NATURE-BASED SOLUTIONS (NbS) POLICY TRACKER

An AI approach to policy-making for enabling NbS worldwide

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Nature4Climate

Nature4Climate (N4C) is an initiative with 19 participating organizations: UN Development Programme, UN-REDD, UN Environment Programme, Convention on Biological Diversity, International Union for Conservation of Nature, Birdlife, Youth4Nature, Conservation International, Environmental Defense Fund, The Nature Conservancy, Wildlife Conservation Society, Woodwell Research Center, World Business Council for Sustainable Development, World Resources Institute, WWF, We Mean Business, Food and Land Use Coalition, Global Mangrove Alliance, and Re:wild (formerly Global Wildlife Conservation).

N4C aims to increase investment in and action on nature-based solutions (NbS). We do this by catalysing partnerships between governments, civil society, business and investors. We campaign to integrate NbS into all government decision-making, to enhance ambition in NDCs using NbS, and to increase and reform finance flows for NbS.

Metabolic

Metabolic advises governments, businesses, and NGOs on how to effectively adapt to a fast-changing global context, while creating disruptive solutions that can dramatically change how economies function. We crunch data, provide strategies and tools, build pilots, and create new ventures that develop scalable solutions to critical problems. The core of achieving our mission is transitioning to regenerative and 'circular' economies.'

Arboretica

Arboretica (formally ZFG Insights) empowers organizations to make smarter, impactful decisions by uncovering meaningful insights from the world's public data. Combining automated open-source intelligence with expert analysis, Arboretica extracts and prioritizes the information you need – and only that you need – to accelerate decision-making and streamline work processes. Arboretica has been trusted by world leading institutions, NGOs, and corporations in Europe, U.S., and China to drive impactful actions in environmental analysis, policy research, industry intelligence and consumer analytics using customized AI solutions.

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• EXECUTIVE SUMMARY •

The clock is ticking for transforming global systems and creating nature-positive economies. Nature is an asset for climate, biodiversity, global health crises and provides solutions that already exist. The Nature-based Solutions (NbS) Policy Tracker is the first to use artificial intelligence and machine learning to identify legislation and investment plans for nature-based solutions (NbS). This is designed to serve as the world's largest global database of public policies to support nature, helping governments and investors target their investments and planned action to tackle the climate emergency, biodiversity crisis, and global health crises more effectively.

Political action can enable the implementation of NbS and our tracker highlights which solutions are in place, where, and why. This report describes the methods used to develop a policy tracker utilizing machine learning and web scraping, selected criteria to assess NbS policies, and case studies that illustrate the criteria in action.

Advanced science, nature technology, and finance mechanisms give governments the chance to feel more confident in adopting NbS within nationally determined contributions (NDCs) needed to to reach the goals set in the Paris Agreement, and contribute to the Sustainable Development Goals (SDGs). **Simultaneously, better knowledge of existing policies and good practices can help make smarter decisions about the allocation of resources.** Within the landscape of current policy trackers, there is a clear gap for better assessment for policies that include NbS.

Our aim is to assist readers through a decade of delivery by shining a spotlight on domestic action to enable NbS as part of a wider transition towards a Nature Positive economy by 2030.

This project represents a first attempt to map successful NbS policies, identify vital components such as inclusion of Indigenous Peoples and Local Communities (IPLCs) and uncover and evaluate the underlying budgets, subsidies, and legislations that enable the creation of NbS throughout the global policy landscape. Policy search was done by automated web scraping, machine and manual validation of assessment criteria.

Building from a literature review to identify criteria for evaluating policy effectiveness, the policies included in the database were graded by basic, binary criteria that--according to best available science--are proven to provide the best outcomes for NbS.

This report describes the artificial intelligence (AI) policy search process, highlights the science-based policy assessment criteria, highlights case studies from the NbS Policy Tracker, collects key insights, and demonstrates possible ways forward.

NbS POLICY TRACKER:
Using Automated Algorithmic Processes to Identify
Policies that Enable Successful Nature-Based Solutions

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Case studies have been able to further identify where finance for NbS is flowing. In Madagascar, the National Plan for Sustainable Development (PND, DIABE) was implemented in 2020, funneling 3.5 million Euros worth of funding (95% from the European Union) for forestation and agricultural programs directed toward women and girls. In Kenya, the Kenya Climate Smart Agriculture Strategy (2017-2026) allocates 5 billion USD of funding over the course of the next six years with very clear objectives for inclusive natural climate solutions. The Fijian government passed a National Development Plan that integrates different NbS such as mangrove restoration, increasing forest area under long term conservation, and improved rice, with a 50 billion USD budget.

The full results of this project will be integrated into the upcoming Natural Climate Solution (NCS) Action Mapper, under development by The Nature Conservancy and Nature4Climate teams. The NCS Action Mapper will serve as an interactive online platform that groups together all relevant scientific information, data and knowledge in a unique and practical way to help practitioners and policymakers make better, more informed decisions on the deployment of NCS at national, regional and local levels. The Mapper will combine the NbS Policy Tracker, the existing NCS World Atlas and other NCS assessment tools and research carried from TNC and its partners.

James Lloyd
Director Nature4Climate

NbS POLICY TRACKER:
Using Automated Algorithmic Processes to Identify
Policies that Enable Successful Nature-Based Solutions

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Time is running out, and there is a need for transformative change within the next ten years. Movement toward a nature-positive economy, including halving global emissions towards a net zero by 2050 is possible. Our response to climate change requires a fundamental transformation across all global food, land, and ocean systems; infrastructure and the built environment; and extractives and energy. These systems represent over a third of the global economy and provide up to two-thirds of all jobs worldwide. This is the decade for decisive action, with the Paris Agreement, the UN Decade of Ecosystem Restoration and SDGs as accelerators.

Solutions exist. Nature is a powerful ally. We require more governments to harness its potential as a solution.

The prize for change is immense, and so is the cost. We strongly believe it is possible to bring the climate within 1.5C degrees, protect nature and biodiversity, ensure healthier diets, improve food security, and strengthen rural economies. Doing so could unlock 4.5 trillion USD in new business opportunities each year by 2030.

