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Grey, green or hybrid? The value of nature-based solutions for DRR

This overview paper will address what are….

- Nature-based Solutions? How do they complement or substitute grey DRR-measures?
- Linkages between Nature-based Solutions and Sustainable Land Management?
- Challenges and opportunities for practical implementation of Nature-based Solutions for disaster risk reduction and adaptation, and why is valuation of ecosystems important?
- Ways forward? How to capture on synergies between these related communities of practice?

Background note

- **Introduction and rationale**

Ecosystem-based approaches to reduce disaster and climate risks have emerged over the past decade as an alternative to grey infrastructure, or engineered approaches, such as sea dykes and walls. Europe has been leading the way, following a number of large flooding events in the 1990s but in the U.S., the U.S. Army Corps of Engineers is also developing guidelines on ecological engineering for disaster risk reduction (DRR). Developing countries are taking heed, with cues coming from international agreements such as the Sendai Framework for Disaster Risk Reduction 2015-2030, the Convention on Biological Diversity, the Ramsar Declaration, and the Sustainable Development Goals. These frameworks have since 2014/2015 adopted various degrees of decisions on ecosystem-based approaches to reducing disaster and climate risks, or "Nature-based Solutions" (NbS) (Monty et al. 2017).

- **What are Nature-based Solutions (NbS)?**

IUCN defines Nature-based Solutions as "*actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits*" (Cohen-Shacham et al., 2016: p. 5).

The term is however subject to debate and multiple interpretations. The European Commission (EC) defines Nature-based Solutions in broader terms as: *"actions that aim to help societies address a variety of environmental, social and economic challenges in sustainable ways"* (EC, 2015, p.5). NbS have gained considerable importance within EU policies and research and have recently been adopted as the main thematic area of research related to disaster risk under the EC Horizon 2020 programme (EC, 2017). It is in particular focusing on 're-naturing' cities and engaging with the private sector.

NbS can be considered as an umbrella concept, with ecosystem-based disaster risk reduction (Eco-DRR) and ecosystem-based adaptation (EbA), as more focused sub-sets of NbS (see box 1).

Nature-based Solutions/IUCN umbrella approaches:

(i)Ecosystem restoration
(ii)Issue specific/ ecosystem-related (e.g. Eco-DRR, EbA)
(iii) infrastructure-related (e.g. natural & green infrastructure);
(iv) ecosystem-based management (e.g. integrated coastal zone management and integrated water resources management);
(v) ecosystem protection (e.g. area-based conservation including protected area management).

(Adapted from Cohen-Shacham, et al. 2016)

- **What are the linkages between Nature-based Solutions for disaster risk reduction and Sustainable Land Management?**

SLM can be defined as the use of land resources - including soil, water, vegetation and animals - to produce goods and provide services to meet human needs, while ensuring the long-term productive potential of these resources and sustaining their environmental functions (WOCAT, 2017). In this context, we can consider that many SLM practices contribute to the same goals as NbS, whether SLM Technologies (a physical practice that controls land degradation and/or enhances productivity, consisting of one or several measures) or an SLM Approach (ways and means used to implement one or several SLM Technologies). Examples of SLM technologies that contribute to NbS include any land management practices that contribute to reducing disaster risks (e.g. slope bioengineering which combines deep-rooted grasses with simple civil engineering structures) or for reducing climate change impacts (e.g. drylands agricultural- and water management practices). An example of SLM approaches may include integrated watershed management which brings together stakeholders from various sectors to manage water for livelihoods as well as disaster and climate risk mitigation.

- **What are the challenges and opportunities for practical implementation of Nature-based Solutions for disaster risk reduction?**

*The main challenge is that NbS are still not fully mainstreamed in DRR planning and disaster response***.** Although the concept of Eco-DRR/CCA is now internationally recognized with robust knowledge and practice, Eco-DRR/CCA approaches are not yet fully mainstreamed into national development policies and programmes. There are several reasons for this:

- Disaster risk management in most countries is still *reactive and engineering-focused* rather than preventive or based on planning, sound development planning and use of natural landscape features to prevent disaster risks (Sudmeier-Rieux et al., 2013).

- There is a *lack of ecological engineering designs* for "green infrastructure", or "green defences" for various types of hazards and ecosystem types that provide policy-makers with quantifiable, evidence-based guidelines for selecting such solutions over grey infrastructure, which have been tried and tested by engineers around the world. One of the few examples is from New York City, which decided to develop a green infrastructure plan for the city based on a cost-benefit analysis (see Figure 1). *Hybrid approaches* which combine both may be optimal but are not well documented.

