

GUIDANCE FOR INCLUDING COASTAL GREEN-GRAY INFRASTRUCTURE IN NDCs



Executive Summary

The impacts of climate change necessitate innovative, preemptive, and scalable adaptation solutions to build resilient societies. Investing in nature-based solutions¹ – such as the conservation and restoration of coastal and marine habitats, particularly mangroves, salt marshes, seagrasses, and coral reefs – can reduce exposure and vulnerability to coastal hazards, providing natural protection from risks. Mangrove ecosystems alone provide flood protection benefits exceeding \$US 65 billion per year and protect more than 15 million people.²

Green-gray infrastructure combines nature-based solutions with traditional infrastructure development to reduce the vulnerability of human communities to the impacts of climate-related hazards such as storm and flood damage, coastal erosion, salinisation of freshwater resources, and loss of agricultural productivity, while optimizing co-benefits such as infrastructure lifespan, water quality, and carbon storage.

This policy brief provides an overview of how coastal greengray infrastructure solutions can contribute to achieving national climate goals and outlines recommendations for countries to include them in their Nationally Determined Contributions (NDCs) under the Paris Agreement and in national adaptation planning.

INCORPORATING GREEN-GRAY INFRASTRUCTURE INTO NDCS

Including commitments to develop green-gray infrastructure in NDCs can facilitate changes to national policies to enable greater uptake of green-gray solutions.³ Furthermore, submitting an Adaptation Communication as part of an NDC can maximize cross-cutting climate solutions that deliver synergies between mitigation and adaptation. The following recommendations can help countries set ambitious green-gray infrastructure goals for climate adaptation in their NDCs.

The below recommendations are meant as an entry point and to highlight ways in which countries have included green-gray infrastructure in NDCs to date. While intended to provide guidance on NDCs, these recommendations are also relevant for related ongoing policy processes such as the revision of National Biodiversity Strategies and Action Plans (NBSAPs) under the Convention on Biological Diversity, as well as the Sendai Framework for Disaster Risk Reduction. They can also be applied to other national communications under the UNFCCC such as the National Adaptation Plans, NDC Implementation Plans, and Technology Needs Assessments.

RECOMMENDATIONS FOR INCLUDING GREEN-GRAY INFRASTRUCTURE IN NDCS

- 1. Undertake, or commit to undertake, a comprehensive national assessment for EbA implementation opportunities, including green-gray options.
- 2. Take a cross-sectoral approach when developing green-gray infrastructure goals.
- 3. Design tangible, ambitious, and quantitative green-gray goals.
- 4. Communicate specific technical, capacity and financial needs for developing, implementing, and monitoring green-gray infrastructure projects.
- 5. Include capacity building goals for green-gray solutions.
- 6. Include goals to assess and eliminate roadblocks in governance and regulatory frameworks.

¹ The Fifth Session of the United Nations Environment Assembly (UNEA-5) in its 'Resolution on Nature-based Solutions for Supporting Sustainable Development', formally adopted the definition of NbS as 'actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human wellbeing, ecosystem services and resilience and biodiversity benefits.'

² Menéndez, P., Losada, I.J., Torres-Ortega, S. et al. The Global Flood Protection Benefits of Mangroves. Sci Rep 10, 4404 (2020). https://doi.org/10.1038/s41598-020-61136-6

³ Ibid, p. 133.

What is green-gray infrastructure?