We have a unique opportunity to drive significant political commitment, regulations, and finances towards more sustainable food and land use systems. Governments have the power to unlock the incredible potential of nature-based solutions (NbS). To create a nature positive
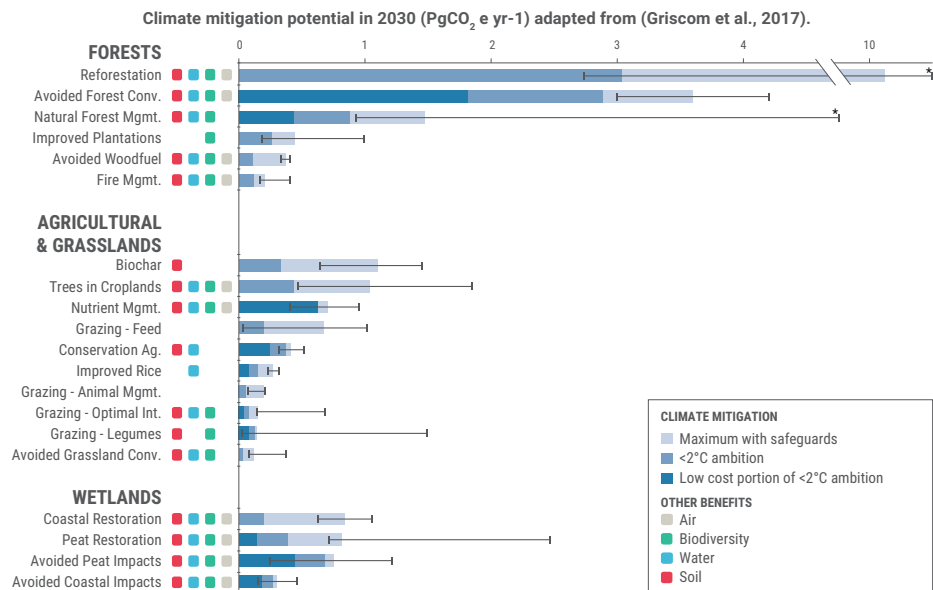
Figure 1: Climate mitigation potential of 20 natural pathways. We estimate maximum climate mitigation potential with safeguards for reference year 2030 (Griscom et al., 2017).

economy we must develop and implement frameworks that recognise the value of nature in decision-making, regulations and market mechanisms.

Action is already being taken but needs to be scaled up. NbS are available and must be designed in accordance with *principles* that responsibly tackle the climate crisis, restore biodiversity, and benefit planetary health and human well-being. State and non-state actors can reference the *IUCN Global Standard* on nature-based solutions to implement the necessary solutions. There is also a growing movement of governments, businesses, scientists, and communities worldwide calling for more nature-based solutions.

Each country must develop enabling policies for long-term targets and pathways supported by credible science as they update and fulfill their NDC commitments – policies designed to:

1. Transition food production, national dietary guidelines, and land-use with sustainable development, conservation, and climate goals. Policies should cover domestic production as well as the impact of imports and foreign aid and investments.

2. Strengthen land use planning and governance to manage competition and trade-offs across different users, support Indigenous and community land tenure, and deliver national economic, social, rights, health and environmental goals that enhance long-term resilience of economies, communities, and ecosystems.

3. Support development and agricultural practices that enable and accelerate the transition to resilient and sustainable food and land use, including fully valuing natural capital, repurposing agricultural subsidies and social assistance to guarantee access to affordable and nutritious food for lower income groups.

4. Prioritize greater investment in insurance, innovation, and education to help local and Indigenous Peoples and vulnerable populations build resilience, and mobilize capital and knowledge including indigenous people's traditional knowledge.

5. Promote economic incentives, equity, and social justice in the transition to net zero, nature positive sustainable food, and land use and the provision of sustainable consumption.

This report accompanies the Nature Policy Tracker. The NbS enabling policies identified in the first iteration of this AI search exercise will be available on N4C's website and further integrated into the NCS Action Mapper.
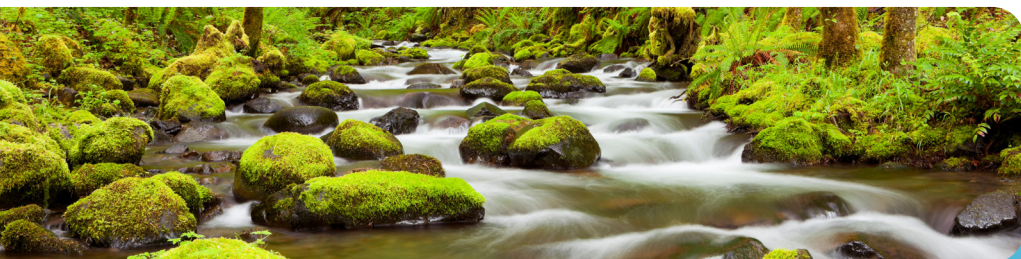
NbS POLICY DATABASE

Governments must incorporate NbS enabling actions in National legislation that considers a wide-range of activities such as national development plans, agricultural policies, and climate action legislation.

The NbS Policy Tracker database bridges an important climate policy tracking gap. The database identifies effective government initiatives, particularly: budgets, legislation and subsidies. Over 220 policies across 80 countries were identified in this initial report. Future versions will include more policies across more countries as we refine our search algorithm to include more languages and search terms. Most policies fall in the categories of coastal restoration (13.6%), followed by deforestation (11.4%), community-led conservation (10.8%), and reforestation (10.4%). Other common themes include protection of natural areas, restoration, mobilization of funds to support/fund NbS projects, increasing research for monitoring, and providing payment for ecosystem services.

After a thorough analysis of these policies, we have identified some best practices:

|	
90%	**of policies recognise the importance of inclusivity, involving stakeholders across society - including local communities, businesses and government**
48%	**include Indigenous Peoples and Local Communities**
44%	**focus on large landscapes, from watersheds to large forests, linking different ecosystems and their populations**
67%	**have allocated budgets**
62%	**have plans to monitor effectiveness**

To illustrate our methodology, we have highlighted 11 policies that provide examples of policies that enable NbS policy. These were collected using our automated search process and the results reviewed in detail to demonstrate the utility of this approach across different geographies.
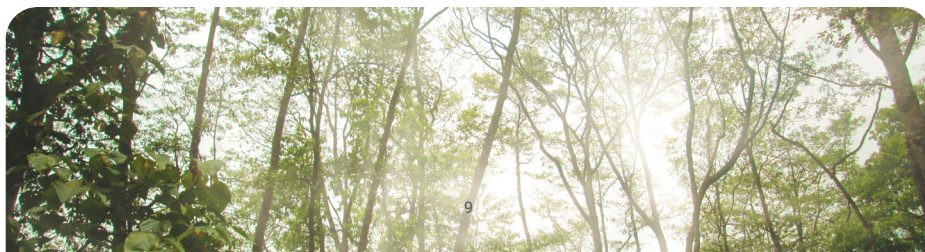
DATABASE DEVELOPMENT ▶

The database includes policies, budgets, and subsidies. We have used automated web scraping to scan the web and identify policies enabling NbS across the different countries (see appendix for the full list). Public policies available in English and published since the Paris Agreement were considered during this preliminary phase.

