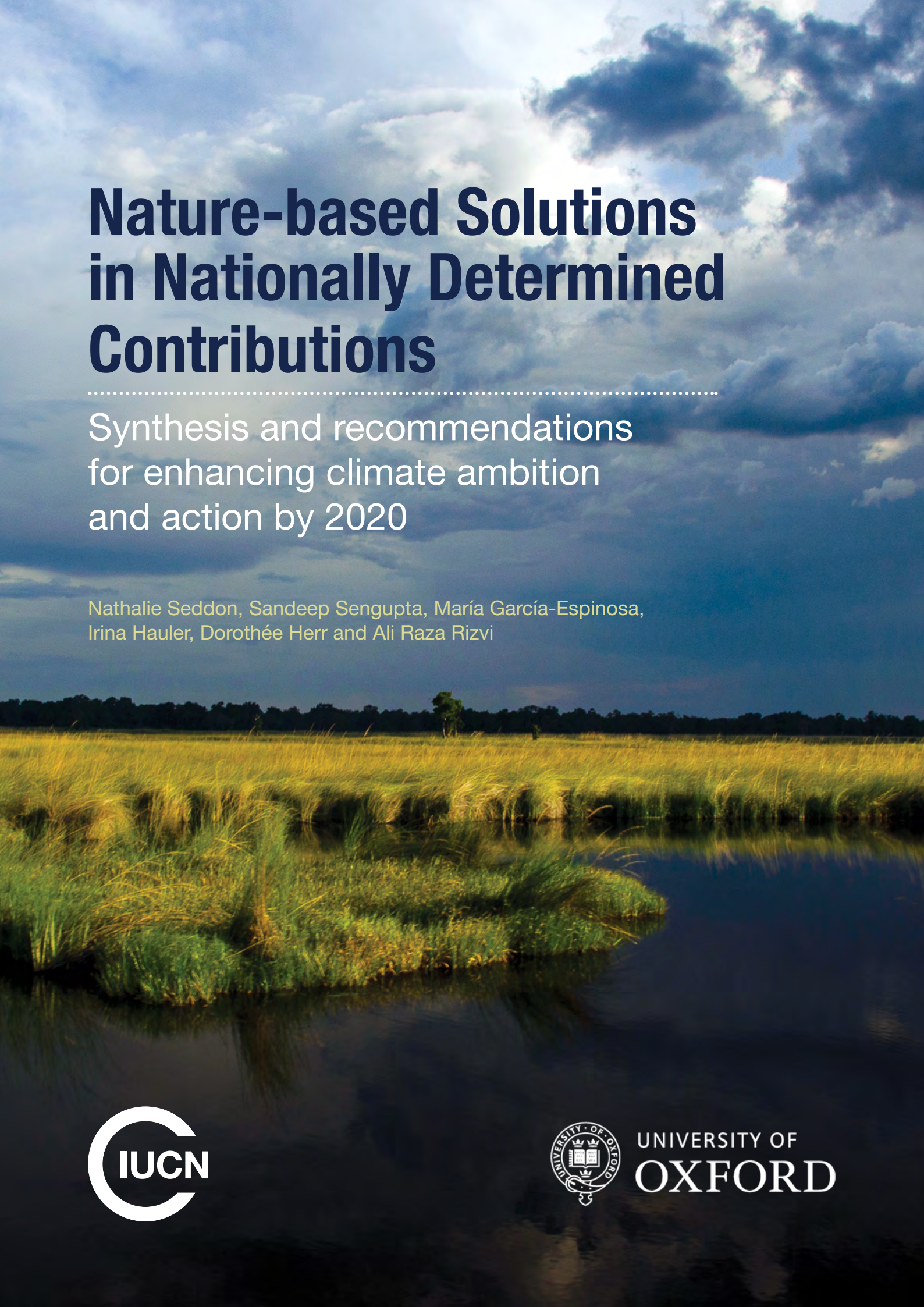

Nature-based Solutions in Nationally Determined Contributions

Synthesis and recommendations for enhancing climate ambition and action by 2020

Nathalie Seddon, Sandeep Sengupta, María García-Espinosa, Irina Hauler, Dorothée Herr and Ali Raza Rizvi

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UNIVERSITY OF OXFORD

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Abbreviations and acronyms

CBD	Convention on Biological Diversity
DRR	Disaster Risk Reduction
EbA	Ecosystem-based Adaptation
EEZ	Exclusive Economic Zone
FLR	Forest Landscape Restoration
GHG	Greenhouse Gas
ICZM	Integrated Coastal Zone Management
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
MFF	Marine Focus Factor
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NbS	Nature-based Solution
NDC	Nationally Determined Contribution
REDD+	Reducing emissions from deforestation and forest degradation, including the conservation, sustainable management of forests and enhancement of forest carbon stocks
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change

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Executive summary

Nature-based Solutions (NbS)[1] – centred on the protection, restoration and sustainable management of the world's ecosystems – have a vitally important role to play in addressing both the causes and consequences of climate change. Recent research suggests that NbS could provide around 30% of the cost-effective mitigation that is needed by 2030 to stabilise warming to below 2°C. Recent research also demonstrates how NbS can help protect vulnerable communities from the impacts of climate change while providing a range of other benefits for society. As countries revise or prepare new Nationally Determined Contributions (NDCs) in support of the Paris Agreement in the run-up to 2020, there is a major opportunity to increase global ambition on climate change through strengthening the role of these natural solutions.

> Nature-based Solutions have a vitally important role to play in addressing both the causes and consequences of climate change

To support the increased uptake of NbS in future NDCs, this report presents an overview of the current level of ambition for nature within them, and highlights what can be done further to fully harness the potential of NbS in global climate action going forward. This is based on an analysis of several major comparative assessments of nature's prominence (biodiversity and ecosystems) in NDCs to date. We analyse the framings, methods and results of these different studies, and identify a set of clear common findings. On this basis, we develop recommendations for the consideration of policy makers on how climate ambition within future NDCs can be raised through the more substantive inclusion of NbS.

Opportunities to strengthen the prominence of Nature-based Solutions in NDCs

This report finds that despite significant variation among the studies reviewed – in numbers and regional distribution of NDCs assessed, definitions, typologies and methods used – they nevertheless share some broad common findings.

1 Nature-based solutions are defined by IUCN as 'actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits', Resolution 69, adopted by 1,300+ IUCN State and NGO Members at the 2016 IUCN World Conservation Congress, Hawaii, USA.

The best evidence suggests that:

- **The majority of NDCs include NbS in one form or another.** At least 66% of Paris Agreement signatories include NbS in some form to help achieve their climate change mitigation and/or adaptation goals.

- **But more concrete, evidence-based targets for NbS are urgently needed.** The prominence of NbS in the NDCs generally does not translate into robust evidence-based targets at present. For example, only around 17% of NDCs with current or planned actions involving NbS for adaptation (i.e. ecosystem-based adaptation) set quantifiable and robust targets. Similarly, although over 70% of NDCs are estimated to contain references to efforts in the forest sector, only 20% of these include quantifiable targets, and only 8% include targets expressed in tonnes of carbon dioxide equivalent. This suggests that considerable potential remains for countries to strengthen the role of NbS in future NDCs.

- **NbS that synergise adaptation and mitigation are underused.** Synergies between mitigation and adaptation actions and targets are rarely highlighted in the NDCs: only 17 countries aim to address adaptation and mitigation together, or have sections in the adaptation components of their NDCs that explicitly highlight the mitigation benefits of adaptation action.

- **There is a major opportunity to scale up NbS in a range of carbon-rich ecosystems in addition to forests.** Actions and targets for NbS for climate change mitigation currently mainly refer to the management, restoration and/or protection of terrestrial forests and/or afforestation. Meanwhile, grasslands, drylands, coastal and/or marine ecosystems (e.g. mangroves) and other wetlands (e.g. peatlands) are relatively poorly represented. For example, only 19% of NDCs from countries with coastal ecosystems refer to them for mitigation purposes.

- **Wealthier countries may have a significant opportunity to increase ambition on NbS in their NDCs.** All 'low income' countries, as classified by the World Bank, currently include NbS actions more prominently in their NDCs, compared to only 27% of high-income countries. This could be, in part, due to the implicit rather than explicit inclusion of NbS in NDCs by the latter. But it nevertheless suggests the potential for more explicit and stronger inclusion of NbS in their future submissions.

- **There is an urgent need to secure robust enabling conditions and enhanced financial flows for NbS.** Enabling conditions and international support are widely recognised as essential for successful NbS implementation. The majority of NDCs presenting NbS as a future priority for adaptation or mitigation have made their actions and implementation conditional on external financing and support.