Green-gray infrastructure is an ecosystem-based adaptation (EbA)^{4,5} solution that employs ecosystem restoration combined with conventional gray infrastructure to optimize co-benefits (e.g., habitat, water quality) and strengthen community resilience. While green infrastructure, such as mangrove forests, provides flood control and wave attenuation benefits, it may yield insufficient protection for communities facing extreme climate and disaster risks, particularly when communities are facing imminent, increasing risks, given the longer timeframes required to fully implement ecosystem-only solutions. Conversely, gray infrastructure like breakwaters, seawalls, and dams may provide immediate protection but can negatively impact biodiversity and community livelihoods and may be prohibitively expensive to build, maintain, and replace. Combined green-gray approaches can conserve and restore ecosystems while

selectively applying conventional engineering approaches,⁶ and can provide more cost-effective, long-lasting, and climate resilient infrastructure solutions than purely gray or green approaches. Additionally, green-gray solutions provide biodiversity and carbon mitigation co-benefits, such as when applied in blue carbon environments.⁷ While this document is primarily focused on coastal applications of green-gray infrastructure for climate adaptation, green-gray solutions can and should be integrated into civil infrastructure for multiple ecosystems and geographies. For further guidance on applications of green-gray infrastructure, see the <u>Practical Guide to Implementing Green-Gray Infrastructure</u> and the <u>Green-Gray Infrastructure Funding and Finance Playbook</u>, and the Additional Resources section at the end of this document.

SPECTRUM FROM GREEN TO GRAY

These solutions draw upon the best of our engineering achievements to create hybrid solutions along the green-to-gray spectrum



Image Source: Practical Guide to Implementing Green Gray Infrastructure

7 Ibid, p. 9.

^{4 &}quot;Friends of EBA (FEBA)." IUCN, 20 Mar. 2021, https://www.iucn.org/theme/ecosystem-management/our-work/ecosystem-based-approaches-climate-changeadaptation/friends-eba-feba.

⁵ Ecosystem-based adaptation (EbA) and Ecosystem-based disaster risk reduction (Eco-DRR) are types of nature-based solutions that use biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change and to reduce disaster risks. EbA and Eco-DRR approaches are centered on the conservation, sustainable management, and restoration of ecosystems to reduce the vulnerability of human communities to the impact of climate-related hazards. In addition to climate adaptation benefits, EbA and Eco-DRR approaches can offer numerous economic, social, and environmental co-benefits.

⁶ Green-Gray Community of Practice. (2020). Practical Guide to Implementing Green-Gray Infrastructure, p. 8.

1. UNDERTAKE, OR COMMIT TO UNDERTAKE, A COMPREHENSIVE NATIONAL ASSESSMENT FOR EBA IMPLEMENTATION OPPORTUNITIES, INCLUDING GREEN-GRAY OPTIONS.

Ideally before setting NDC targets, countries should conduct a comprehensive national assessment to determine the vulnerability of coastal and inland infrastructure, human settlements, and ecosystems to climate change impacts. This process should identify the ecosystems and ecosystem services affected by climate change, determine their geographic scope, and assess their risk reduction contributions. When evaluating potential adaptation actions, the assessment should consider where ecosystem-based and hybrid actions, such as greengray infrastructure, would be feasible.⁸ Adaptation strategies can be assessed through a cost-benefit analysis that incorporates environmental, social, and economic dimensions that capture the multiple benefits of ecosystem-based approaches. Countries can also commit to undertaking comprehensive national assessments in their NDC, as a beginning step.

All countries should assess their needs to implement greengray infrastructure solutions - finance, technology, capacity, and other policy or regulatory needs - as this information is critical for prioritizing and developing green-gray infrastructure targets within the NDC. Countries should assess areas where technical assistance may be required (i.e., project identification, design of climate-resilient restoration practices, implementation guidance and training, and development of regional or national resilience plans).

Example text: [Party] will conduct a comprehensive national assessment of the vulnerability of coastal and inland infrastructure, human settlements, and ecosystems, identifying key ecosystems and ecosystem services affected by climate change and laws and regulations including land use and marine and coastal planning. The national assessment will also assess locations where green-gray infrastructure is an appropriate adaptation solution, evaluating the costs, benefits and potential barriers to implementing these solutions.