Six criteria were established to determine which aspects of policies are responsible for the success of NbS. We do not claim that this search is exhaustive, but rather a way of collating as many policies as possible for NbS. We intend, in the near future, to further refine, expand the countries and categories, including documents available in other languages. In the meantime, we welcome comments and suggestions from the public regarding the search process in order to improve the NbS Policy Tracker.

This policy database uses a highly automated algorithmic search process, consisting of four main steps, as shown in figure 2. First, we scanned the internet for sources that fit our initial queries (see supplemental table 1 in appendix for query list). Then, we extracted policies from sources. We manually validated the policy and adjusted the scope of the search algorithm. Three rounds of validation were performed to assure the accuracy of the results.

Source Collection → **Policy Extraction** → **Policy Qualification** ↔ **Validation**

Figure 2: Flow chart outlining the four steps used to identify results based on web scraping and validating results.

1. Source Collection (Algorithmic)
- Construed list of target countries and NbS related topics.
- Automated search and collection of content from online sources for each topic and country of interest within relevant time period.

2. Policy Extraction (Algorithmic)
- Extracted policy related content from sources and built the initial policy data pool from those sources.

3. Policy Qualification (Algorithmic)
- Identified policy titles and key content phrases.
- Categorized each source based on the target topics of interest.
- Indexed each policy semantically against the six criteria.
- Analyzed and qualified each policy based on publication date (and timeline).

4. Validation (Manual)
- Reviewed the results from the policy qualification step.
- Sent feedback to the algorithm and improved policy qualification accuracy over iterations.

CRITERIA DEVELOPMENT ▶

The criteria are as follows:

|	CRITERIA 1	CRITERIA 2	CRITERIA 3	CRITERIA 4	CRITERIA 5	CRITERIA 6
	Budget	**IPLC Knowledge**	**Prioritization of avoidance**	**Inclusivity**	**Science-based MRV**	**Landscape-level intervention**
Description	The policy has a clearly allocated budget.	The policy includes Indigenous Peoples and Local Communities (IPLC) in establishment, maintenance, monitoring, and budget.	The policy interventions prioritize avoidance of destruction of intact ecosystems.	The policy includes whole-of-society involvement: businesses, local community, etc. involved in the NbS.	The policy includes a monitoring plan and Key Performance Indicators (KPIs) based on best available science for the NbS.	The policy emphasizes landscape level interventions considering different spatial scales.
Semantic Search Terms	Budget, $	Indigenous, tribe, IPLC, traditional indigenous knowledge, involvement of traditional land holders	Protect, avoid, remain, avoid/prevent destruction	Societal challenges, stakeholders, company, business, community	Monitoring, reporting, verifications (MRV), indicators, KPIs, measurement, science	Landscape, spatial scale
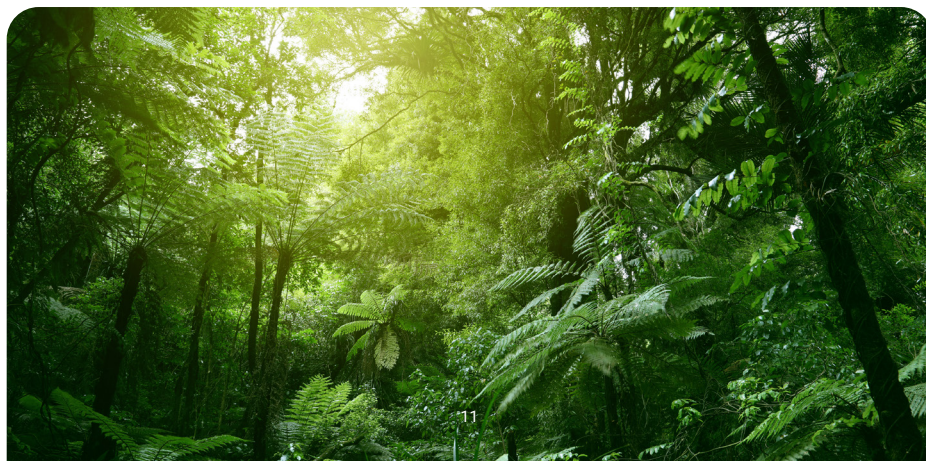
💲 BUDGET

Policies with an allocated budget.

Current NbS funding is insufficient and estimates show that there will be a funding gap for NbS of up to 4.1 trillion USD by 2050 (Dasgupta, 2021). Reallocating finances and subsidies toward NbS is essential to fill this gap (Cornelius & Pérez-Cirera., 2021). According to the European Commission, funding pathways for NbS are complicated due to their cross-cutting political nature (European Commission, 2020). Examples of where NbS funding can be designated are: data collection, restoration, and monitoring (i.e. weather stations). When reliable, long term NbS funding is achieved, it is easier to leverage other financing opportunities (Cornelius & Pérez-Cirera., 2021). Therefore, legislation that provides funding for protecting natural capital and ecosystem services are essential.

🧠 IPLC KNOWLEDGE

Policies that include Indigenous Peoples and Local Communities (IPLC) in establishment, maintenance, monitoring, and budget.

Science is coalescing with traditional knowledge. Climate science should be inclusive of various knowledge systems. Indigenous Peoples have been stewards of nature for millenia. IPLCs, making up less than 5% of the world population, protect 80% of biodiversity across forests, deserts, grasslands, and marine environments around the globe (World Wildlife Fund [WWF], 2020). NbS that have a proper structure and are based on science and/or traditional knowledge safeguard the survival of existing ecosystems and livelihoods, being key to preserving these environments. Ensuring that policies are appropriate to local context, considerate towards traditional knowledge and co-designed alongside knowledge holders improve the success of NbS (Cohen-Shacham et al., 2019). Inclusive governance has proven to be an indicator of success for NbS, especially in climate-vulnerable areas (Cornelius & Pérez-Cirera, 2021; Seddon et al., 2021; Townsend et al., 2020).

🦴 PRIORITIZATION OF AVOIDANCE

Policy interventions that prioritize avoidance of the destruction of intact ecosystems.