Recommendations

On the basis of these findings, policy makers may, moving forward, wish to:

1. **Build on the increasing global recognition of the importance of ecosystems for addressing both climate change mitigation and adaptation, and fully incorporate NbS into future NDCs.** All countries – rich or poor – can strengthen their future NDCs by substantially incorporating NbS in them. High-income countries in particular may benefit from more explicitly recognising the potential of NbS to help achieve their Paris Agreement goals without lowering their level of ambition in other sectors.
2. **Include NbS actions across a wide range of naturally occurring ecosystems.** This means, in addition to forests, also include actions in other carbon-rich dryland, coastal (e.g. mangroves) and wetland (e.g. peat) ecosystems.
3. **Step up NbS actions that address climate change adaptation and mitigation as well as support sustainable development and biodiversity conservation.** This would help to develop integrated climate, development and biodiversity agendas and action plans. For example, countries could prioritise ecosystem restoration that both enhances carbon storage and contributes to adaptation, and favour protecting and/or restoring biodiverse and climate-resilient natural ecosystems (as opposed to establishing plantations with single non-native species). Actions that promote such synergies should be prioritised for funding, whether direct actions or enabling conditions.
4. **Include more specific, measurable and robust NbS targets in NDCs and associated national implementation plans.** For adaptation, these would benefit from addressing specific vulnerabilities to climate change; for mitigation, targets should be based on well-supported carbon estimates and accounting. As much as possible, targets must be clearly informed by scientific and local indigenous knowledge including about sustainable management and local dependencies. Working with local stakeholders would help foster societal participation in NbS implementation and avoid perverse and inequitable outcomes on the ground.
5. **Align NDCs with other relevant national plans and international processes.** For example, NDCs could be aligned with National Adaptation Plans and National Adaptation Programmes of Action, as well as with other relevant international policy processes outside the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. Particularly, in relation to NbS, it could be beneficial for NDCs to have more explicit links with the Sustainable Development Goals and the other two Rio Conventions, and with national plans and targets associated with these. This includes the Aichi Targets and National Biodiversity Strategies and Action Plans (NBSAPs) under the Convention on Biological Diversity (CBD) and the Land Degradation Neutrality (LDN) targets under the United Nations Convention to Combat Desertification (UNCCD). It would also be beneficial to develop common frameworks and indicators for reporting and tracking NbS-related actions under these.

6. **Mobilise funding for NbS to climate change.** A number of countries that include NbS in their NDCs have made these conditional on external support. Therefore, mobilising more funding would enable greater and more effective action on the ground. It would also support building capacity to research, design and implement cost-effective and equitable NbS policies and actions at national, sub-national and local levels.
7. **Include key NbS-relevant information in revised or new NDCs** to help track the level of ambition for nature more systematically. In particular:
    - **Climate change impacts on ecosystems**, where known;
    - **Ecosystem dependencies**, i.e. ways in which human communities benefit from healthy, functioning ecosystems;
    - **How NbS actions contribute to mitigation efforts**;
    - **How NbS actions address specific vulnerabilities to climate change**;
    - **NbS actions across a range of ecosystems**, not only forests, but also wetlands, peatlands, grasslands, drylands, and coastal ecosystems, for example;
    - **Adaptation synergies and linked benefits of mitigation actions, and vice versa**; and
    - **Robust NbS targets**, i.e. ones that are measurable, time-bound and based on science and/or local knowledge and consultation.

Background and purpose

Nature-based Solutions (NbS) are increasingly regarded as a critical element in the fight against the causes and consequences of climate change (Seddon et al. 2019a-c). Globally, ecosystems capture and store significant amounts of carbon and thereby can help slow global warming (Andersen et al. 2019, IPCC 2019, UNEP 2017a). Recent estimates suggest that these natural climate solutions can provide around one-third of the cost-effective climate mitigation needed between now and 2030 to stabilise warming to below 2°C (Griscom et al. 2017). They can also provide a powerful defence against the impacts and long-term hazards of climate change (e.g. Hochard et al. 2019, Beck et al. 2018, Bhattacharjee et al. 2018, Narayan et al. 2017). Therefore, efforts to avoid ecosystem loss or degradation, or other adverse land- and sea-use changes, and conserving, restoring, and sustainably managing the world's ecosystems can ensure that nature continues to provide these important benefits to society.

While countries are in the midst of revising and strengthening their Nationally Determined Contributions (NDCs) under the Paris Agreement on climate change, further guidance is needed to help streamline and strengthen the inclusion of NbS in the NDCs.

This report aims to provide just that. Based on an in-depth analysis across 10 substantive assessments of the role of nature and NbS in the NDCs, it proposes a set of recommendations on how ambition and action for NbS can be further increased within the NDCs in the run-up to 2020, and beyond.

Introduction and rationale of the study

What are Nature-based Solutions?

The NbS concept has emerged within the last decade or so as governments, international organisations and other stakeholders search for ways to work with ecosystems – rather than relying solely on conventional engineered, or 'grey' solutions (such as seawalls, levees and irrigation infrastructure) – to tackle societal challenges. The idea is that by working with rather than against nature, we can address the drivers and impacts of climate change, while protecting biodiversity and securing the flow of ecosystem services that support human well-being. As such, NbS are often described as 'no-regret' options, providing benefits to people in a range of scenarios. Within the context of climate change, NbS is an umbrella term for a wide range of actions and interventions that involve enhancing and working with nature to help both climate change mitigation and adaptation (reviewed in Seddon et al. 2019b). For the purposes of this report, we follow the IUCN definition of NbS (Figure 1).

Figure 1. Nature-based Solutions are defined as 'actions to protect, sustainably manage and restore natural or modified ecosystems, that address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, simultaneously providing human well-being and biodiversity benefits'. This was the definition that was formally adopted by IUCN's 1,300+ State and NGO Members at the 2016 IUCN World Conservation Congress held in Hawaii, USA, and which represents the broadest agreed view of the global conservation community.[2] Image © Cohen-Shacham et al. 2016.

2 Resolution 69, 2016 IUCN World Conservation Congress, Hawaii, USA

Nature-based Solutions and the Paris Agreement

The Paris Agreement, adopted at the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP21), has huge political momentum, having been signed by 196 countries and ratified by 185 countries (as of September 2019) (UNFCCC 2019).[3] The Agreement requires all Parties to set out their post-2020 mitigation and adaptation actions and targets in the form of a Nationally Determined Contribution (NDC) communicated to the UNFCCC, to be revised every five years and demonstrate increased ambition over time. Collectively the climate actions agreed in the NDCs will determine whether the world will achieve the overarching long-term goals set out under the Paris Agreement to limit warming and help people adapt and build resilience in the face of unavoidable climate change.

Specifically, aggregated mitigation actions across the NDCs will determine whether Parties are able to hold '*the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change*' (Article 2.1). Meanwhile, collective actions to deal with climate change impacts will determine if Parties can meet the broad goal of '*enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2*' (Article 7.1). A key element of the Paris Agreement is also the 'global stocktake' – an exercise to be undertaken every five years, starting from 2023, '*to assess the collective progress towards achieving the purpose of this Agreement and its long-term goals*' (Article 14.1).

> NbS are often described as 'no-regret' options, providing benefits to people in a range of scenarios

In acknowledgement of the significance of ecosystems for climate change mitigation and adaptation, as well as their broader societal value in general, the Paris Agreement explicitly recognises 'the importance of the conservation and enhancement, as appropriate, of sinks and reservoirs of the greenhouse gases referred to in the Convention' (Preamble). These include 'biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems' (UNFCCC Article 4.1 (d)). The Paris Agreement also notes 'the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth' (Preamble). It then includes, in various Articles, several explicit references that are directly relevant to nature-based solutions, as outlined in Table 1.

3 https://unfccc.int/process/the-paris-agreement/status-of-ratification

Table 1. What the Paris Agreement says about nature: direct (explicit) and indirect (implicit) goals involving or directly relevant to Nature-based Solutions

Paris Agreement	Specific quote/reference
Preamble	Recognizing the importance of the **conservation and enhancement, as appropriate, of sinks and reservoirs** of the greenhouse gases referred to in the Convention.
	Noting the importance of ensuring the **integrity of all ecosystems, including oceans, and the protection of biodiversity**, recognized by some cultures as Mother Earth, and noting the importance for some of the concept of "climate justice", when taking action to address climate change.
Article 4	
4.1	Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and **removals by sinks** of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.
4.7	Mitigation **co-benefits** resulting from Parties' adaptation actions and/or economic diversification plans can contribute to mitigation outcomes under this Article.
4.13	Parties shall account for their nationally determined contributions. In accounting for anthropogenic emissions and **removals** corresponding to their nationally determined contributions, Parties shall promote **environmental integrity, transparency, accuracy, completeness, comparability and consistency**, and ensure the avoidance of double counting, in accordance with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to this Agreement.
Article 5	
5.1	Parties should take action to **conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests.**
5.2	Parties are encouraged to take action to implement and support, including through results-based payments, the existing framework as set out in related guidance and decisions already agreed under the Convention for: policy approaches and positive incentives for activities relating to **reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks** in developing countries; and alternative policy approaches, such **as joint mitigation and adaptation approaches for the integral and sustainable management of forests**, while reaffirming the importance of **incentivising, as appropriate, non-carbon benefits** associated with such approaches.
Article 6	
6.1	Parties recognize that some Parties choose to pursue voluntary cooperation in the implementation of their nationally determined contributions to allow for higher ambition in their mitigation and adaptation actions and **to promote sustainable development and environmental integrity.**

Article 7	
7.1	Parties hereby establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2.2. Parties recognize that adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions, and that it is a key component of and makes a contribution to the long-term global response to climate change **to protect people, livelihoods and ecosystems**, taking into account the urgent and immediate needs of those developing country Parties that are particularly vulnerable to the adverse effects of climate change.
7.2.	Parties recognize that adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions, and that it is a key component of and makes a contribution to the long-term global response to climate change **to protect people, livelihoods and ecosystems**, taking into account the urgent and immediate needs of those developing country Parties that are particularly vulnerable to the adverse effects of climate change.
7.5	Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, **taking into consideration vulnerable groups, communities and ecosystems**, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and **environmental policies and actions**, where appropriate.
7.9	Each Party shall, as appropriate, engage in adaptation planning processes and the implementation of actions, including the development or enhancement of relevant plans, policies and/or contributions, which may include: (c) The assessment of climate change impacts and vulnerability, with a view to formulating nationally determined prioritized actions, **taking into account vulnerable people, places and ecosystems**. And (e) building the **resilience of socioeconomic and ecological systems**, including through economic diversification and sustainable management of natural resources.
Article 8	
8.4	Accordingly, areas of cooperation and facilitation to enhance understanding, action and support may include: (h) **Resilience of communities, livelihoods and ecosystems.**

To what extent do Nature-based Solutions feature in the NDCs?

