NATURE-BASED SOLUTIONS IN THE CENTER OF CLIMATE ADAPTATION

INFO CARD n° 01

Authors: Georges Farina [1], Guillermo Garcia Alvarez [1], Ariane Kaploun [2], Rhea Kochar[2], Helena Määttä [3], Kati Berninger [3]

(1) Institute for Environmental Studies (IVM) - Vrije Universiteit Amsterdam
(2) AXA Climate
(3) Tyrsky Consulting

What are Nature-Based Solutions (NBS)?

Nature-based solutions (NBS) is an umbrella term for all ecosystem-based approaches designed to tackle societal challenges (Cohen-Shacham et al., 2016). The term NBS defines all actions that aim at conserving, restoring, rehabilitating, or creating ecosystems, in order to harness Ecosystem Services. Their main characteristic is their multifunctionality: they can address risks (such as flood risks, or heat island effects), while also providing multiple co-benefits. NBS are a diverse type of solutions that can address multiple types of risks and societal challenges. They can also span many spatial scales. Concretely, they can be the restoration and conservation of large ecosystems at the regional level, such as rivers, wetlands, coastal ecosystems, or mangroves. They can also be the smaller scale urban infrastructures such as water retention ponds and green areas, implemented in streets, public spaces, as well as private areas. Here we focus on the use of NBS in climate adaptation.
NBS interventions address various risks simultaneously, hence the same types of NBS may be used to tackle different challenges, generating many co-benefits unlike conventional grey infrastructures where one solution is tailored for a single problem. Comparative studies have indicated that NBS are often more cost-effective solutions than conventional grey infrastructures (Kabisch et al., 2017).

01. Flood Risk Mitigation

Several NBS can be used to mitigate the impact of floods. Coastal and pluvial flooding are expected to increase in frequency and intensity in the following decades (IPCC, 2021), and NBS have emerged as a viable solution that can also provide several co-benefits. Common types of NBS for flood mitigation are: floodplain development, restoration of wetlands and mangroves, re-meandering (or widening) of rivers, water-storage ponds, etc. Floodplains' increased infiltration, compared to agricultural land, enhance the natural absorption of rainwater, thereby reducing the impact of floods.

However, NBS for flood-risk mitigation have several challenges that have limited their applicability so far.
First, large portions of land are usually needed to implement them, which can lead to political or landowners resistance. NBS can also take some time until they can provide the optimal level of risk-reduction, which often leads to governments relying on traditional gray solutions (i.e. dikes) that can be effective since their implementation. For this reason, hybrid solutions (combination of traditional solutions and NBS) are becoming increasingly popular in recent years.

NBS's risk reduction potential can, for instance, be relevant for insurance companies. If NBS lowers flood risk then this may trigger lower insurance claims and limit premiums in countries where flood risks are covered by insurance (EIOPA, 2023). Alternatively, in countries without flood insurance coverage, NBS creation that limits flood risk may foster the insurability of the risk and enable the introduction of new flood insurance products.

Moreover, NBS for flood protection offer a wide range of co-benefits, such as recreational spaces, promote educational and physical activities, benefiting human health and wellbeing. For example, wetlands and floodplains can act as NBS in buffering against floods but also provide sites for recreation, biodiversity enhancement and local climate regulation. Assessing the value of co-benefits and their distribution among various parties is challenging. It often limits their inclusion in investment decisions for flood protection and, as a result, undermines the case of NBS against traditional solutions (Jones and Doberstein, 2022).

For example, the Po Valley of Panaro River in Italy, is a good example of NBS for coastal flood risk management. A combination of NBS have been implemented, for example the construction of an artificial dune to act as a natural barrier and restoration of marine seagrass. To avoid salt intrusion that reaches far upstream and damages fragile ecosystems, halophytes have been planted which have the ability to absorb salts. (OPERANDUM, 2020). These NBS address multiple hazards, from floods and droughts to coastal erosion and storm surges. It also provides co-benefits for the local community such as biodiversity enhancement by providing a habitat for species.


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02. Urban Climate Risk Adaptation

Cities are facing multiple risks with climate change and anthropic pollution: urban heat, air pollution, flood risks. 1.2 billion people are exposed to flood risks across the world, and are in majority urban citizens, and this figure is expected to rise to 1.6 billion by 2050. As such, most cities around the world are exposed to water-related risks such as pluvial floods. (WWAP & UN-Water, 2018).