The most effective NbS for climate are specifically designed to enhance and/or protect biodiversity and support healthy and resilient ecosystems (Seddon et al., 2021). The mitigation hierarchy for nature conservation, which prioritizes environmental intervention on preference for the environment includes 1) avoid, 2) minimize, 3) remediate, and 4) offset (Arlidge, 2018). NbS that avoid impact have proven to be more reliable, more effective ecologically, and more likely to result in a no-net-loss outcome than restoring damaged territories (Chausson et al., 2020; Lindenmayer et al., 2017; Watson & Ventor, 2017). Such NbS are at times also the most cost effective (Cross Sector Biodiversity Initiative, 2015). When it comes to drafting policies, prioritizing avoidance might mean protecting existing biodiversity, clear guidance on critical biodiversity areas, and setting aside areas of high societal value (Arlidge, 2018).

👥 INCLUSIVITY

Policies that include wide areas of involvement: businesses, local communities, NGOs, governments, etc. to address societal challenges.

Promoting multi-stakeholder involvement and engagement enables meaningful partnerships between public and private stakeholders within a landscape. Together, these partnerships contribute to the implementation of NbS with a joint, long term vision. Multi-stakeholder involvement can also enhance connectivity, biodiversity and carbon sequestration, whilst also addressing societal challenges (such as equal benefit distribution among relevant actors) (Cornelius & Pérez-Cirera, 2021). Including stakeholders in NbS policy design and implementation also ensures inclusion of those living near the affected area, and helps NbS practitioners enable context-appropriate solutions and objectives, as well as mobilize diversified funding. NbS policies have frequently provided services for governments and communities distant from the implementation site, but including many local stakeholders leads to effective NbS outcomes (Cohen-Shacham et al., 2019). Additionally, as NbS can benefit a wide range of sectors, policies that include local stakeholders can help secure different types of funding for joint initiatives (Cornelius, & Pérez-Cirera, 2021). Furthermore, stakeholders can provide additional input on potential outcomes of NbS (e.g., between ecosystem services and society). This input from stakeholders can support practitioners in determining NbS which are context appropriate and can help establish impact assessment objectives (Dumitru & Wendling, 2021).

📊 SCIENCE-BASED MONITORING, REPORTING, AND VERIFICATION (MRV)

Policies that include a monitoring plan and Key Performance Indicators (KPIs) based on best available science for the NbS.

Within NbS policy design and implementation, scientific evidence is used for setting targets, planning, governance, and coherence across policy goals (Chausson et al., 2020). A lack of clear definitions, guidelines, metrics, and methodologies to track, quantify, and value NbS can substantially restrict the development and financing of NbS (Swann et al., 2021). For NbS to be sustainable long-term, policy should include assessment criteria addressing the efficacy and effects of intervention (McShane & Wells, 2004). Successful monitoring and assessing can be achieved by creating a monitoring and evaluation plan for the entire duration of the project,which allows for iterative learning and enables adaptive management (International Union for Conservation of Nature [IUCN], 2020). Using appropriate performance indicators provide credible evidence on achievements and outcomes (Dumitru, & Wendling, 2021), since identified, benchmarked, and periodically assessed KPIs (IUCN, 2020) help to measure impacts and track the progress of a certain NbS against national and international commitments(Cornelius & Pérez-Cirera, 2021; IUCN, 2020). Plans for NbS data collection encourage time series comparison for effective and impactful measurement of KPIs (Dumitru & Wendling, 2021, Calliari et al. 2019).

🌾 LANDSCAPE LEVEL INTERVENTION

Policies that emphasize landscape level interventions considering different spatial scales.

NbS can range greatly in scale (Dumitru & Wendling, 2021). The IUCN (2020) reports that current NbS projects are not large enough in scale. This affects the ability of the project to mediate upstream and downstream relationships, dependencies, and benefits (Cohen-Shacham et al., 2016). Considering a landscape (the landforms and the people who inhabit it) and building NbS with this scale in mind allows for consideration of larger ecological processes and interactions (Selman, 2006), and provides spatial information for effective NbS design (Albert et al., 2020). NbS projects should therefore be upscaled (to the level of a landscape) whenever possible (Cohen-Shacham et al., 2019). Scaling up NbS to the landscape scale also increases the potential to enhance climate mitigation, resilience, and adaptation as well as improve the lives of local residents and address biodiversity loss (Cornelius, & Pérez-Cirera, 2021). Lastly, NbS design is informed by the landscape's features, scale, and community members finding synergies between the economy, society, and ecosystem (IUCN, 2020a).

CASE STUDY 1
CAMEROON

Policy: *Cameroon Rubber Accord, 2019*
Relevant NbS Categories: Deforestation, Improved Plantation, Reforestation

Summary

A multi-stakeholder group in Cameroon created the Cameroon Rubber Accord to protect the environment and human rights within rubber growing areas. This accord outlined both formal and informal channels for grievances to ensure that the company's obligations were being met. The sustainability grievances site scaled to include grievances beyond the Cameroon rubber industry.

Criteria

Inclusivity:

• Smallholders, a rubber company, NGOs, and local governments came together to draft a plan to protect rubber producing landscapes. To ensure the long term satisfaction of all parties remaining content with the accord, the stakeholders set up a grievances system for accountability.

Landscape level:

• This accord brought together all the stakeholders at a landscape level. The parties that designed and agreed to the policy are part of the rubber production industry in Cameroon.
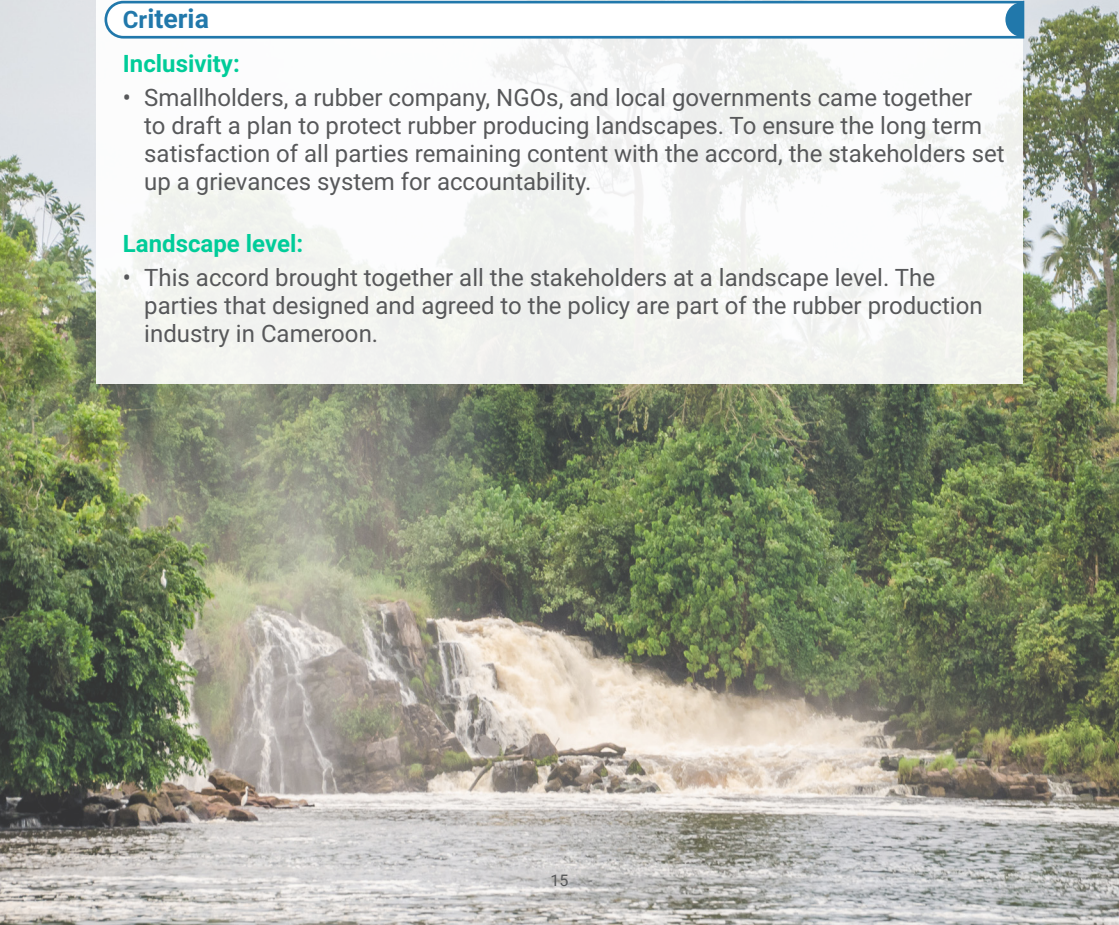
CHINA

Policy: _Forest Law (Amendment) 2020_
Relevant NbS Categories: Reforestation

Summary

China's recently amended Forest Law introduces improvements that enable NbS in forest management. Instead of solely focusing on timber production, the revised law also looks at balancing the role of forests in providing economic, social, ecological and cultural benefits.

Criteria

MRV:

- The law makes it possible to use natural classification systems and allocates specific resources to enhance science-based protection and restoration of ecosystems.

Prioritization of Avoidance:

- The law provides regulations for protecting and managing forests for more than just financial gains. It introduces the importance of environmental value of forests. The new regulations include the protection of rivers, catchment areas, wetlands, reservoirs, nature reserves, forests, and more. In addition to providing better protection for these areas, the law also restricts illegal timber mining and improves the Forest Harvesting Quota and Harvesting Licensing System. The law further protects forest tenure, introducing stronger protections of the rights of private forest right holders.

COLOMBIA

Policy: *National Development Plan, 2020*
Relevant NbS Categories: Carbon Sink, Conservation Investment, Deforestation

Summary

The National Development Plan (NDP) 2018-22 "Pacto por Colombia, Pacto por la equidad" aims to boost equality, entrepreneurship and legal means for preventing deforestation. Cross-cutting areas include environmental sustainability; science, technology and innovation; transport and logistics; digital transformation; public services in water and energy; mining resources; identity and creativity; peace building; ethnic groups; people with disabilities; and equality for women. The plan includes a chapter named Agreement for Sustainability which describes actions to halt deforestation and mitigating climate change.
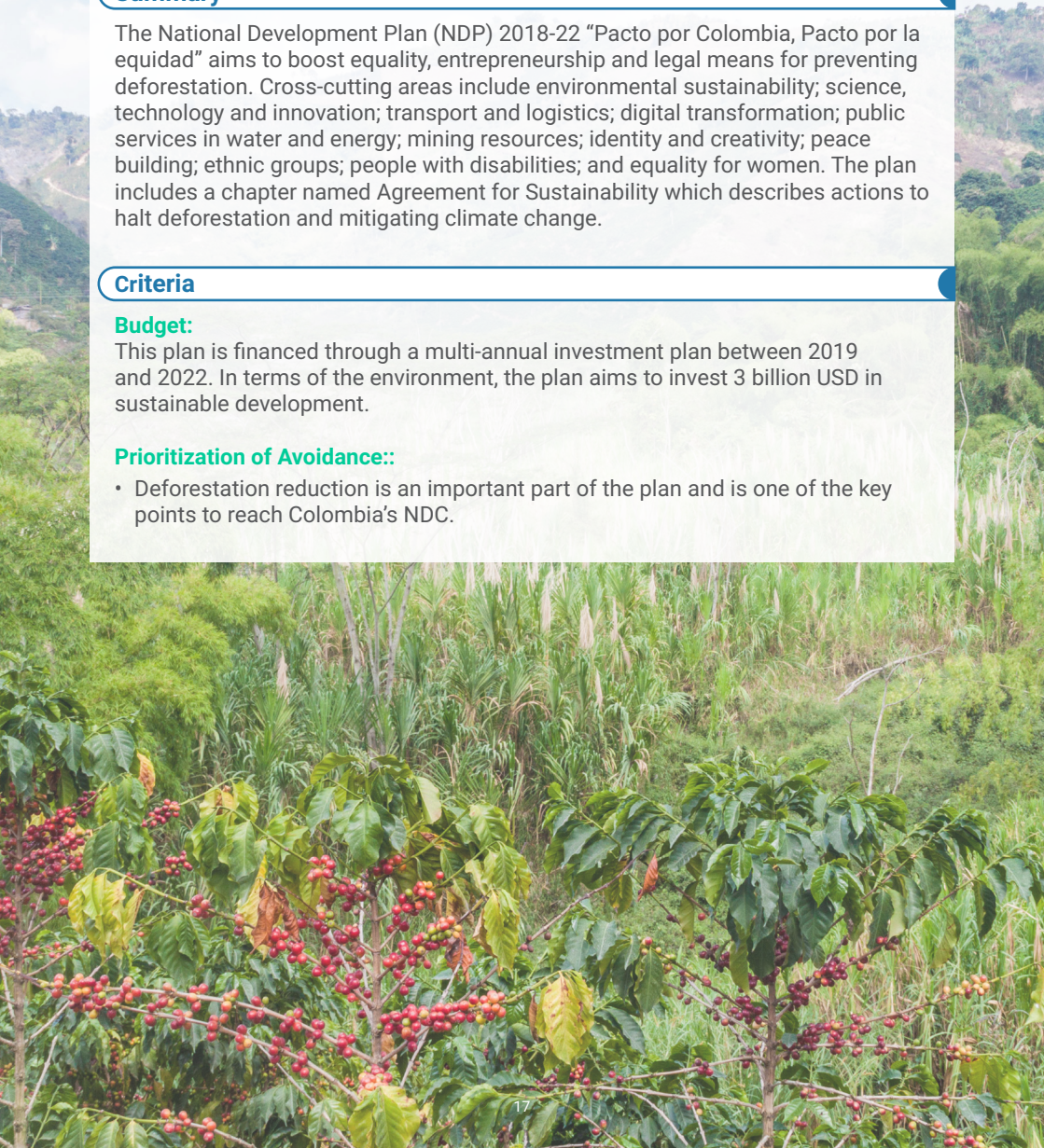
Criteria

Budget:

This plan is financed through a multi-annual investment plan between 2019 and 2022. In terms of the environment, the plan aims to invest 3 billion USD in sustainable development.