Country example: Saint Lucia

'Evaluate the costs and benefits of hard infrastructure vs. various natural buffers on reducing exposure to climate impacts island-wide.' - Saint Lucia, NAP, 2021, p. 110

2. TAKE A CROSS-SECTORAL APPROACH WHEN DEVELOPING GREEN-GRAY INFRASTRUCTURE GOALS.

Green-gray elements can be incorporated into adaptation solutions across multiple sectors of the economy, and therefore can and should be considered throughout the entire adaptation component of a country's NDC, not solely within sections related to the adaptation of natural resources. Green-gray infrastructure is particularly applicable in providing coastal and flood protection and can be incorporated in adaptation planning for urban infrastructure, ports, tourism, and more. Some examples include green-gray coastal defenses, stormwater drainage and treatment systems, fisheries and aquaculture, and wastewater treatment.

Example text: [Party] will employ green-gray infrastructure solutions to increase the resiliency of ports, the coastal tourism sector and coastal industries to storms and flooding.

Country example: Suriname

'A contribution will, therefore, be made through a number of investment projects for improving the road and drainage infrastructure, this includes sea defense infrastructure (grey and green) for Paramaribo, upgrading of roads and canals. In the north it can be protected by a green sea defense system consisting of sufficient clay dams or retaining walls, combined with wetlands.' - Suring NDC, 2020, p. 18

Country example: Fiji

'Fiji will take measures to ensure that public infrastructure is resilient to cyclones and floods, prioritizing nature-based economically viable solutions, and developing future infrastructure and building projects while keeping in mind the effects of climate change.' - Fiji, NDC, 2020, p. 19

⁸ United Nations Environment Programme (2021). Guidelines for Integrating Ecosystem-based Adaptation into National Adaptation Plans: Supplement to the UNFCCC NAP Technical Guidelines, p. 53, https://wedocs.unep.org/20.500.11822/36703

3. DESIGN TANGIBLE, AMBITIOUS, AND QUANTITATIVE GREEN-GRAY GOALS.

Adaptation commitments to develop green-gray infrastructure in NDCs should include ambitious, measurable, and time-bound targets. Quantitative targets may include hectares of area9 being protected by green-gray infrastructure, percentage of people with reduced vulnerability to climate risks, percentage or area of ecosystems restored, or green benchmarks for infrastructure projects. Any greenhouse gas emissions reduction or sequestration outcomes of green-gray infrastructure targets can be included in the NDC mitigation component (if they can be quantified within the national inventory) or described as a mitigation co-benefit. NDCs can outline the types of proposed green-gray infrastructure projects as well as locations and timelines for implementation. Additionally, where applicable, countries can include steps needed to scale existing pilot projects, develop needed capacity, and establish metrics to support monitoring and evaluation.

Developed countries may wish to set unconditional green-gray adaptation targets and fund green-gray infrastructure investments through national funding sources. For developing countries, particularly SIDS and LDCs which face a high probability of hazardous events and where coastal adaptation projects are most needed, available national funding can be directed to the most pressing adaptation needs, identified through a risk assessment, and included as unconditional NDC targets. Where national funding sources are insufficient, countries can frame green-gray infrastructure commitments as a conditional contribution. Conditional contributions are contingent on the receipt of financial support or other external conditions. Where additional funding for adaptation is needed, countries may wish to make partly unconditional commitments, outlining the additional measures they would undertake with financial support. Communicating support needs for meeting conditional targets can facilitate receiving funding.

While NDC commitments will ideally include specific greengray infrastructure actions and targets as detailed above, as an alternative preliminary step, countries can commit to taking a nature-based or hybrid approach to adaptation within their NDC.¹⁰ Additionally, countries may wish to include intermediary or "stepping-stone" time-bound goals necessary to meet their NDC commitments. These intermediate goals may also be communicated in accessory documents such as NDC Implementation Plans.

Example text: [Party] will design and implement green-gray infrastructure solutions to protect [x] hectares of coastline, reduce the climate vulnerability of [x]% of the coastal population and restore [x] ha of degraded coastal ecosystems to increase the climate resilience of urban infrastructure, ports, stormwater drainage and treatment systems, and wastewater treatment facilities.