How do climate commitments or targets expressed in the Nationally Determined Contributions (NDCs) submitted by countries to date reflect the role of nature or nature-based solutions in climate change mitigation and adaptation? Several studies have attempted to address this question by analysing the NDCs, each with different entry points and approaches. Together these studies provide a wide range of statistics on the prominence of nature and NbS in national commitments under the Paris

Agreement. Some of these send somewhat contradictory messages. For example, while one study reports that 45 NDCs feature nature in a 'prominent position' (Laurans et al. 2016), another refers to a figure of 127 NDCs (IUCN and Climate Focus 2017). Similarly, while one analysis reports that 87 NDCs feature marine and/or coastal 'blue carbon' ecosystems such as mangroves, tidal marshes and seagrass meadows among their adaptation and/or mitigation plans (Herr and Landis 2016), another gives a figure that is closer to 112 NDCs (i.e. 70% of 161 NDCs; Gallo et al. 2017). Seddon et al. (2019c) state that 77% of NDCs contain at least one quantitative target for ecosystems in general. Closer examination of these studies' objectives and methods suggest robust reasons for these different figures (Annex 1). However, when viewed in isolation, different statistics for broadly similar assessments risk sending mixed messages about the current level of ambition for NbS represented within NDCs and what actions are needed to enhance ambition.

To address this issue, we looked at 10 substantive comparative analyses of the prominence of NbS in NDCs undertaken to date. Our aim was to identify a set of common findings and, on this basis, suggest practical recommendations for policy makers on how to strengthen the role of NbS in enhancing climate ambition and action in future iterations of NDCs. We highlight both opportunities and challenges.

Synthesis of key findings and recommendations

By August 2018, there were 10 substantive comparative assessments of the prominence of NbS in the NDCs. The basic characteristics of these studies are given in Table 2, while Annex 1 provides information on our review methods as well as an assessment of the different analytical approaches adopted.

Table 2. Basic characteristics of NDC studies included in this review

Author (year), Institution	Main study aim	#NDCs	Basic analytical approach	Geographical context
(1) Nature-based Solutions Initiative (2018) *University of Oxford, IIED, IUCN, UNEP-WCMC*	Broad overview of intentions for NbS to climate change adaptation, in particular Ecosystem-based Adaptation (EbA).	167†	Codified and systematically analysed adaptation component of NDC; brief assessment of mitigation component.	Geographical region and income group
(2) IUCN (2018) *International Union for Conservation of Nature*	Adaptation gaps and synergies for EbA implementation and scaling up in multi-level governance frameworks.	5	Policy analysis/ qualitative and quantitative; data on inclusion of 10 different adaptation actions or enabling conditions.	Mesoamerica (Mexico and four Central American countries)
(3) Bahn et al. (2017) *Ecological Solutions, New Delhi*	Prominence of forestry (afforestation, restoration, protection).	5	Qualitative review; key statements about forestry extracted and discussed in relation to NDC mitigation targets.	BRICS nations (Brazil, Russia, India, China and South Africa)
(4) Gallo et al. (2017) *Scripps Institution of Oceanography*	Overview of inclusion of marine and coastal ecosystems.	161†	Qualitative (textual analysis) and quantitative using a quantitative marine focus factor.	Annex I countries and Small Island Developing States

Author (year), Institution	Main study aim	#NDCs	Basic analytical approach	Geographical context
(5) IUCN and Climate Focus (2017) *International Union for Conservation of Nature*	Extent of forest landscape restoration (FLR) measures.	165†	Assessment and interpretation of all NDCs for forest-related targets (both qualitative and quantitative) and non-target activities using the (FLR) approach as an overarching lens.	Global
(6) Rankovic et al. (2017) *IDDRI and IUCN*	Review and ranking of the NbS actions in NDCs based on their level of ambition for biodiversity protection.	2	Qualitative/ quantitative - NbS identified and ranked according to the level of attention given to biodiversity.	Tunisia and Morocco
(7) WWF (2018) *World Wide Fund for Nature*	Investigating the extent of the alignment of climate actions with the Aichi Targets (biodiversity conservation actions).	44	Textual analysis, to rate each NDC for each Aichi target (20 in total) as strong or less strong	Developed, developing and least developed countries
(8) Herr and Landis (2016) *International Union for Conservation of Nature, The Nature Conservancy*	Review of blue carbon ecosystems as climate mitigation or adaptation solutions.	163†	Qualitative textual analysis; types of mitigation or adaptation action related to coastal blue carbon ecosystems, with specific actions and timelines.	Examples of countries mentioning coastal wetlands, split by region
(9) FAO (2016) *Food and Agriculture Organization*	Assessment of the prominence/ coverage of the agriculture sectors (crops, livestock, forestry, fisheries and aquaculture).	162†	Full qualitative textual analysis.	Developed countries, economies in transition, developing countries and LDCs
(10) Laurans et al. (2016) *IDDRI*	How INDCs translate intentions for biodiversity conservation, highlighting countries emphasising this.	159†	Qualitative/textual analysis of the NDCs with some quantification.	Broad-scale regional analysis and countries with different level of development

†I/NDC submissions accessed using the official UNFCCC portal (https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx); I=Intended

Despite differences among the 10 studies in aims, methods, regional focus and types of information reported (Tables 2 and A2), all have their strengths and they share a number of key findings (Tables 3 and 4). Here, these 'common findings' are arranged with respect to a) the overall extent and type of broad commitments to NbS, and b) challenges around how NbS are included in NDCs. In the next section, we provide some broad policy recommendations arising from this synthesis. Examples of best practice around the inclusion of NbS in the NDCs are given in Annex 2.

Table 3. Summary of key findings on the prominence of NbS in the NDCs, arranged with respect to broad types of NbS and ecosystem focus (results converted to percentage of NDCs assessed in each study)

(1) Forest restoration and/or protection (including agroforestry)	
IUCN and Climate Focus (2017)	• 77% of NDCs reference current or planned efforts in the forest sector, including FLR · 74% of NDCs include forest-related targets, 20% of which are quantifiable, 8% expressed in tons of carbon dioxide equivalent · 55% of NDCs include forests as part of economy-wide targets · 65% of NDCs with forest targets have those that are conditional upon international support · 31% of Bonn Challenge countries have included quantifiable targets for forestry, conditional and unconditional.
Bahn et al (2017)	• BRICS nations have a demonstrable focus on the forest sector to meet mitigation goals · Brazil commits to restoring 12 million hectares of forest, 15 million hectares of degraded pasturelands, and 5 million hectares of integrated cropland-livestock-forestry systems by 2030 · Russia aims to reduce emissions by 70-75% by 2030 below 1990 levels largely through sustainable forest management (70% of the world's boreal forests, 25% of world's total forest area) · India aims to increase its carbon sink from 2.5 to 3 billion tonnes CO_2 equivalent by increasing forest cover · China aims to increase forest stock by 4.5 billion m^3 from 2005, with 2.2 billion m^3 achieved by 2014 (i.e. 21.6 million hectares) · South Africa identifies forests as a priority sector for adaptation.
FAO (2016)	• 97% of countries include LULUCF in mitigation plans · 71% of NDCs include forests in adaptation plans · 19% include integrated systems such as agroforestry · NDCs rarely include quantified sector-specific targets for LULUCF, though forestry is the second most referenced sector for non-GHG targets · 42% include afforestation and reforestation, 38% include forest management · 32% embark on policies and measures for reducing deforestation (all developing countries) · 18% give concrete measures for forest restoration.
(2) Restoration and/or protection of marine and/or coastal ecosystems	
Herr and Landis (2016)	• 93% of countries that have submitted NDCs (151 out of 163) contain at least one marine and/or coastal ecosystem, 43% contain mangroves, seagrass meadows and coral reefs · 19% of Parties with coastal ecosystems include these habitats in the mitigation component of their NDCs, 39% in their adaptation component · 32% of NDCs include conservation and restoration of coastal ecosystems as an adaptation strategy, 7% recognising mitigation co-benefits · 13% of NDCs reference planning or zoning-related efforts (i.e. integrated coastal zone management) · 9% of NDCs recognise coastal habitats as opportunities to enhance carbon sequestration and/or protect carbon sinks.