Prioritization of Avoidance::

- Deforestation reduction is an important part of the plan and is one of the key points to reach Colombia's NDC.

FIJI

Policy: *National Development Plan, 2017*
Relevant NbS Categories: Carbon Sink, Coastal Restoration, Mangroves

Summary

This policy is an overarching development plan that includes clauses on reducing climate change mitigation and involves NbS in the agricultural, forestry, and fishery industries. Some examples of NbS that are included are mangrove restoration, increasing forest area under long term conservation, and improved rice production.

Criteria

Budget:

• There is a 50 billion USD budget allocated to this development plan.

IPLC Knowledge:

• A clear goal listed as part of the policy is to preserve Fijian cultural heritage. In particular, the policy aims to develop a digital archival system to "preserve sacred indigenous records (Vola-ni-Kawa-Bula) to safeguard the tribal knowledge and protocol of the iTaukei".

MRV:

• Clear indicators are assigned to each of the actions that form part of the development plan. There are specific programmes, target dates, expected outputs, and lead responsible agencies for each of the objectives within the policy.

Time Frame:

• The policy has two clear implementation time frames. There is clear guidance on NbS actions in the next five years and a set vision for the next twenty years. Part of the MRV is the policy outlining clear completion deadlines for each of the objectives.

KENYA

Policy: *Kenya Climate Smart Agriculture Strategy 2017-2026*
Relevant NbS Category: Carbon Sinks, Conservation Investment, Improved Rice

Summary

Kenya Climate Smart Agriculture Strategy 2017-2026 harmonizes agriculture, development, and climate change objectives under a single, cohesive policy addressing climate smart agriculture (CSA). The policy has a budget of 5 billion USD from diverse sources over a set amount of time. The policy aims to develop agricultural NbS by improving farmer livelihoods (i.e. providing insurance and increasing productivity/profitability), diversification of agricultural products, baselining natural capital assets, and improving rice cultivation.

Criteria

Budget:
- There is a clear budget (5 billion USD) outlined for each activity within the policy as well as the key activities the policy focuses on.

Inclusivity:
- The policy covers different public and private stakeholders. Each of the relevant stakeholders are listed in the implementation index alongside the key activities.

IPLC Knowledge:
- One of the strategies outlined in the policy document is to preserve species with an "adaptive capacity". A key government action underneath this strategy as defined in the implementation annex is to collect data and information on indigenous knowledge with a clear budget. The knowledge building and coordination also includes unification with indigenous knowledge and allocates a budget for the activity.

MRV:
- There is a clear monitoring, reporting and verification plan outlined in the implementation index. Each of the components of the MRV plan has a list of relevant stakeholders and a clear budget.

Time Frame:
- The implementation annex has an indicated timeline for every activity with the activity starting with the most pressing timeline at the top of the list.

MADAGASCAR/EUROPEAN UNION

Policy: *National Plan for Sustainable Development (PND) - DIABE, 2020*
Relevant NbS Categories: Reforestation, Improved plantation, Avoided woodfuel

Summary

The main objective of the National Plan for Sustainable Development (PND) is to contribute to the sustainable increase of income and food security of rural households, particularly women and children, while at the same time preserving the natural environment in the peri-urban area of Antananarivo, Madagascar.

Criteria

Budget:
• The 3.5 million euro DIABE project was launched in November 2020 with the financial support of the European Commission. The project stretches seventy-nine villages in nine districts of the Analamanga, Itasy and Alaotra-Mangoro regions in Madagascar. This project has been 95% funded by the European Union.

Inclusivity:
• The project has six project partners, including NGOs, research organizations, and local and international governments. The project also aims to involve locals by providing training and workshops.

IPLC Knowledge:
• The project aims to enhance environmental awareness by providing workshops and training for local nurserymen and foresters.

NEPAL

Policy: _National Agroforestry Policy, 2019_
Relevant NbS Category: Reforestation, Trees in Cropland

Summary

Goals of the National Agroforestry Policy are to increase the productivity of agricultural/forestry land by ensuring it services multipurposes. The policy provides mechanisms to reduce pressure on biodiverse forests. This pressure is released through policy that facilitates finance for farmers and for science-based MRV. The policy is designed to improve capacity building for tree planting in the right places.

Criteria

Inclusivity:
- The policy includes a coordination committee consisting of multiple government agencies, universities, farmer cooperatives, and forestry groups.

Landscape level:
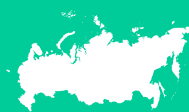- The policy includes a geospatial assessment of Nepal to understand where tree planting is beneficial.

MRV:
- Mechanisms for monitoring and evaluation of agroforestry are included on federal, provincial, and local levels to ensure long term success and flexibility to adjust the policy when necessary.

RUSSIA

Policy: ***Forest Code of the Russian Federation, 2020***
Relevant NbS Category: Community Conservation, Deforestation, Improved plantation, Mangroves, Reforestation

Summary

This policy was developed to create a Russian economic and environmental forestry plan. It is a holistic forestry policy that uses best available science as guidance. The policy champions changing monoculture forestry plantations into more biodiverse forests.

Criteria

Landscape level:

• The policy outlines possible logging options. Instead of clearing entire forest areas, the forest is kept and legal cutting areas defined on a case by case basis, preventing the devastation of forests.

Time Frame:

• The policy includes a timeline clause for implementation of the project that protects long term forestry management rather than. This clause gives the forestry management planning a long-term strategy and enables the sustainable use of forests for future generations.

SAINT KITTS AND NEVIS

Policy: _National Conservation and Environmental Management Bill, 2020_
Relevant NbS Category: Community Conservation, Grazing, Mangroves, Reforestation, Wetlands

Summary

The National Conservation and Environmental Management Bill (2020) outlines national laws around protected areas, resource management, ecosystems, and soils. The bill addresses which stakeholders participate and establishes a new National Environmental Council to oversee implementation of the policy.