Example text: "[Party] commits to taking an ecosystem-based approach to adaptation evaluating the social, environmental, and economic costs and benefits of infrastructure investments, and where feasible, prioritizing nature-based or hybrid actions.

Country Example: Liberia

'Design and implement green-gray infrastructure approaches along 60% of Liberia's highly vulnerable coastline by 2030 (Link to Transport sector).' - Liberia, NDC, 2021, p. 38

4. COMMUNICATE SPECIFIC TECHNICAL, CAPACITY AND FINANCIAL NEEDS FOR DEVELOPING, IMPLEMENTING, AND MONITORING GREEN-GRAY INFRASTRUCTURE PROJECTS.

Developing countries may wish to communicate their financial, technological, and capacity-building needs as part of their NDC or accessory documents such as an NDC Implementation Plan and/or Technology Needs Assessment (TNA) to better facilitate support requests to donor countries and funds. Communicating these needs can also facilitate reporting on how any support they receive contributes to achieving their commitments within the Biennial Transparency Reports (BTRs). Possible financing avenues include international funding source(s) e.g., Green Climate Fund, Global Environmental Facility, Adaptation Fund, Payment for Ecosystem Services, and national funding source(s).

Country Example: Liberia

'Set up an initiative to explore innovative financing models for ecosystem-based adaptation in forests, coastal zones, and urban green corridors, as well as climate-resilient practices for agriculture, fisheries, and aquaculture by 2025 (Linked to Mitigation target)'. - Liberia, NDC, 2021, p. 32

10 Seddon, N., Sengupta, S., García-Espinosa, M., Hauler, I., Herr, D. and Rizvi, A.R. (2019). Nature-based Solutions in Nationally Determined Contributions: Synthesis and recommendations for enhancing climate ambition and action by 2020, p. 17. Gland, Switzerland and Oxford, UK: IUCN and University of Oxford.

⁹ Area based metrics should always be combined with associated indicators of ecosystem health.

5. INCLUDE CAPACITY BUILDING GOALS FOR GREEN-GRAY SOLUTIONS.

Successful green-gray infrastructure implementation requires institutional capacity for EbA techniques at the local level and across government ministries. Capacity building activities include integrating green-gray concepts in universities' engineering curricula, developing engineering guidelines for utilizing nature-based methods, education and outreach initiatives for environmental authorities, local leadership, technical experts, and communities, and forming a national green-gray community of practice. Communication and education campaigns should focus on the true costs, savings, risks, and avoided hazards associated with green-gray investments.¹¹

When possible, ecosystem-based adaptation should be incorporated into existing infrastructure and engineering best practices, for example, via the process outlined in the <u>PIEVC Green</u> <u>Protocol</u>. Where environmental impact assessments are mandatory for large scale infrastructure projects, an assessment for ecosystem-based adaptation and green-gray infrastructure should be included in existing tools and processes.

Colombia

"Strengthen the institutional capacity of the environmental authorities to facilitate the implementation of EbA actions in Coastal Environmental Units. Develop the skills and competencies needed by the staff from the environmental authorities to implement and monitor EbA actions on blue carbon ecosystems and enable the establishment of a community of practice." - Colombia, NDC, 2020, p. xxi

Australia

'The <u>Australian guide to nature-based methods for</u> <u>reducing risk from coastal hazards</u> aims to translate global and Australian research into a practical tool that can be used to support decisions by coastal practitioners to use nature-based methods.' - Australia, Adaptation Communication, 2021, p. 19

Example text: [Party] will develop the institutional capacity for ecosystem-based adaptation and green-gray infrastructure techniques by integrating green-gray concepts in universities' engineering curricula, developing engineering guidelines for utilizing nature-based methods, and developing education and outreach initiatives for environmental authorities, local leadership, technical experts, and communities.

