONS AND NEXT STEPS FROM THE ANALYSIS OF FUNDING AND FINANCE MECHANISMS

The implementation of NBS projects for increasing resilience against water related natural hazards need to define clearly the necessity of funding (who and how ultimately will pay for the investments made) and financing (the up-front resources needed to be paid over time by the funding). Financing can make use of a variety of instruments such as grants, direct subsidies, tax incentives, loans (such as bonds), and others. Funding and financing mechanisms can be both public and private, with blended finance being a common option.

Some mechanisms as with low, medium or high potential to finance climate adaptation through NBS have been identified.

As low potential mechanisms we have detected:

- Crowdfunding: its major potential can be the same of microcredit (see below): relevant for financing small-scale NBS, e.g. on household level. Nevertheless, several limitations apply: loan size, maturity and risk aversion, risks for the crowd-lenders, the lack of guarantee about the quality of the investment or the ecosystem value.
- Clean Development Mechanism: high potential in developing countries, but not in Europe.
- REDD+: EU countries not eligible to REDD funds for NBS.

As medium potential mechanisms we have detected:

- Emission trading system: NBS that capture a lot of CO_2 could generate revenues by being able to sell more emission credits.
- Microcredits: could be particularly relevant for financing small-scale NBS, e.g. on household level.
- Habitat banking can be a useful mechanism to fund NBS projects to increase resilience against natural hazards, although they have limited flexibility in NBS design.

As high potential mechanisms we have detected:

- Different public mechanisms: they can be separated as public support mechanisms and public financing mechanisms.
    - Public support mechanisms: feed-in tariffs, tax credit programs, renewable energy quotas, standards, repealing support for "brown" sectors, grants, subsidies, project aggregation.
    - Public financing mechanisms: project lending, debt funds, bonds, concessional/flexible loan terms, direct capital investment, loan guarantees, insurance foreign exchange/liquidity facilities.
- Concerning public mechanisms, particularly potential in the European Union needs to be paid to the European Structural and Investment Funds (ESIF) (European Regional Development Fund (ERDF), Cohesion Fund (CF) and European Social Fund (ESF)), the European Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF). Of particular interest is European Commission commitment to mobilise EUR 500 bn in additional investments through the European Fund for Strategic Investments (EFSI) by 2020, targeted to several strategic sectors which include water, other infrastructure, agriculture, and the promotion of future-oriented initiatives, such as the circular economy and specifically climate mitigation and adaptation.
- PPPs and blended finance have a high potential of investment for projects providing public and private benefits, which is a typical characteristic of NBS projects, although business models need still to be defined and legally implementable.
- Payments for Ecosystem/Watershed Services and Water Funds are an existing business model that fit particularly well with NBS for DRR. The number of examples is growing worldwide, with water funds being a particular example that can be applied for NBS in DRR. In some cases, the particular social structure can determine the success of the instrument, and some legal or regulatory changes may be needed.
- Environmental and social impact, as well as green and climate bonds are particularly designed to finance, between other options NBS in DRR. There are

as well existing working examples. They have a special potential to finance large scale projects or initiatives, usually developed by public institutions.

- CatBonds have special interest to implement NBS after a natural hazard has occurred, as preparation for future events. It can serve as well as incentive to the bond borrower to implement DRR measures, and therefore using NBS for it.

- Resilience bonds: it has high potential, but still legal and regulatory changes are needed at an EU and/or national scale. They capture insurance value of ES by offering expected reduction in insurance claims. The size is too large for most common individual NBS projects.

Next steps will consist in identifying which of the described funds and financing mechanisms are present on each of the 8 countries where our Demo's are located. We will as well design new business models or define which existing ones have a higher potential to capture the positive externalities of the climate adaptation and NBS projects, and in some cases, to convert them in to revenue streams for investors. Business models embrace both institutional/organizational and financial matters and may use a combination of funding (revenue generating activities) and financing mechanisms. We will develop this task looking at the existing related business models in the world, as well as using participatory techniques in the nine NAIAD demos.

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