Criteria

MRV:

• There is a clear monitoring plan in place for the policy's implementation which contains a set timeline. The policy states: "the department shall review the coastal zone management plan at least once every five years after the date on which it was approved and where appropriate, make changes to the plan."

Inclusivity:

• The bill requires a national council to be appointed to build capacity among stakeholders and be ultimately responsible for the inclusion of stakeholders across society. This inclusion will also feature international stakeholders to help implement the different policy objectives.

Prioritization of Avoidance:

• The policy declares watersheds a part of natural resource management. The legislation also aims to prevent chemical exposure to humans and the environment by closely monitoring the use of chemicals.

UNITED KINGDOM

Policy: *England Peat Action Plan, 2021*
Relevant NbS Categories: Peat Restoration

Summary

The England Peat Action Plan sets out the government's long-term vision for the management, protection and restoration of peatlands, as peatlands provide a wide range of benefits to wildlife, people and the planet in general.

Criteria

Budget:

• The plan immediately funds at least 35,000 ha of peatland restoration by 2025, through the Nature4Climate Fund and other sources. The government's new Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery Schemes will then provide support for peatland restoration after 2024-2025, and Nature for Climate grants will act as an important precursor. The plan will also drive private investments in peatland restoration through natural capital markets that allow the accreditation and sale of the ecosystem services that healthy peatlands can provide.

MRV:

• The plan provides a comprehensive set of metrics, through which progress can be measured, reviewed and revised. The results will be published in 2023. This 2023 assessment will also determine whether other steps are required to further improve the environment, including peatland. Following the assessment, Natural England will publish an Implementation Plan, which will provide a more detailed trajectory to recovery by 2050, including five year targets.

Inclusivity:

• The plan outlines multi stakeholder involvement with the aim to continue the plan's development, and to get peatland back on the road to recovery. The plan will achieve this recovery by encouraging stakeholders to take several actions, such as applying for funds, providing input, working together on development of planning, tools, mapping, and more.

Prioritization of Avoidance:

• The plan aims to protect and restore existing peatland back to healthy, well-functioning ecosystems rich in wildlife. The plan outlines a Nature Recovery Network creating and restoring 500,000 hectares of wildlife rich peatland.

VANUATU

Policy: *The Vanuatu National Environment Policy and Implementation Plan 2016–2030*
Relevant NbS Category: Mangroves

Summary

This legislation aims to align various policies, including national policy surrounding biodiversity protection, sustainable resource management, climate change and finance and capacity building.

Criteria

Inclusivity:

• The policy includes capacity building provisions for data sharing throughout different government agencies as well as the educational system. The policy provides guidance for how donors and NGOs can participate in NbS throughout Vanuatu. There is also an annex with the implementation plan that clearly outlines which stakeholders are involved in certain aspects of the policy.

IPLC Knowledge:

• The policy integrates conservation with traditional knowledge and practices, rather than isolating the area from all human activities. One of the indicators of success for the policy is the "number of awareness activities promoting traditional knowledge and practices related to biodiversity conservation"".

MRV:

• The policy outlines clear targets and indicators to measure whether targets are being met. Some examples of indicators are the type of IPLC educational materials used in schools, biosecurity bills that aim to be turned into legislation, and the number of marine protected areas.

KEY INSIGHTS ▶

The results provide valuable key insights into the global policy landscape and important considerations for the future. These keys shed light on the feasibility of using AI tracking, the role of finance in case studies, and semantic insights.

FEASIBILITY

This project illustrates that AI can track policy. Automated web scraping and algorithmic searches can be helpful in identifying policies that provide shining examples of policies that enable NbS for other policies to emulate. We call these policies "case studies". The output of the algorithm has been manually validated three times to improve accuracy. More detailed validation can increase the comprehensiveness of the collected NbS policies. Machines can scan faster and collect a wider range of policies than humans. However, manual review is still a key part of the AI refinement process.

FINANCE & CASE STUDIES

By highlighting the case studies, we have identified where finance is being directed for NbS. In Madagascar, the National Plan for Sustainable Development (PND, DIABE) was implemented in 2020 providing 3.5 million euros (95% from the European Union) for forestry and agricultural programs directed toward women and girls. In Kenya the Kenya Climate Smart Agriculture Strategy (2017-2026) allocates 5 billion USD in funding in the next six years with very clear objectives for inclusive natural climate solutions. The Fijian government passed a National Development Plan that integrates many NbS (mangrove restoration, increasing forest area under long term conservation, and improved rice) with a 50 billion USD budget.

SEMANTIC INSIGHTS

The searches used for this exercise led to the collection of NbS policies from a wide range of countries and topics (see supplemental figure 1 in appendix for country list). Finding the right keywords depends on the specific identifying terms.

Policy titles are very diverse and have proven to be one of the most challenging aspects of the project. Some terms we have found useful to find relevant policies include: Plan, Directive, Directory, Deal, Protected (Area), Reserve, Act, Project, Policy, Bill, Action, Agreement, Initiative, Proclamation, Program/Programme, and Project. Removing semantic indicators for websites that included research (i.e. researchgate) was also helpful in identifying sources describing policies.

POSSIBLE PATHWAYS FOR EXPANSION AND REFINEMENT ▶

The first version of the Nature-based Solutions (NbS) Policy explored the possibilities of using AI. We do not assert that the outputs are exhaustive, rather a first attempt at gathering relevant NbS policies. To ensure accuracy in this exercise, we limited the scope of the assessment and number of policies included in the analysis.

- The web search in English only.
- The search process was designed to identify legislation, subsidies, and budgets.
- Though the initial web search was fairly comprehensive, we prioritized accuracy over comprehensiveness, meaning that the results represent only a small number of policies available at the present moment.
- The research focused on identifying policies currently enacted, and does not consider proposed or draft policies or nonbinding plans, such as road maps or frameworks.
- Included active policies from 2016 onward.
- The NbS Policy Tracker uses the latest science to create criteria for semantically scoring the policies, based on the identified criteria. Currently, the tracker does not connect the actual implementation or outcomes with the written policy, meaning the tracker cannot measure whether objectives or goals are being accomplished or are beneficial.

This project is the tip of the algorithmic policy analysis iceberg, so to speak .
In the future, we aim to build a more comprehensive NbS policy tracker. This
version represents a minimum viable product with many opportunities to enhance
comprehensiveness, effectiveness, and accuracy.

Some of the directions this project will continue to explore include:

Expanding the current policy database

- Expanding the scope to include other languages.
- Increasing the size and comprehensiveness of the policy database with more manual
validation.
- Developing an input system that includes crowdsourced validation
- Making automated policy updates possible.