6. INCLUDE GOALS TO ASSESS AND ELIMINATE ROADBLOCKS IN GOVERNANCE AND REGULATORY FRAMEWORKS.

Coastal ecosystems span diverse and complex regulatory landscapes and are often under the jurisdiction of multiple agencies and levels of government. Regulatory frameworks such as landuse planning and zoning policies designed solely for traditional gray infrastructure can hinder the uptake of green-gray infrastructure approaches.¹² Policymakers designing NDCs and NDC Implementation Plans may wish to develop approaches to enhance regulatory alignment on national and subnational development, adaptation, and coastal management planning.¹³ Existing laws and regulations, particularly land use, marine and coastal planning, and approval procedures, may need to be evaluated and modified to reduce barriers to green-gray infrastructure implementation.¹⁴ If needed, NDCs can call for the development of a comprehensive and overarching law for environmental protection and infrastructure management and define a clear institutional framework for environmental management. Planning frameworks like Integrated Watershed Management, Integrated Coastal Zone Management, Coastal Resource Planning Committees, and Resiliency Master Planning may be useful approaches to help facilitate vertical, horizontal, and

cross-sectoral harmonization. Planning frameworks should be developed in partnership with Indigenous peoples and local communities and ensure security of land tenure and access.

Colombia

'Adopting and implementing 100% of the Integrated Management Plans for the Coastal Environmental Units (POMIUAC) with ecosystem-based adaptation (EbA) on mangroves and seagrasses, and other coastal ecosystems.' - Colombia, NDC, 2020, p. 20

Myanmar

'In recognition of the importance for inter-ministerial coordination in these regions, a National Coastal Resources Management Central Committee (NCRMC) has been established to formulate policy, strategy, laws, rules and regulations regarding Myanmar's vulnerable coastal resources.' - Myanmar, NDC, 2021, p. 39

Example text: [Party] will, in partnership with Indigenous people and local communities, develop an inter-ministerial integrated planning framework for coastal zones that prioritizes improving ecosystem health, nature-based approaches, and green-gray infrastructure solutions. [Party] will conduct a thorough review of existing laws and regulations that govern coastal infrastructure development and modify them to reduce barriers to implementing green-gray infrastructure solutions.

¹¹ Green-Gray Community of Practice (2020). Practical Guide to Implementing Green-Gray Infrastructure, p. 133.

¹² Green-Gray Community of Practice (2020). Practical Guide to Implementing Green-Gray Infrastructure, p. 133.

¹³ Blue Carbon Initiative (2020). Guidelines for Blue Carbon and Nationally Determined Contributions, p. 35.

¹⁴ Green-Gray Community of Practice (2020). Practical Guide to Implementing Green-Gray Infrastructure, p. 134.

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Additional Resources

<u>Global Green-Gray Community of Practice</u>

Friends of Ecosystem-based Adaptation (FEBA)

Practical Guide to Implementing Green-Gray Infrastructure. CI, Green-Gray Community of Practice, FEBA.

Green-gray Infrastructure Funding and Finance Playbook, Green-Gray Community of Practice (2022).

Collaborate to create 21st century engineering guidelines for our 21st century challenges. Global Green-Gray Community of Practice (2022).

Incorporating Climate Change Impacts and Adaptation in Environmental Impact Assessments: Opportunities and Challenges Opportunities and Challenges, OECD (2011).

Enhancing NDCs Through Nature Based Solutions. WWF.

<u>Guide to Including Nature in Nationally Determined Contributions.</u> Nature 4 Climate, CI, EDF, TNC, NWF, Land Use and Climate Knowledge Initiative, Climate Advisers, WCS.

<u>Blue Nature-based Solutions in Nationally Determined Contributions: A Booklet for Successful Implementation.</u> GIZ, GRID, IUCN, UNEP.

Blue Carbon In Nationally Determined Contributions. The Blue Carbon Initiative

Nature-based Solutions in Nationally Determined Contributions: Synthesis and recommendations for enhancing climate ambition and action by 2020. IUCN, University of Oxford.

Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standards. FEBA

Innovative Approaches for Strengthening Coastal and Ocean Adaptation, FEBA and IUCN (2022).