Gallo, Victor & Levin (2017)	• 70% of NDCs include marine issues, 29% of those that don't are from coastal states · 45% of NDCs include marine issues both in mitigation and adaptation components · 47% of NDCs include marine issues in an adaptation component only · 8% of NDCs include marine issues in a mitigation component only · 48% of NDCs mention general concerns about ocean warming · 7% of NDCs (mostly small island developing states) mention ocean acidification · Annex 1 countries focus on climate change as a problem of mitigating emissions, and under-represent ocean ecosystems in their NDCs.
(3) Conservation of biodiversity and ecosystems in general	
Rankovic, et al. (2017)	• Biodiversity issues receive more attention in Morocco's NDC and are seen as a guarantee of ecosystem resilience to climate impacts; attention to biodiversity is greater in the adaptation section · Tunisia has more NbS measures corresponding to extensive sectoral and/or territorial reorganisation processes, especially for adaptation.
Laurans et al. (2016)	• 28% of NDCs position NbS prominently · NbS is more common in Africa and Central and South America than in Asia (excluding China) and Europe · 19% of NDCs include better management of forests, wetlands, coastal ecosystems and marine areas as both adaptation and mitigation measures · 7% of NDCs include actions to control land-use change.
WWF (2017)	• "Quite a few NDCs incorporate biodiversity, some explicitly linking climate action to Aichi Targets" · Forest-related actions are most prevalent · Not all NDCs mentioning forests include concrete targets · Marine and terrestrial coastal ecosystems and biodiversity mainly feature in adaptation plans · There is a clear difference between NDCs of developing and developed countries with the latter mostly report economy-wide targets.
(4) NbS in adaptation planning or ecosystem-based adaptation (EbA)	
Nature-based Solutions Initiative (2018)	• 66% of NDCs state that ecosystems and/or biodiversity are threatened by climate change · 63% of NDCs declare that the protection of ecosystems and/or biodiversity is the intended outcome of adaptation planning · 62% of NDCs include NbS as adaptation actions (42% refer to EbA actions, 20% to traditional conservation) · EbA actions are included in the adaptation plans of 77% of low-income, 55% of lower middle-income, 29% of upper middle-income and 12% of high income countries.
IUCN (2018)	• 101 adaptation commitments identified and analysed across five Mesoamerican NDCs • Natural infrastructure is the most common action on the ground, followed by sustainable practices and behaviour and early-warning systems · 75% of adaptation actions refer to enabling conditions · Most adaptation commitments are enabling conditions related to management and policy, followed by policy and law and capacity building.

Collectively the 10 studies revealed widespread, global recognition of the inherent importance of ecosystems[4] as well as the importance of NbS to both addressing the causes and consequences of climate change. Here, we present a set of common findings derived from the studies, with quotes from NDCs when relevant. The common findings are summarised in Table 4.

Table 4. Common findings about the prominence of NbS in NDCs and limitations in the way NbS were included

(a) Overall extent and nature of broad commitments to NbS
1. Ecosystems are important to people but are severely impacted by climate change
2. Action is needed to address the impacts of climate change on ecosystems whether to help ecosystems directly or because doing so helps people adapt
3. Nature-based Solutions can help countries meet mitigation and/or adaptation goals
4. Enabling conditions are widely recognised as important for NbS implementation
(b) Challenges around how NbS are included in the NDCs
5. NbS in non-forest ecosystems are not well represented
6. Developing countries appear to place more emphasis on NbS than developed countries
7. Adaptation benefits of mitigation actions (and vice versa) are rarely taken into account
8. There are often mismatches between vulnerabilities and actions/targets for adaptation
9. NDCs rarely include measurable targets against which progress can be tracked
10. Most NbS actions are planned, rather than implemented, and conditional on financial support

Overall extent and type of broad commitments to NbS

Common finding 1: Ecosystems are important to people but severely impacted by climate change

Two-thirds of NDCs state that ecosystems are important and vulnerable to climate change. For example, Morocco's NDC declares that 'forest ecosystems serve an important purpose for the country and the lives of vulnerable populations…[but are] already witnessing the impacts of climate change…'. In fact, ecosystems feature in the top five sectors most frequently declared as being vulnerable to climate change, below food and water security but above fisheries, energy and transport (Nature-based Solutions Initiative 2018; Seddon et al. 2019c). Some countries highlight negative impacts on ecosystems in general. China's NDC, for example, states that 'climate change has significant impacts on global natural ecosystems', while Kenya's emphasises the need to 'enhance the resilience of ecosystems to climate variability and change'. Other NDCs focus on specific ecosystems: Morocco states that 'climate

4 NDCs referred to nature variously as natural habitats, ecosystem, biodiversity, wildlife, etc. We use the term ecosystem throughout to encompass all these terms.

change will have an impact on how vibrant and dynamic forest ecosystems are, on their ability to regenerate and to adapt to regular climate fluctuations, their biodiversity (both of their fauna and flora), their consistency, and their spatial distribution'. Many highlight the importance and vulnerability of coastal and/or marine ecosystems, e.g. the Maldives describes its reefs as a 'vital ecosystem [that] is highly sensitive to changing sea surface temperature and other climatic factors'. Overall, 53% of 163 NDCs analysed by Herr and Landis (2016) include coastal 'blue carbon' ecosystems within their adaptation and/or mitigation components (Herr and Landis 2016), while 70% of 161 NDCs analysed by Gallo et al (2017) refer to issues in marine ecosystems and 48% raise concerns about ocean warming (see Box 3).

Common finding 2: Action is needed to address impacts of climate change on ecosystems whether to help ecosystems directly or because doing so helps people adapt

The protection of ecosystems was a declared motivation for adaptation planning in most (63%) of NDCs and was the fifth most frequently mentioned intended outcome of adaptation planning (ranked below disaster risk reduction and food/water security but above protection of the economy or human health (Nature-based Solutions Initiative 2018; Seddon et al. 2019c). Indeed, ecosystems featured frequently in overarching climate change adaptation 'vision statements' in many of the NDCs. For some countries, the aim is to address impacts on ecosystems directly. For example, the Republic of the Congo's NDC emphasises the 'protection of natural heritage, biodiversity, forests and fishery resources, through an adaptation approach rooted in the protection of ecosystems', Belize's NDC states that 'the overall goal is to enhance the protection and restoration of forest ecosystems and build the resiliency of water catchment areas', and Ecuador's NDC stresses the need to 'guarantee the rights of nature and promote environmental, sustainability globally'. Other countries are instead explicit that protecting ecosystems is for the benefit of people. For example, Armenia embraces the ecosystem approach for adapting to climate change', Ethiopia aims to 'enhance the adaptive capacity of ecosystems, communities and infrastructure through an ecosystem rehabilitation approach' and Cambodia commits to 'promoting and improving the adaptive capacity of communities, especially through community-based adaptation actions, and restoring the natural ecology system to respond to climate change (see www.nbspolicyplatform.org for all nature-based adaptation vision statements).

> Action is needed to address impacts of climate change on ecosystems whether to help ecosystems directly or because doing so helps people adapt

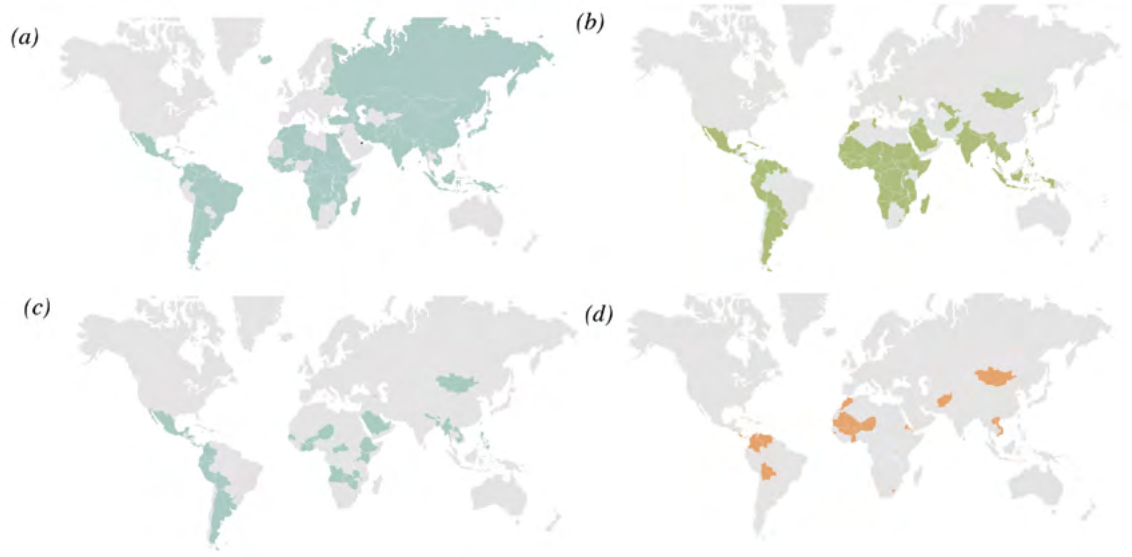

Figure 2. Global distribution of countries that included in their NDCs: (a) NbS in the mitigation component; (b) NbS in the adaptation component; (c) explicit mention of synergies between mitigation and adaptation actions; and (d) several quantitative adaptation targets. Figures generated using the Nature-based Solutions Policy Platform in August 2019 (www.nbspolicyplatform.org).