Expanding the analyzed criteria

- Explore further semantic relationships to include more complex criteria. These
complex criteria can include 'time frame' and 'human rights based approaches', for
example. This exploration of further semantic relationships can be done through
additional research and coding of the algorithm to better identify the presence of
time frame.

  *For example we have not explored IPLC territorial rights, empowering local control, or
  investing in communities for sustainable livelihoods. In the future versions, we aim to
  include more nuance and human rights based semantic search.*

- Developing an algorithmic search to pull up financial policy information.

Connecting the database with NDCs and NbS outcomes

- Connecting the NbS Policy Tracker with an NbS outcome tracker. We could expand
this database and develop it in such a way that it is possible to include a more robust
selection of NbS than are available in the database.
- Performing a gap analysis on NDCs by using automated web scraping and emission
modeling. This analysis would connect the emission reductions associated with the
NbS policies in the NbS database to the NDC for each country.
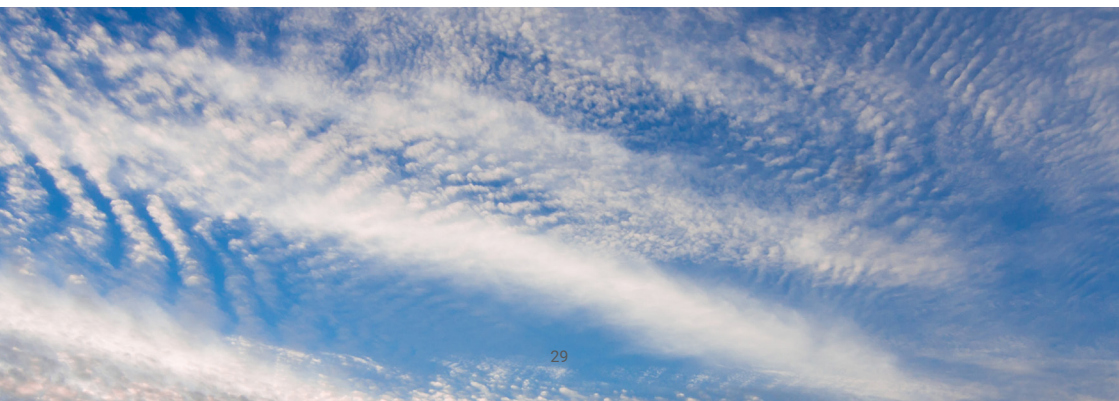
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Semantic Search for NbS in Policy

Supplemental Table 1: The search queries used to scrape the web for relevant NbS policies

GENERAL TERMS
Bill | act | legislation
Fund | subsidy
Policy | governance | commitment | action plan

TOPIC NAME	QUERY
Agriculture Carbon	Carbon farming
Carbon Sinks	Carbon sinks | carbon capture
Communities & Conservation	Environmental steward | community conservation
Conservation & Corporations	Community conservation
Conservation & Investment	Green finance | impact investment
Conservation & Technologies	Green tech | tech4good
Cover Crops	Cover crop
Deforestation	Deforestation
Mangroves	Mangrove protection
Natural Climate Solutions	Natural climate solution
Regenerative Agriculture	Regenerative agriculture
Soils	Healthy soil
Wetlands	Wetland protection
Reforestation / Avoided forest conversion / Natural forest management	Forest conversion | natural forest management
Improved plantation	Plantation
Avoided woodfuel	Woodfuel
Fire management	Peat fire | savana fire | prescribed fire
Biochar	Biochar
Trees in cropland	Cropland
Nutrient management	Nutrition management
Grazing, feed; Grazing, animal management; Grazing, optimum intensity; Grazing, legumes	Grazing
Improved rice	Improved rice
Avoided grassland conversion	Grassland
Peat restoration / Avoided peat impact	Peatland
Coastal restoration / Avoided coastal impact	Coastal restoration

Countries included:

Supplemental Figure 1: Country coverage of NbS enabling policies captured in this exercise.
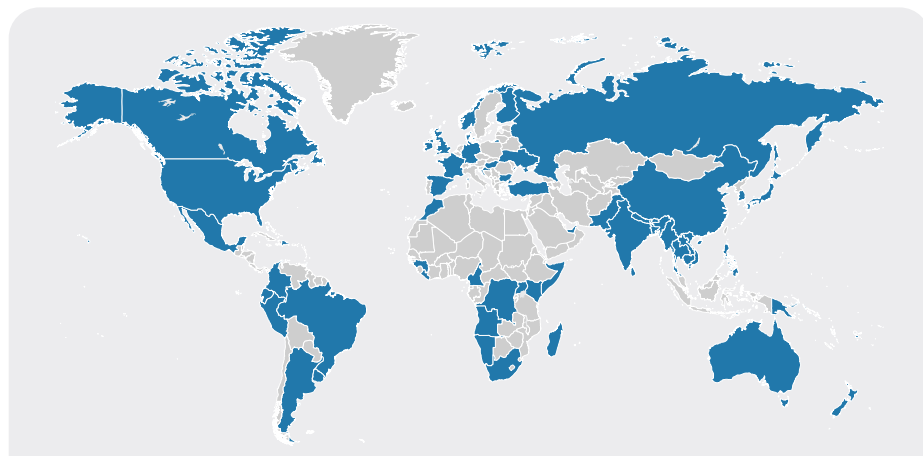
Angola	Dominican Republic	Latvia	Rwanda
Argentina	El Salvador	Liberia	Saint Kitts and Nevis
Australia	European Union	Madagascar	Saint Lucia
Bahamas	Fiji	Mauritius	Saint Vincent and the Grenadines
Bangladesh	Finland	United States	Singapore
Brazil	France	Mexico	Somalia
Brunei Darussalam	Germany	Morocco	South Africa
Bulgaria	Grenada	Myanmar	Spain
Cambodia	Guinea	Namibia	Sri Lanka
Cameroon	Guyana	Nepal	Switzerland
Canada	Japan	New Zealand	Timor-Leste
China	Thailand	Norway	Trinidad and Tobago
Colombia	Honduras	Pakistan	Turkey
Ecuador	Hungary	Papua New Guinea	Uganda
United States of America	India	Peru	Ukraine
Congo	Ireland	Philippines	United Arab Emirates
Croatia	United Kingdom	Portugal	United Kingdom
Cyprus	Jamaica	Qatar	Uruguay
Denmark	Kenya	Republic of Korea	Vanuatu
Dominica	Lao People's Democratic Republic	Russian Federation	Viet Nam