Nature-based solutions for climate change and biodiversity conservation

What are Nature-based solutions?

Nature-based solutions are actions to protect, sustainably manage and restore ecosystems to answer both societal challenges (climate change, food & water security, disaster risk, human health, poverty) and biodiversity conservation. Climate change is recognised as a key threat to biodiversity, but biodiversity helps us mitigate, and adapt to, climate change. Biodiversity and climate change are **inter-dependent processes**, and the biodiversity and climate change crises are therefore interconnected and cannot be resolved separately. Worldwide, natural ecosystems absorb about half of CO^2 emissions generated by human activities each year and functioning ecosystems have a buffer effect on climate and reduce the risks and impacts of extreme events such as storms, landslides and floods.

Nature-based solutions is thus a concept that promotes solutions provided by nature to these challenges. They are widely recognised as being more cost efficient than technological and/or infrastructure investments to tackle climate change.

Some facts and figures:

Forests and other ecosystems store carbon in vegetation and soil, harbour biodiversity, regulate rainfall, sustain livelihoods, support water and food security, and buffer communities from climate change impacts. They are ubiquitous, self-replicating, and need little maintenance or technological development. And yet the adoption of Nature-based solutions has been very slow (the Nature Conservancy refers to them as the 'Nature's sleeping giant'[1]). **Currently only 2% of climate finance flows to Nature-based solutions[2] despite the fact that they are cost-effective and have benefits far beyond reducing climate change**. Limiting warming to 1.5 °C requires near complete elimination of current CO^2 emissions and multiple decades of net-negative global emissions, and even complete and immediate decarbonisation of energy and industry alone might not be sufficient to limit warming to 1.5°C. **Nature-based solutions constitute a relatively untapped set of natural solutions which would be a powerful complement to energy transformations**.

A recent study[3] looked at the potential of 20 types of natural climate solutions[4] covering forests, wetlands, grasslands and agricultural land, where conservation, restoration, and improved land management actions[5] increase carbon storage and/or avoid greenhouse gas emissions. The study demonstrates that **the potential of natural climate solutions is cost-effective[6] and totals 11.3 Gt CO2e per year, more than 30% of mitigation needed between now and 2030 to achieve the Paris target**. Roughly half of this total lies in eliminating current anthropogenic emissions from ecosystem destruction, and the other half in ecosystem removals of atmospheric CO^2 - a feat not yet matched at scale by any other technology. Note however that the benefits of Nature-based solutions **do not decrease the imperative for mitigation from the energy and industrial sectors**[7].

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[1] http://naturalclimatesolutions.org/

[2] W.R. Turner 2018. Looking to Nature for solutions. Nature Climate Change Vol 8 : 14-21 https://doi.org/10.1038/s41558-017-0046-0

[3] Griscom, B. W. et al. 2017. Natural Climate Solutions. Proc. Natl Acad. Sci. USA 114,11645–11650 (2017). www.pnas.org/cgi/doi/10.1073/pnas.1710465114

[4] 'Natural climate solutions' are essentially 'nature-based solutions' that target specifically carbon storage and greenhouse emission avoidance.

[5] For example: reforestation, avoided forest conversion, natural forest management, fire management, agro-forestry, conservation agriculture, grazing management, avoided grassland conversion, coastal restoration, peat restoration, avoided peat impacts, etc….

[6] Estimated at <US$100 per tonne CO^2.

[7] Christa M. Anderson et al. 2019. Natural climate solutions are not enough. Science 363(6430), 933-934. https://science.sciencemag.org/content/363/6430/933?rss=1

Forests, mangroves, and peatlands capture and store a significant amount of carbon. Furthermore 31% of the carbon stored is in the biomass and 69% in the soil. Preserving forest soil, and vegetation-covered soil is thus a major issue for long-term carbon storage.

Marine ecosystems absorb ¼ of human generated CO^2 annually. They form the largest living carbon stores and their carbon concentration is 50 times higher than the atmosphere's. Natural ecosystems absorb ½ of human activity-generated CO^2 emissions and protected areas hold at least 15% of the world's terrestrial carbon stocks. Deforestation and peatland degradation account for 15% of annual anthropogenic CO^2 emissions.

Every year natural hazards such as landslides, hurricanes, floods, wild fires, heatwaves and droughts affect millions of people. Healthy ecosystems contribute to reducing natural hazard exposure and the impacts of extreme events. Wetlands regulate floods and protect water resources during droughts. Mangroves and dunes act as natural barriers against winds and coastal erosion. Greening in cities helps cool the air and improve its quality. The protection and sustainable management of ecosystems contributes to strengthening or maintaining their resilience and adaptation capacity in the face of coastal, flood, wildfire or drought hazards, and thereby to reducing the impact of these disasters on human societies. Protected areas have a critical role to play in this respect and also serve as excellent sites to observe and enhance knowledge of the role of ecosystems in CC and disaster risk reduction

Types of Nature-based solutions.
IUCN defines 5 categories of Nature-based solutions[8]:

CATEGORY	EXAMPLES / APPROACHES
Ecosystem Restoration	**Ecological restoration.** eg restoring a drained and exploited peat swamp to recover its original carbon storage capacity and biodiversity
	Ecological engineering. eg planting marram grass on dunes to stabilise the sand and help the ecosystem act as a buffer against erosion and marine submersion
	Forest landscape restoration. To restore an optimal balance of ecological, social and economic benefits provided by forests and trees in a multi-use landscape
Ecosystem-based Management	**Integrated Coastal Area management**
	Integrated water resource management
Ecosystem Protection	**Conservation, including protected area management**
Issue specific	**Ecosystem-based Adaptation** - using biodiversity and ecosystem services as part of an overall adaptation strategy in order to help populations to adapt to climate change.
	Ecosystem-based Mitigation - the use of biodiversity and ecosystem services to capture and store greenhouse gases
	Ecosystem-based Disaster Risk Reduction - ecosystem protection, sustainable management and restoration in order to reduce natural disaster risks.
Infrastructure	**Green Infrastructure** – a strategically planned network of natural and semi-natural areas designed to deliver a range of ecosystem services. Particularly relevant to urban ecosystems as they allow for natural or semi-natural areas to interconnect.