In addition, other urban risks directly affect citizens, such as the urban heat island effect. This phenomenon directly affects human health: it increases the risks of cardiovascular and mental pathologies. It also has negative impacts on well-being, livability, and productivity in cities (Heaviside et al., 2017).

Nature-based solutions help to combat these effects by mitigating climate risks through the production of Ecosystem Services. In urban areas, NBS are many different actions and infrastructures dedicated to protecting or introducing nature for example the conservation or creation of green areas, such as urban forests and parks, and of urban "blue" areas like rivers, lakes, wetlands, and ponds (Axelsson et al., 2021; WWAP & UN-Water, 2018). Urban NBS are also small scale vegetated infrastructures that can be implemented within streets and public spaces, including green areas, small urban parks, urban microforests, bioswales, bioretention basins, and ponds.

In France, Paris Oasis Schoolyards programme was aimed to transform schoolyards into green oases accessible to school pupils and local communities in order to address urban heat island effect. The NBS solutions used included increasing the vegetated areas in the schoolyards through the planting of trees, lawns, orchards and vegetable gardens as well as by using rainwater to wet the ground, which enhanced the ground's cooling effect via evapotranspiration and could also be used for water games and school gardening. In the pilot phase, there were 10 schoolyards transformed successfully. The programme has since developed further resulting in 75 transformed schoolyards in Paris by 2022.
(Climate-ADAPT, 2022)

One example of NBS that offer multiple co-benefits in dense urban areas, where available space is scarce, are **green roofs**. Green roofs are roofs that are partially or completely covered by vegetation, ranging from small layers of moss to entire gardens. They are structural improvements to buildings that provide various benefits to homeowners, mainly by 1) improving building thermal insulation, leading to associated energy savings, and by 2) increasing the roof structure protection against weather elements (rain, UV) – and thus its overall lifespan. Green roofs can also provide benefits to society in general, by storing rainwater, in order to mitigate flood risks - and are thus often labeled "Blue-Green Roofs". Green roofs also provide aesthetic amenities, as well as their recreational amenities, when they are accessible by residents. When implemented alongside ecological corridors and in connection to each other, they can provide increased habitat and support biodiversity.

PIISA aims especially at evaluating the capacity of green roofs to mitigate urban risks, in a case study in the Netherlands.

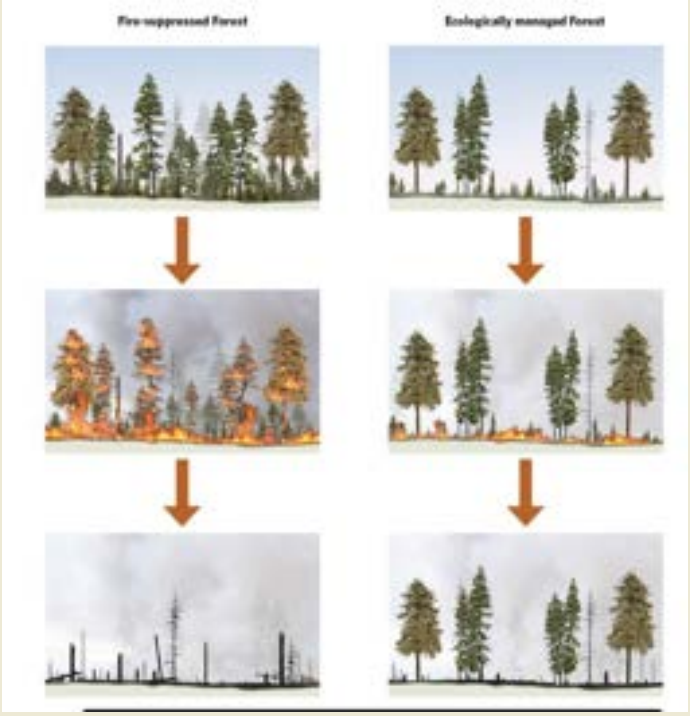
03. Forest as Nature-Based Solutions

Forests provide important ecosystem services, combating climate change by sequestering carbon dioxide, helping in water regulation, fostering biodiversity, mitigating flood risks, preventing erosion, and providing numerous other essential benefits. Forests can be managed or protected to serve as Nature-based solutions, for example in fire control.