Common finding 3: Nature-based Solutions can help countries meet mitigation and adaptation goals

Many countries articulate a broadly 'nature-based' or 'ecosystem-orientated' vision for mitigation and adaptation in their NDCs and propose a range of 'green' actions and targets to achieve these visions (Nature-based Solutions Initiative 2018; Seddon et al. 2019c). These actions mainly involve the management, restoration and protection of ecosystems or nature-based agricultural practices and therefore meet the IUCN definition of a Nature-based Solution (NbS, Figure 1). According to the most comprehensive study reviewed (Nature-based Solutions Policy Platform 2018), 130 of 167 NDCs include NbS priority actions or targets, in one form or another, as part of their mitigation and/or adaptation components, equivalent to 66% of Paris Agreement signatories (78% of NDCs).[5] This signals broad global consensus that NbS are crucial to meeting the Paris Agreement's mitigation and adaptation goals.

- ### NbS for mitigation

  Almost all (97%) of NDCs recognise the impacts that the Land Use, Land Use Change and Forestry (LULUCF) sector has on climate change (FAO 2016) and consequently the majority of countries (62% of NDCs) refer to restoration, management and protection of natural forests and/or tree plantations as key land-based actions for mitigation purposes (Seddon et al. 2019c). Indeed, forests are the second most referenced sector for targets (other than those for reduced greenhouse gas emissions): 42% NDCs include actions and targets

5 The difference between number of Paris Agreement signatories and NDCs arises because a single NDC has been submitted jointly by 28 EU member states.

for afforestation and reforestation in general, 38% include targets for forest management, and 32% of NDCs (all from developing countries) outline policies and measures for reducing deforestation (FAO 2016; IUCN and Climate Focus 2017). For example, 'Colombia reaffirms its commitment to reduce deforestation in the country and to preserve important ecosystems such as the Amazon region, given its huge potential to contribute to the stabilization of greenhouse gases in the atmosphere'. Meanwhile, BRICS nations – a group of some of the largest economies in the world – have a 'demonstrable focus on forestry sector to meet mitigation goals' (Bahn et al. 2017). For example, India commits to increase its carbon sink from 2.5 to 3 billion tonnes CO_2 equivalent by increasing forest cover, while China commits to increasing forest stock by 4.5 billion m^3 from 2005 levels having already achieved an increase of 2.2 billion m^3 by 2014.

- **NbS for adaptation**

  Around 62% of NDCs include current or planned NbS actions in their adaptation plans (Nature-based Solutions Initiative 2018; Seddon et al. 2019c). For example, Mexico's NDC refers to the need to protect 'communities from adverse impacts of climate change, such as extreme hydro meteorological events related to global changes in temperature; as well as [increase] the resilience of strategic infrastructure and of the ecosystems that host national biodiversity'. To achieve this vision Mexico aims to, for example, 'conserve and restore ecosystems in order to increase ecological connectivity of all Natural Protected Areas and other conservation schemes, through biological corridors and sustainable productive activities'. It has a target of 'reaching a rate of 0% deforestation by the year 2030', and it will achieve this with the 'equitable participation of the population'. As with mitigation, the most commonly implemented or planned NbS action for adaptation purposes is agroforestry, which falls within the LULUCF sector (Figure 3) especially in African nations (Seddon et al. 2019c). For example, Rwanda's NDC commits to the 'development and implementation of an intensive agroforestry programme', and Sudan pledges to introduce 'agroforestry in areas vulnerable to climate change to enhance agricultural production as well as empower vulnerable communities through their involvement in community forests activities/products'.

Common finding 4: Enabling conditions and international support are widely recognised as essential for NbS implementation

For adaptation action, enabling conditions commonly referred to in NDCs include education, research, policy and capacity building at individual, community and institutional level. They can be viewed as actions that enable behavioural change to minimise losses from climate change and promote policy uptake and facilitate implementation. Across the NDCs of Mesoamerica, there is a particular emphasis on improving the enabling conditions for NbS, especially around management and policy, law and capacity building (IUCN 2018). In fact, enabling conditions were ubiquitous in NDC adaptation plans across the globe (Nature-based Solutions Initiative 2018; Seddon et al. 2019c). Laurans et al. (2016) stated that policy networks are more important than direct adaptation measures; and Gallo et al (2017) stressed the need to

build capacity for marine research through collaboration with developing countries, and found that the need for more marine ecosystem science was the fifth most common 'marine issue' highlighted in the NDCs. Conditionality of NDC implementation in relation to forests is also brought out clearly in IUCN and Climate Focus (2017).

Challenges around how NbS are included in the NDCs

Common finding 5: NbS in non-forest ecosystems are not well represented

For both mitigation and adaptation purposes, there is strong emphasis on terrestrial forests and forestry (FAO 2016; Seddon et al. 2019c; IUCN and Climate Focus 2017). Specifically, actions and targets for nature-based mitigation generally refer to the management, restoration and protection of terrestrial forests, afforestation and agroforestry, while coastal and marine habitats are relatively less represented (e.g. Herr and Landis 2016 estimate that only 19% of Parties include coastal ecosystems specifically in the mitigation component of their NDCs and 39% in the adaptation components; Box 1). NbS references for adaptation most commonly cited in the NDCs involve terrestrial forests or woodlands, i.e. protection, restoration (reforestation) or afforestation. These are highlighted in the adaptation component of 68 NDCs, i.e. 41% (Nature-based Solutions Initiative 2018; Seddon et al. 2019c). The protection and restoration of coastal or marine habitats appeared in the adaptation component of 47 NDCs (28% of the total, but 37% of NDCs from nations with coasts), followed by similar actions in river catchments, including wetlands (28% of NDCs). Much less common are references to working with grasslands and rangelands (10% of NDCs) or montane habitats as an adaptation approach (4% of NDCs). Almost all examples of grassland or rangeland NbS adaptation actions come from Africa, despite the extensive presence of these habitats on other continents. Nature-based agricultural practices, such as agroforestry, were included in the adaptation component of 39 NDCs (i.e. 23%). These were strongly emphasised in African nations.

> Actions and targets for nature-based mitigation generally refer to the management, restoration and protection of terrestrial forests, afforestation and agroforestry, while coastal and marine habitats are relatively less represented

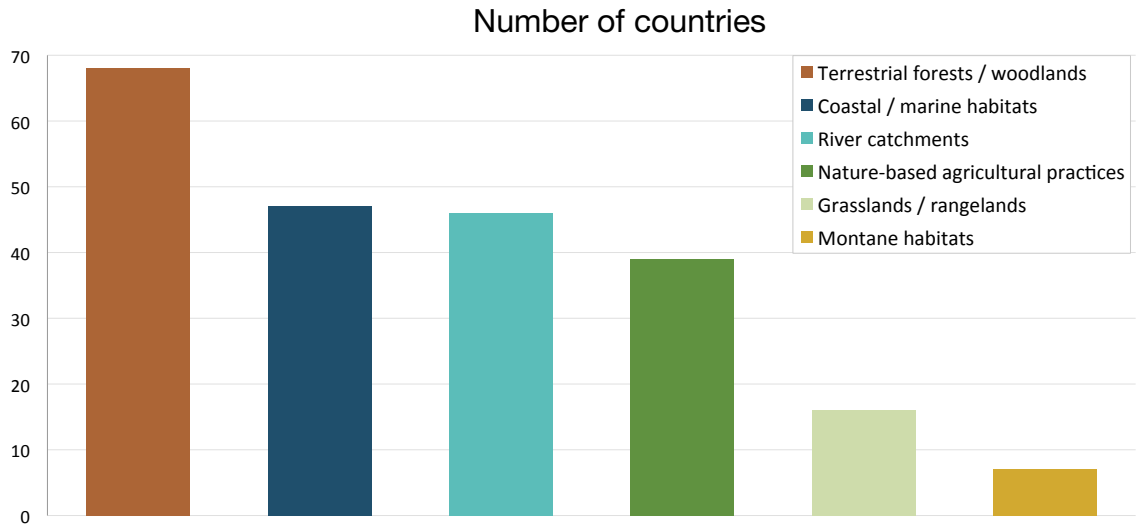

Figure 3. Number of countries that include NbS actions for adaptation in one or more of five broad and non-mutually exclusive ecosystems types as well as nature-based agricultural practices: (i) terrestrial forests or woodlands (excluding mangroves); (ii) river catchments (including wetlands and rivers; lake management or preservation and any fluvial measures, watershed and wetland management; measures to protect or preserve large water bodies including internal seas); (iii) nature-based agricultural practices (including agroforestry systems, conservation agriculture and permaculture activities, agricultural and forestry systems, and planting trees in agricultural areas); (iv) coastal and marine habitats (including mangroves, seagrass meadows, coral or shellfish reefs, dune systems, coastal wetlands and saltmarshes); (v) grasslands and rangelands (including savanna); and (vi) montane habitats (including cloud forest, etc.) Figure generated using the Nature-based Solutions Policy Platform (www.nbspolicyplatform.org).