[8] IUCN French Committee (2019). Nature-based Solutions for climate change adaptation and disaster risk reduction. Paris, France. https://uicn.fr/wp-content/uploads/2019/07/uicn-g20-light.pdf

Financial mechanisms for Nature-based solutions

Ecosystem preservation, restoration and management are long term processes requiring sustainable funding**. By highlighting the contribution of Nature-based solutions to climate change mitigation and disaster risk reduction, projects should be able to tap into a wider range of funding sources and mechanisms than those typically dedicated to biodiversity conservation projects**.

These could include:

- funding for 'climate projects' such as carbon credits;
- financial tools for 'disaster risk prevention' projects;
- financial tools for the agriculture sector (particularly where Nature-based solutions are directly contributing to soil carbon sequestration;
- innovative public/private sector mechanisms such as: Payment for Ecosystem Services (eg watershed PES schemes); Climate or Green bonds; eco-conditionality of public financial support; natural capital financing facilities;

Additional information on the key importance of soil carbon and Blue Carbon habitats.

Soil carbon: The world's soils contain 2 to 3 times more Carbon than the atmosphere, but soil degradation poses a threat to an estimated 40% of the Earth's land surfaces. The '*4 per mille Soils for Food Security and Climate*'[9] initiative, launched by France at the Paris COP21, aims at increasing global soil carbon stocks annually by 0.4% (4 per 1000) in agricultural soils as compensation for human-induced global emissions of greenhouse gases. This tiny improvement in soil carbon sequestration will go a long way toward combatting climate change. Land management and agricultural strategies to enhance the soil carbon pool include soil restoration, no-till farming, cover crops, manuring, woodland regeneration, water conservation and harvesting, agroforestry, improved grazing and fire management.

In the African savannahs there are significant opportunities for emissions mitigation through improved grazing and fire management. A 2018 communication in Nature[10] shows that switching from late burning to early burning fire regimes can reduce carbon emissions by up to 40%. When combined with improved grazing techniques soil carbon stocks can be further enhanced. The 'Northern Kenya improved grazing project'[11] is piloting an innovative carbon project that will not only create a sustainable, new income stream for community-led conservation efforts, but it will also sequester greenhouse gases, make this vulnerable region more resilient to the impacts of climate change and protect wildlife habitat. This project presents a new solution to the challenges of overgrazing, tensions over scarce land, and frequent droughts by providing revenues to local communities (through Verified Carbon Units) to improve grazing practices.

Blue Carbon habitats: Blue Carbon is the carbon stored in coastal and marine ecosystems, which include mangroves, salt marshes and seagrasses. Mangroves, salt marshes and seagrasses are critical habitats, supporting coastal water quality, healthy fisheries, and coastal protection against floods and storms. For example, mangroves are estimated to be worth at least US$1.6 billion each year in ecosystem services that support coastal livelihoods and human populations around the world. Like terrestrial forests, blue carbon ecosystems also sequester and store large quantities of carbon in both the plants and the root systems and sediment below. **Over 95% of the carbon in seagrass meadows is stored in the sediments; and while seagrasses occupy only 0.1 percent of the total ocean floor, they are estimated**

[9] https://www.4p1000.org/

[10] G.J. Lipsett-Moore et al. 2018. Emissions mitigation opportunities for savanna countries from early dry season fire management. Nature Communications, volume 9, Article n°: 2247 https://www.nature.com/articles/s41467-018-04687-7

[11] https://nativeenergy.com/project/northern-kenya-improved-grasslands-project/

to be responsible for up to 11 percent of the organic carbon buried in the ocean. One acre of seagrass can sequester 83 g carbon per square meter per year, the same amount emitted by a car traveling around 6,212 km. When degraded or destroyed, these ecosystems emit the carbon they have stored for centuries into the oceans and the atmosphere and become sources of greenhouse gases. Experts estimate that as much as 1.02 billion tons of carbon dioxide are being released annually from degraded coastal ecosystems, which is equivalent to 19% of emissions from tropical deforestation globally.

In recent years there has been a growing trend for Locally Managed Marine Areas (LMMA) in East Africa. The LMMA model has proved particularly strong for engaging with local communities to improve food security and livelihoods, reduce conflict over fisheries, conserve biodiversity and strengthen resilience to climate change. For example in areas that had been overfished in Madagascar LMMAs are able to demonstrate that a simple temporary fish closure could bring spectacularly rapid returns in terms of increased productivity of fish, octopus, shrimps, crabs, etc[12]. They have shown that recovering fisheries is a very cost effective conservation investment as it benefits biodiversity and has a rapid and tangible impact on livelihoods. At the same time LMMAs covering mangroves and seagrass beds contribute significantly to climate change mitigation and disaster risk reduction.

[12] https://blueventures.org/about/