

User Guidance

Methods used to generate the NBSI bibliography



Overview of scope

This online bibliography encompasses Nature-based Solutions (NbS) to the drivers and impacts of climate change. It covers a much broader scope than our systematic map [1] which consolidates evidence on the *effectiveness* of nature-based interventions for climate change adaptation and disaster risk reduction. In addition to original research articles on disaster-risk reduction and climate change adaptation, including for food and water security, the bibliography complements the evidence map in two key ways. First, by including reviews, methods, commentaries, perspective articles, and policy-oriented articles broadly relevant for understanding NbS in policy or practice. Second, by including peer-reviewed published articles on the use of biodiversity, ecosystems, and associated processes to address a) carbon storage or reduced carbon emissions (e.g. the carbon storage potential of protected areas, agroforestry) and b) ecosystem-health (e.g. interventions promoting adaptive capacity or resilience of ecosystems to secure the flow of climate change mitigation, adaptation and other vital ecosystem services).

Scope of approaches

Any specific and discrete action or set of actions (hereafter referred to as NbS) for managing, restoring or protecting biodiversity, ecosystems, ecological functions and processes or ecosystem services. Articles included either report outcomes of nature-based solutions or the potential of natural systems to address a desired outcome, to guide nature-based solutions.

Scope of habitats

Habitats spanning terrestrial, freshwater, coastal, marine and production landscapes (e.g. aquaculture, agricultural plots) outside of urban environments, unless the intervention under study extended into urbanized or metropolitan landscape (see definitions below).

Article subject focus

Our bibliography includes:

- Studies investigating the effectiveness of NbS from an economic, social, or environmental perspective
- Studies on NbS for carbon capture/storage across terrestrial and marine landscapes (i.e. green and blue carbon)
- Policy-oriented articles including on the assessment of NbS implementation policies and their effectiveness, policy recommendations (improving or establishing effective policies on NbS), or the incorporation of NbS in existing policy frameworks.
- Studies on increasing implementation effectiveness or mainstreaming of NbS across landscapes.
- Method articles on the design, implementation, and effectiveness assessments of NbS as well as approaches for integrating NbS into policy
- Commentaries and perspective articles, such as those highlighting research gaps and future applications of NbS.

Review process

This exercise is on-going, and the database is regularly updated. As a starting point, we searched the literature on NbS using a set of 3 search strings in Web of Science, and crawling reference lists of key review and seminal articles on NbS. We selected articles focusing on the role or use of nature (biodiversity, ecosystems, and ecological processes) to address social issues, including climate change adaptation, mitigation, and food and water security (see below). Search results were subsequently given a second round of screening, conducted in a stepwise manner (first title, then abstract). Full texts were checked when a reference could not be assessed based on the abstract. We are building on this

set by progressively adding additional articles we become aware of, including through regular targeted google scholar searches using "nature-based solutions" OR "nature-based approach" OR "nature-based approaches" OR "natural solutions" OR "ecosystem-based adaptation". This exercise is on-going and will collate the evidence base on the effectiveness of NbS for addressing the impacts stemming from climate-hazards or helping humans or economic sectors adapt to the adverse, long-term impacts of climate change.

Article meta-data (Author, Title, Source name, Publication Year) were compiled. To facilitate targeted searches, articles were then categorized with respect to region, habitat, the societal issue addressed by the intervention, and the broad type of nature-based solution under study (NbS Approach).

Societal challenge

Climate change adaptation: articles on NbS for socioeconomic and ecosystem adaptation to the short-term hazards or long-term impacts of climate change.

Climate change mitigation: articles on NbS for carbon sequestration and storage.

Disaster-risk reduction: articles on NbS to reduce the impacts of natural and climate change related disasters.

Ecosystem health: articles on NbS to enhance the resilience or adaptive capacity of ecosystems, or to provide biodiversity co-benefits, explicitly in the context of climate change adaptation, disaster risk reduction, or carbon sequestration.

Food and water security: articles on NbS to address food and water security, or to provide food and water security co-benefits, explicitly in the context of climate change adaptation, disaster risk reduction, or carbon sequestration.

Human well-being: articles on NbS to human well-being (e.g. equity, poverty reduction, physical or mental health) or socio-economic development (e.g. economic impacts on specific sectors), or to provide wellbeing co-benefits, explicitly in the context of climate change adaptation, disaster risk reduction, or carbon sequestration.

NbS approach

Nature-based Solutions in general: articles explicitly using the terms “nature-based solutions”, “natural solutions”, or “nature-based approaches”. Describing actions that work with and enhance habitats to help address societal challenges, *Nature-based Solutions is an umbrella term which encompasses all of the approaches described below* [2].

Articles tagged with these approach terms either explicitly used the term, or described an intervention falling under the definition of the term.

Area-based approaches: ecosystem protection, including protected areas and their management.

Community-based adaptation: a climate change adaptation approach focusing on empowering communities to use their own knowledge and decision-making processes to take action on dealing with the impacts of climate change [3].

Ecosystem-based adaptation: “sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities” [4].

Ecosystem-based management: integrated, science-based approach to natural resource management aimed at sustaining the health, resilience and diversity of ecosystems while allowing for sustainable use by humans [5,6].

Ecosystem-based mitigation: sustainable management, conservation and restoration of ecosystems for the purpose of enhancing carbon sequestration and storage [4].

Ecosystem-based disaster risk reduction: sustainable management, conservation and restoration of ecosystems to provide services that reduce disaster risk by mitigating hazards and by increasing livelihood resilience [7].

Ecological engineering: the design of sustainable ecosystems integrating human society and ecosystems for the benefit of both [8,9].

Ecological restoration: process of assisting the recovery or otherwise enhance the structure and function of an ecosystem that has been impacted by environmental change [10,11].

Forest-landscape restoration: a planned longterm process aimed at restoring the ecological integrity and enhance human well-being in deforested or degraded landscapes [12,13].

Infrastructure-related approaches or green infrastructure: a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver ecosystem services in both urban and rural settings. It incorporates green or blue (aquatic) spaces and other physical features in terrestrial (including coastal) and marine areas [14].

Nature-based agricultural systems: Agricultural, agro-pastoral, or aquaculture practices, that are based on the conservation, restoration, sustainable management of biodiversity or ecological functions and processes that provide adaptation benefits, reduce greenhouse-gas emissions, or sequester carbon. This includes agroforestry, conservation agriculture, permaculture activities, silvopasture, and the planting of trees in agricultural areas to reduce soil erosion [15].

Habitat definitions

The habitat categories of Munroe et al. [16] were adapted using IUCN Red List Habitat Classification Scheme (Version 3.1) [17]:

- Artificial landscapes – Aquatic: aquaculture ponds
- Artificial landscapes – Terrestrial: arable land, pastureland, plantations, rural gardens, urban areas.
- Coastline: shorelines, beaches, mud flats, salt flats, salt marshes, mangroves, sand dunes
- Desert: hot, temperate, cold deserts
- Forest: tropical, subtropical, temperate, boreal and taiga
- Grassland: tropical, subtropical, temperate, sub-arctic, sub-antarctic, and tundra
- Marine: coral reefs, seagrass, estuaries, oceanic
- Montane: habitats above 1000 m, including forest, grassland and wetland
- Wetlands: inland, including rivers, streams, creeks, irregular rivers, freshwater lakes and pools, tundra wetlands
- Not applicable: habitat type not specified

References

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17. IUCN Red List Habitats Classification Scheme (Version 3.1) <https://www.iucnredlist.org/resources/habitat-classification-scheme>