Common finding 6: Developing countries appear to place more emphasis on NbS than developed countries in their NDCs

Several of the studies reviewed noted greater emphasis on NbS in the NDCs produced by developing countries (see also Figure 2). For example, one found that NbS actions (both ecosystem-based adaptation and conservation actions) are included in the adaptation plans of all of the NDCs from countries classified as 'low-income' by the World Bank, compared to 27% of NDCs from high-income countries (Nature-based Solutions Initiative 2018; Seddon et al. 2019c). Laurans (2016) also notes that the use of NbS in NDCs is common in Africa, South America and the Caribbean, and far less so in Asia (excluding China) and Europe, and states that 'China and Mexico in particular are emerging as champions'. Bahn et al (2017) states that BRICs nations clearly focus on forests in their NDCs, in particular Brazil, China and India. On the mitigation side (LULUCF – land use, land-use change, and forestry) there is bias towards Asia and South and Central America (where the emphasis is on afforestation, restoration and conservation; FAO 2016); on the adaptation side, the greater emphasis is found among African nations (where agroforestry is commonly included in the NDCs; Seddon et al 2019c). This could be due, in part, to the economy-wide nature of targets included in developed country NDCs, which may incorporate NbS more implicitly. However, it nevertheless suggests that these could be made more explicit and stronger in future submissions especially given that a number of developed nations (e.g. in North America and Europe) are implementing NbS on the ground (see Seddon et al. 2019c).

Common finding 7: Adaptation benefits of mitigation actions (and vice versa) are rarely taken into account

A low proportion of NDCs (28%) explicitly recognises synergies between mitigation and adaptation and there tends to be more emphasis placed on the mitigation value of adaptation than vice versa. For example, Peru states that it is necessary to 'increase the promotion, development and implementation of complementary and synergistic actions of mitigation and adaptation', Mexico that 'some of the adaptation actions presented foster positive synergies with mitigation actions' and Zambia that all its planned adaptation actions 'have strong synergies with mitigation actions'. Even fewer NDCs (10%) address adaptation and mitigation together (e.g. China, Bolivia and Somalia (Nature-based Solutions Initiative 2018), or have sections in their adaptation components explicitly highlighting the mitigation benefits of adaptation action, or vice versa. An exception is Lao PDR's NDC which emphasises the country's ambition to integrate mitigation and adaptation actions in the forest sector and contains an entire segment on forestry and land-use change within the adaptation section.

Common finding 8: There are often apparent mismatches between climate impacts and vulnerabilities, and actions or targets

The studies reveal a high degree of mismatch between vulnerabilities and actions, and between actions and targets. For example, some countries declare ecosystems and biodiversity as a vulnerable sector and state the importance of adaptation action to protect and conserve these ecosystems but do not include any specific actions. Others have a high-level commitment to ecosystems, but lack relevant on-the-ground actions (Seddon et al. 2019c). For example, of 51 NDCs with an adaptation vision that includes EbA, explicitly or otherwise, only 35 then go on to describe tangible EbA actions. In a handful of such cases, detailed plans are instead provided in other national policy documents (e.g. NAPs), suggesting the need for greater coherence among different national policy processes. For the majority, however, the mismatch hints there may be limited understanding of how best to integrate NbS within mitigation and adaptation planning processes.

Common finding 9: NDCs rarely include measurable targets or indicators against which progress on climate action through NbS can be tracked

Most studies agreed that high-level commitments or references to NbS in the NDCs often do not translate into robust evidence-based targets. For example, only 17% of NDCs with current or planned actions involving EbA set quantifiable targets (Nature-based Solutions Initiative 2018; Seddon et al. 2019c), while only 20% of forest-related targets in the NDCs are quantifiable, and only 8% include targets expressed in tons of carbon dioxide equivalent (IUCN and Climate Focus 2017). Countries rarely include quantified sector-specific targets for agriculture and LULUCF (FAO 2016), while 'not all countries mentioning forests included concrete targets' (WWF 2017). Even where measurable targets are set, it is unclear whether they will be sufficient to meet the adaptation needs of the communities and ecosystems involved or achieve the

emissions reductions required, as expressed in the Paris Agreement and stressed by the IPCC Special Report on Global Warming of 1.5°C (IPCC 2018). Of the 70 countries that commit to one or more EbA actions in the adaptation component of their NDCs, only 18 provide either time-bound or quantitative targets and, of those, only 12 are broadly measurable and so could be tracked in theory (Table 3; Seddon et al. 2019c). Measurable targets generally involve the protection or restoration of specific areas of habitat within given timeframes. For example, Bolivia states that it will 'increase forest areas with integrated and sustainable community management approaches with 16.9 million hectares in 2030, in reference to 3.1 million hectares by 2010'. Some targets also include the types and numbers of communities involved: Burkina Faso states that '200 rural communes [will] develop and implement […] assisted natural regeneration projects with the participation of at least five village communities each' involving an area of 800,000 hectares. Other targets centre on agroforestry. For example, Ghana is aiming for 'modified community-based conservation agriculture [to be] adopted in 43 administrative districts', and Rwanda 'intends to mainstream agro-ecology technologies in its current agriculture intensification programme and other natural resource-based livelihood programmes. 100% of the households involved in agriculture production will be implementing agro forestry sustainable food production by 2030'. The remaining NDCs outline targets that are more difficult to measure. For example, Guinea-Bissau aims to 'develop a national reforestation and sustainable management of forest and agro forestry ecosystems programme by 2025'. For the case of those commitments or actions proposed as mitigation efforts, only 8% of NDCs with references to forests include measurable targets expressed as tons of CO_2 equivalent, as noted above, while most are expressed as area to be subject to diverse type of land or ecosystem-based management practices (IUCN and Climate Focus 2017).

> Measurable targets generally involve the protection or restoration of specific areas of habitat within given timeframes

Common finding 10: Most NbS actions or targets are planned, rather than implemented, and conditional on financial support

The majority of NDCs present NbS as a future priority for adaptation, and one that is conditional on external financing. For example, Afghanistan commits to the 'regeneration of at least 40% of existing degraded forests and rangeland areas (the area covered will be approximately 232,050 ha for forestry; and 5.35 million ha for rangelands). Finance needs: 2.5Bn US$'. Likewise, 65% of the 91 Parties that have included forests in their economy-wide NDCs have made these conditional to the provision of international support (IUCN and Climate Focus 2017).

BOX 1 | The importance of coastal and marine ecosystems for climate change mitigation and adaptation, and the prominence of these ecosystems in the NDCs

Coastal and marine ecosystems encompass a wide range of important habitats: coral reefs, mangroves, seagrass meadows, kelp forests, sand dune systems and saltmarshes. They are among the planet's greatest carbon storehouses, with CO_2 burial rates (i.e. rates at which carbon is converted into biomass through photosynthesis) 20 times greater than any other terrestrial ecosystem, including boreal and tropical forests [1].

In 2012, mangroves stored 4.19 petagrams (10^{15} grams) of carbon globally (around 70% in the soil, 30% above ground), with Indonesia, Brazil, Malaysia and Papua New Guinea accounting for more than 50% of the global stock. Meanwhile, between 2000 and 2012, 22% of global mangrove carbon was lost through deforestation, equivalent to around 317 million tonnes of CO_2 emissions [1]. This combination of high density of stored carbon and high rates of deforestation means that mangrove forests contribute substantially to carbon emissions. Conversely, their protection could play a vital role in slowing climate warming.

Coastal ecosystems also protect coastlines from storm surges and flooding across the globe. A recent study estimated annual expected damages from flooding would double and costs from frequent storms would triple in the absence of reefs globally [2]. As Sustainable Development Goal 14 (Life Below Water) outlines, the health of our ocean and coastal ecosystems is of fundamental importance for human well-being and sustainable development, while also playing a key role in both slowing climate warming and helping humans deal with climate change impacts. These ecosystems should therefore feature prominently in the NDCs of nations with major coastlines.

There have been two global comparative studies of the role of marine and/or coastal ecosystems in the NDCs [3,4]: one emphasised marine issues in general with a particular focus on oceans [3], the other focussed on conservation of coastal wetlands [4]. These different scopes mean that, although they paint a broadly similar picture, the precise figures quoted are difficult to compare. We therefore conducted an additional more holistic analysis of the NDCs of nations with coasts including all blue carbon ecosystems (based on the Nature-based Solutions Policy Platform [5]) then synthesised the key messages from the three studies.