- There is an equal *lack of cost-benefit methods* and examples for comparing green versus grey infrastructure for DRR. This starts by valuing the protective values of ecosystems for reducing impacts of hazard events. (See text box). Green infrastructure may cost more upfront to install and maintain but its benefits will increase over time and extend beyond just protection against hazards to also providing co-benefits and livelihoods support (Sudmeier-Rieux et al., 2013, see box 2). Examples include protection forests on steep slopes which provide firewood and other wood products, or wetlands which can absorb excess rain water but also fish and fibers.

Valuing ecosystems for disaster risk reduction

Three main types of ecosystem valuation include: direct market valuation; indirect market valuation; and survey-based valuation (i.e. contingent valuation and group valuation) (DeGroot, 2010). If data are lacking, economists often use "replacement or avoided costs". This refers to the cost that would be incurred if an ecosystem (i.e. coral reefs) is destroyed and has to be replaced by an engineered structure (i.e. seawalls). Replacement costs also refer to the cost of having to rebuild infrastructure (i.e. roads, housing) that are no longer protected by ecosystems (i.e. forests on mountain slopes). Emerton (2009) estimated that along the coast of Indonesia, the cost of replacing roads and houses in the event of strong waves is estimated at US$50,000/km, and the cost of maintaining sandy beaches for tourism is US$1 million/km, both are protected and maintained naturally by coral reefs (Emerton, 2009), saving society large sums of money.

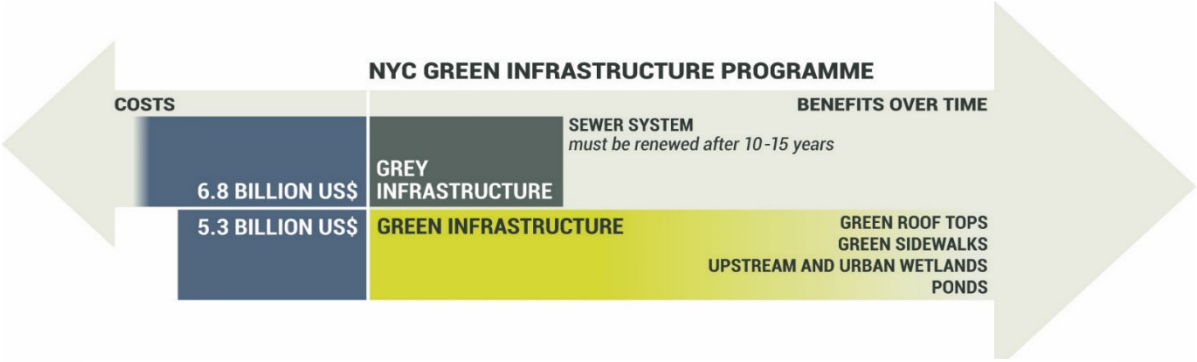

Figure 1. Green versus grey infrastructure cost-benefit analysis for New York City. Source: NYC, 2010

- **Ways forward? How to capture on synergies between these related communities of practice?**

To address these challenges, a number of exciting initiatives on NbS, in addition to the above mentioned, are currently underway at the global and local levels. Examples at the global level include the Global Facility for Disaster Reduction and Recovery (GFDRR) and the World Bank. Guidelines on NbS, Eco-DRR, EbA and ecological engineering are being developed and several first time Eco-DRR and EbA projects are being implemented by international actors who have demonstrated benefits and paved the way for greater up-scaling. At the local level there are many good NbS being practiced by NGOs and communities, based on indigenous know-how which could be captured and more systematically replicated. We conclude that at the local level, communities usually do not distinguish between NbS, Eco-DRR or EbA, while at the global level, communities of practice and policy arenas differ between NbS subsets: Eco-DRR (Sendai Framework for DRR), EbA (UNFCCC) and SLM (UNCCD). However, there are more overlaps than differences and multiple opportunities for creating further synergies, if we are willing to step across our institutional boundaries. One example is the success of the Partnership for Disaster Risk Reduction (www.pedrr.org) which brings together 24 international members, including IUCN, UN Environment, and the World Business Council for Sustainable Development and the Swiss NGO DRR Platform, which advocates for Eco-DRR at the local and global levels.

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