In a context of increasing climate pressure, Forests are increasingly exposed to weather-related risks. The largest forest fire ever recorded in the EU occurred in northern Greece in the summer of 2023. Data sourced from the European Forest Fire Information Service (EFFIS) indicates that wildfires in Greece have led to an accumulated burned area of nearly 175,000 hectares since the beginning of the year. The combined carbon emissions from wildfires in July and August ranked as the third highest on record, trailing only behind the years 2007 and 2021. (EFFIS, 2024; ECMWF, 2024)

The weakening of trees' health following large-scale natural disasters provides an ideal breeding ground for diseases and invasive species such as bark beetles. Bark beetles contribute to tree mortality, particularly affecting trees that are already stressed or damaged. In 2020, in the Eastern region of France, an estimated 3.3 million cubic meters of degraded wood—significantly reducing its value due to insect infestation or other factors—were documented, including 1.8 million cubic meters of spruce. This species by itself constitutes approximately two-thirds of the volume extracted from decaying wood, according to the French Forestry Office ONF (2024). In the Jura region of France, the situation has been deteriorating since 2018, with further escalation observed in 2022 (largely attributable to heatwaves and drought) and 2023.

To promote the long-term resilience of European forests, forest owners, managers and investors must develop adaptation practices that will decrease the vulnerability of this natural asset to the changing climate and maintain all the associated ecosystem services. For instance, by precisely assessing current and future wildfire risks, we can better understand the characteristics of vegetation that contribute to wildfires. This detailed understanding makes it possible to select fire-resistant vegetation.



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A TNC study in Sierra Leone provided compelling evidence for the effectiveness of ecological forestry in addressing the challenges faced by forests. Measures to reduce fire risk include increasing tree diversity, implementing prescribed burns, and promoting grazing by herbivores. Replacing invasive tree species with native ones and maintaining native grasslands, including through herbivory such as sheep grazing, can enhance landscape diversity, reduce fuel continuity, and consequently mitigate the spread of wildfires. (Kelsey 2019)

In Ferraria de São João, a small rural village in central Portugal, a community-initiated forest management system called Village Protection Zone has been initiated after catastrophic forest fires in the area in 2017. Village Protection Zone is a 100-meters-wide strip around the village in which highly flammable trees (pine, eucalyptus) are uprooted and replaced with more fire resistant trees such as chestnuts and cork oaks. The aim is to protect the village from forest fires as well as restoration of the forestry area and landscape surrounding the village. The whole village community has been involved in the process which has enabled the reforestation efforts including the removal of 50 thousand high risk trees and planting about 500 more fire resistant trees. The solution also has other benefits such as improved socio-economic value of the area and landscapes which can improve the well-being of humans and, for example, attract more tourists and visitors to the village. (Smart Rural Villages, 2021)

In response to these challenges, forest insurance against climate threats becomes a valuable tool by enabling restoration and conservation efforts. This financial mechanism increases the long-term resilience of trees by securing cash flows that can complement or compensate for missing emergency fundings coming from national or local regulators. In addition, insurance products can encourage the deployment of adaptation measures by integrating the decreased level of risk due to new practices in their design.

By addressing these challenges, forest insurance plays a pivotal role in safeguarding natural ecosystems and bolstering their resilience against the impacts of climate change. This is the vision that PIISA is promoting and teams are deploying with two pilots in Germany and Portugal.

PIISA

Piloting Innovative Insurance Solutions for Adaptation

Piloting Innovative Insurance Solutions for Adaptation PIISA horizon project aims to develop and deploy a range of insurance innovations that incite households and firms to adapt proactively and sufficiently for their own sake and their neighborhood's sake. PIISA also incites public authorities to set up adaptation and create adaptation promoting conditions. PIISA co-develops climate resilient insurance portfolios and develops solutions for sharing losses and climate risk data. PIISA works with five pilots, and NBS are in the centre of the green roofs pilot and forestry pilots.

Read more about the project: https://piisa-project.eu/ and the pilots https://piisa-project.eu/pilots

NATURANCE

Nature for insurance, insurance for nature

NATURANCE aims to assess the technical and financial feasibility of Nature-based Solutions for climate risk reduction. NATURANCE partners include financial sector stakeholders from the insurance sector besides academia and research institutions. As part of NATURANCE, several workshops with financial sector and public sector stakeholders have taken place to understand the barriers and challenges in mainstreaming investment in NBS. Simultaneously, NATURANCE members also work on improving existence methods for assessing the benefits of NBS for climate risk.

Read more about the project: https://www.naturanceproject.eu

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