We found that of the 198 nations or territories with coastlines, 128 submitted NDCs of which 107 included adaptation components (i.e. 84%). Of these NDCs, 79 (79%) identify marine and/or coastal fisheries as being threatened by climate change and 82 (77%) declare biodiversity and/or ecosystems as being threatened. For example, Brunei Darussalam identifies the fisheries sector as a priority for further climate change adaptation actions; Cape Verde's NDC 'seek(s) to implement actions for the adaptation of fishing activities and fishing communities, building on the scenarios and strategies

BOX 1 | continued

already developed by the Fishery Development National Institute (INDP)', and Ecuador's NDC mentions 'marine and coastal biodiversity protection'. Most coastal nation NDCs (96%) state the intended outcome of adaptation planning was to reduce risks and disasters compared to 69% to protect ecosystems and/or biodiversity. Of those 79 coastal nations declaring vulnerabilities to coastal ecosystems and fisheries, 65 follow this up with appropriate adaptation actions: 38 (58%) commit to NbS such as mangrove restoration, 31 (48%) pledge engineered actions such as seawalls and 47 (72%) commit to hybrid actions such as Integrated Coastal Zone Management (ICZM). Egypt mentions ICZM as a 'necessary adaptation policy', and Georgia commits to giving priority to ICZM. Fiji recognises the role of mangroves in adaptation, with mangrove planting and enforcement of buffer zones for coastal and mangrove areas identified as adaptation measures, with 'the planting of mangroves, construction of seawalls and the relocation of communities to higher grounds' all being part of ongoing adaptation initiatives. Overall, across all the NDCs from coastal nations hybrid and NbS actions were pledged more often than engineered, with particular emphasis on NbS in those nations classified as more vulnerable to climate change according to German Watch Climate Risk Index (Figure 4).

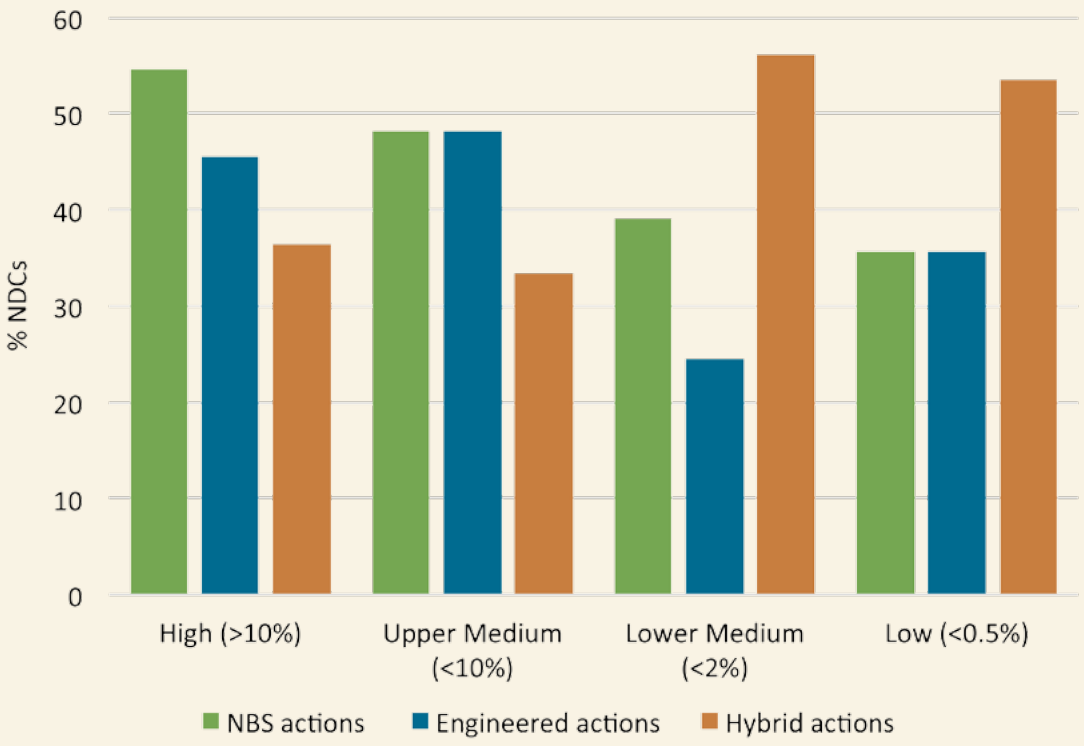

Figure 4. Relative emphasis on different broad type of adaptation action with respect to coastal zone vulnerability (high, upper medium, lower medium and low risk from climate change impacts), as indicated by the German Watch Global Climate Change Risk Index [6]

BOX 1 | continued

Synthesis

All studies agreed that a high proportion (more than 70%) of NDCs include mention of coastal and/or marine ecosystems, the majority in the context of coastal impacts (disaster risk reduction), ocean warming impacts and fisheries impacts. These issues are more prominently highlighted in the adaptation component of the NDCs than the mitigation, and are under-represented in the NDCs of developed countries. For example, of those Parties that have no references to marine and coastal ecosystems in their NDCs, 14 are coastal including those with large Exclusive Economic Zones (EEZs) such as Australia, Brazil, the European Union, Micronesia, New Zealand, Norway, the Russian Federation, and the USA [3].

When it came to NbS in the context of marine/coastal ecosystems, there was also greater emphasis on adaptation than mitigation. For example, while 39% of Parties with coasts include conservation of these ecosystems in their adaptation component of NDCs, only 19% recognise coastal habitats as opportunities to enhance carbon sequestration and/or protect carbon sinks (Herr and Landis 2016). Interestingly, despite widespread anecdotal association of NbS with coastal areas (for example the use of mangroves as coastal defences) ecosystem-based activities followed the more traditional model of conservation: only 37% of NDCs describing NbS in the coastal zone included actions with EbA characteristics (Seddon et al. 2019b.) Meanwhile, opportunities provided by conservation in coastal marine or ecosystems to promote the adaptation benefits of mitigation actions and vice versa is rarely acknowledged: only 12 countries have acknowledged such synergies (Antigua and Barbuda, Bahrain, Belize, Cook Islands, Madagascar, Marshall Islands, Mexico, Philippines, St Lucia, Saudi Arabia, Suriname and Togo; Herr and Landis 2016).

Studies like these demonstrate that NDCs that integrate adaptation and mitigation efforts in relation to oceans and coastal ecosystems are not being given the appropriate level of attention. As countries review their NDCs, coastal ecosystems should receive important consideration given their vital role in both carbon sequestration and climate change adaptation. Our analyses point to a number of key recommendations to scale up ambition and be more rigorous as NDCs are revised; these are presented in the next section.

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4. Herr, Landis. 2016. Policy Brief. Gland, Switzerland: IUCN and Washington, DC, USA: TNC.
5. Nature-based Solutions Policy Platform www.nbspolicyplatform.org.
6. Global Climate Risk Index 2017 (CRI) compiled by https://germanwatch.org/en/12978.

Suggested guidance for including NbS in future NDCs

At the national level much can be done to scale-up and mainstream NbS, building on progress to date and acknowledging that tackling climate change is a process; it is not prescriptive and involves learning by doing. A set of six broad recommendations for policy makers is suggested to support this process. These are based on analyses of the 10 comparative assessments of NbS in the NDCs, detailed feedback received from partners, and analytical work undertaken to further unpack key features of NDCs from an NbS perspective. More specific sets of technical recommendations are also provided: one targeting agencies revising or preparing future NDCs (Box 2), the other focussing on NbS in marine and/coastal ecosystems (Box 3). The aims are to help improve clarity and rigour around how NbS are included, and allow climate ambition through NbS to be better monitored and increased, including through successive global stock-takes.

The six broad recommendations are as follows:

1. **Build on the increasing global recognition of the importance of ecosystems for addressing both climate change mitigation and adaptation, and fully incorporate Nature-based Solutions into future Nationally Determined Contributions**. All countries – rich or poor – can strengthen their future NDCs by substantially incorporating NbS in them. High-income countries in particular may benefit from more explicitly recognising the potential of NbS to help achieve the goals of the Paris Agreement without lowering their level of ambition in other sectors.
2. **Include NbS actions across a wide range of key naturally occurring ecosystems.** This means, in addition to forests, also include other carbon-rich dryland, coastal (e.g. mangroves) and wetland (e.g. peat) ecosystems where they naturally occur.
3. **Step up NbS actions that simultaneously address climate change adaptation and mitigation, as well as support sustainable development and biodiversity conservation.** This would help to support the development of integrated climate, development and biodiversity action plans. We recommend that synergies between mitigation and adaptation actions are made explicit (highlighted in Articles 4.7 and 5.2), as well as potential trade-offs between different policy goals. For example, countries could prioritise ecosystem restoration activities that both enhance carbon storage and contribute to adaptation, and favour protecting and/or restoring biodiverse and climate-resilient natural ecosystems (as opposed to establishing plantations with single non-native species). In a similar way, they may wish to ensure that adaptation or other development actions such as building desalination plants to improve water security do not come at the cost of ecosystem health (such as through pollution of coastal and marine ecosystems). We also recommend prioritising the funding of actions that promote synergies, whether direct actions or enabling conditions.

4. **Include measurable and robust NbS targets in NDCs and associated national implementation plans.** For adaptation, targets should aim to address specific vulnerabilities to climate change; for mitigation, they should be based on well-supported carbon estimates and accounting. In general, targets should aim to be clearly informed by scientific and local indigenous knowledge about ecosystems, their sustainable management and their local dependencies. A stronger dialogue between scientists, local and indigenous communities, and policy makers would enable this by allowing the co-creation of knowledge about the effectiveness of NbS. It would also help to foster societal participation in their implementation and ensure the avoidance of perverse and inequitable outcomes on the ground. We also recommend that policy makers consider designing the structure of future NDCs in a manner that allows the systematic tracking of ambition for nature, including measurable targets in national plans drawn on best available scientific evidence, local knowledge and good practice (see Box 2).

   There would also be real benefits from policy makers working more closely with researchers from the natural and social sciences, as well as with economists, to draw on the growing evidence base for socio-economic and ecological effectiveness of NbS to climate change mitigation and adaptation. Such action would be in accordance with Article 7.7(c) of the Paris Agreement *Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making*. Many local, including indigenous, communities have historically worked closely with nature to help buffer the impacts of climatic variability for millennia; many are using those techniques now. Policy makers would benefit from consulting these local stakeholders, drawing on their traditional and indigenous knowledge and expertise, and allowing this to inform both scientific investigations and policy formulation on the effectiveness of NbS.

5. **Align NDCs with other relevant national plans and international processes.** For example, with National Adaptation Plans and National Adaptation Programmes of Action, as well as with other relevant international policy processes outside the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. Particularly, in relation to NbS, it could be beneficial for NDCs to have more explicit links with the Sustainable Development Goals and the other two Rio Conventions, and with national plans and targets associated with these, such as the Aichi Targets and National Biodiversity Strategies and Action Plans (NBSAPs) under the Convention on Biological Diversity (CBD) and the Land Degradation Neutrality (LDN) targets under the United Nations Convention to Combat Desertification (UNCCD). It would also be beneficial to develop common frameworks and indicators for reporting and tracking NbS-related actions under these.

6. **Mobilise funding for NbS to climate change.** A number of countries that include NbS in their NDCs have made these conditional on external support. Therefore, mobilising more funding would enable greater and more effective action on the ground. It would also support building capacity to research, design and implement cost-effective and equitable NbS policies and actions at national, sub-

national and local levels. Leading global climate finance platforms and associated bilateral support initiatives could consider a more holistic approach to climate and biodiversity action by highlighting and supporting NbS, noting their wide-ranging co-benefits for sustainable development. Climate and development finance could prioritise overlapping priorities of NDCs with SDGs and the CBD Aichi/post-2020 targets thereby providing an incentive for greater coherence among these policy processes.

BOX 2 | Recommendations for agencies revising or preparing new NDCs in 2020

Formal UNFCCC guidance for developing future NDCs is available in the Katowice Climate Package as agreed to by Parties at UNFCCC COP24. Here we attempt to provide some additional guidance for Parties to consider for incorporating NbS while increasing the ambition of their future NDCs, in line with their national priorities and contexts. The proposed framework, visualised in Figure 5 and described in detail below, provides an overview of the different pieces of information an NDC might usefully include, separated by the broad headings of mitigation and adaptation. This framework can also be used for analysing the next round of NDCs to be submitted in 2020 and to achieve a more harmonised approach and greater comparability between different efforts.

In accordance with Article 4.13 to improve the comparability and transparency and to facilitate the tracking of ambition for NbS, we suggest including the following information:

On the VULNERABILITIES OF SOCIO-ECONOMIC AND ECOLOGICAL SYSTEMS, include:

I. Key short-term impacts as well as long-term hazards from climate change
II. Vulnerable sectors and groups (including gender perspectives):
    - Information on ways in which specific ecosystems are impacted by climate change
    - Information on ways in which human communities benefit from intact ecosystems (i.e. ecosystem dependencies including but not limited to ‘adaptation services)

On MITIGATION and NbS:

I. Elaborate on mitigation actions, current or planned, conditional or unconditional, that help the country meet emissions reductions targets
II. Explain the carbon sequestration and storage potential of key ecosystems, including calculations of the extent to which the restoration of degraded or destroyed ecosystems can help meet a country’s emissions reduction targets
III. Identify priority ecosystems for NbS mitigation actions, i.e., rich in carbon and which might provide important adaptation and other key ecosystems services to people

BOX 2 | continued

IV. Identify the climate change vulnerabilities of ecosystems important for mitigation and ensure that adaptation actions address these

V. Include NbS mitigation actions in non-forest, in particular coastal habitats, wetlands (especially peatlands), montane habitats, and grasslands

VI. Align commitments to community-based conservation actions and commitments to NbS

VII. Harmonise the content of the NDCs with other national climate and development policy processes

VIII. Explicitly link mitigation actions to other international policy goals: i.e. clarify how mitigation actions contribute to achieving the SDGs and biodiversity (Aichi) targets

IX. Include a clear tabulated action plan, with timeframe, costs and quantitative (or qualitative) targets, based on scientific evidence and/or local knowledge.

On ADAPTATION and NbS

I. Explain why adaptation is critical in your country's sectors and ecosystems – linking to long-term national and regional development strategies and goals

II. Elaborate on adaptation actions, current or planned, conditional or unconditional, that address stated vulnerabilities, including those potentially reducing the effectiveness of mitigation action

III. Identify priority ecosystems for NbS adaptation actions, i.e. ecosystems that are vulnerable to climate change and which provide adaptation and other key ecosystem services to people, and provide synergies with NbS mitigation actions

IV. Align NbS actions with socio-economic and ecosystem vulnerabilities to climate change

V. Harmonise NbS adaptation actions across different sectors (e.g. energy, infrastructure, water, agriculture, and tourism)

VI. Include NbS actions in all key naturally occurring ecosystems, including coastal habitats, wetlands (especially peatlands), montane habitats, and grasslands, as well as natural forest

VII. Align commitments to community-based conservation actions and commitments to NbS

VIII. Harmonise the content of the NDCs with other national policies (e.g. National Adaptation Plan) and other national climate and development policy processes

IX. Explicitly link adaptation actions to other international policy goals: i.e. clarify how adaptation actions contribute to achieving the SDGs and biodiversity (Aichi) targets.

X. Include a clear tabulated action plan, with timeframe, costs and quantitative (or qualitative) targets, based on scientific evidence and or local knowledge.

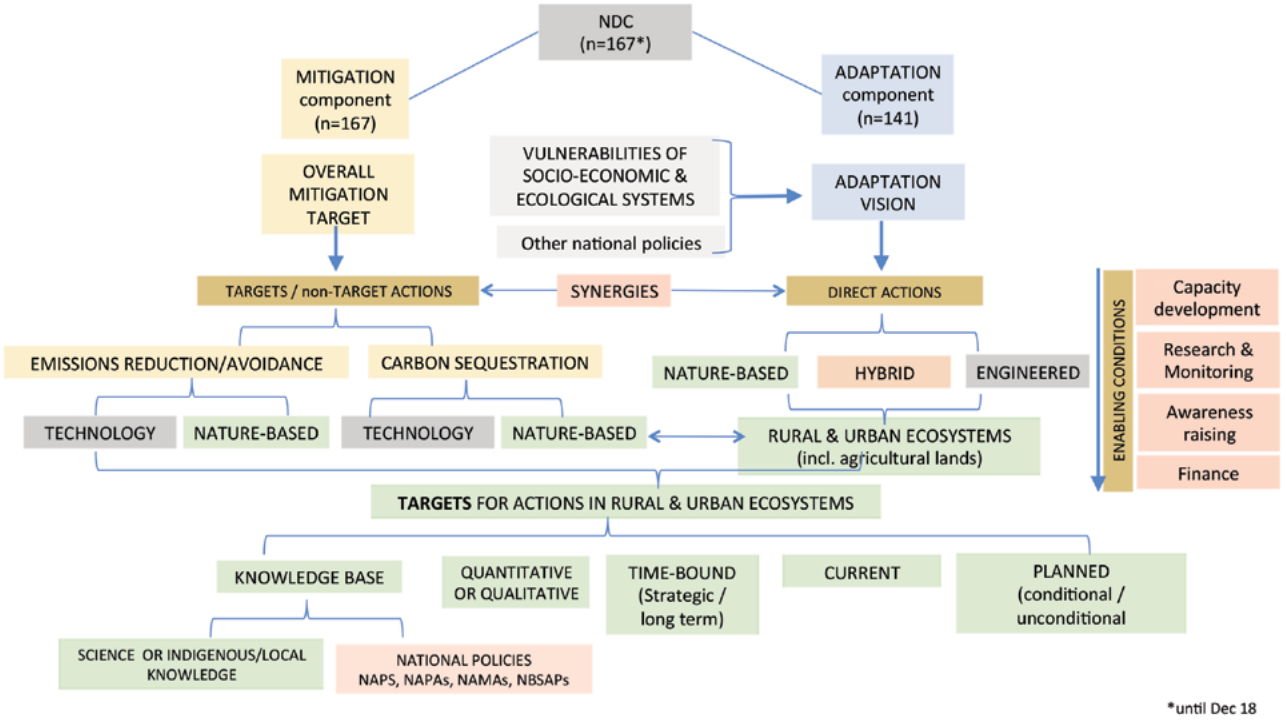

Figure 5. Key information for potential inclusion in new or revised NDCs. This graphic collates the key terms and types of NbS-relevant information extracted from the NDCs across all the analyses, representing the general content of an NDC. The terminology is explained in Annex 3.

BOX 3 | Recommendations for nations with coasts

As countries review their NDCs, it is important to consider marine and coastal ecosystems given their vital role in both carbon sequestration and climate change adaptation. Our additional analyses and synthesis of studies of coastal and marine ecosystems in the NDCs point to a number of key recommendations that can help scale-up ambition as NDCs are revised.

Coastal nations may wish to consider:

- Including and expanding the role of coastal ecosystems in *both* the mitigation and adaptation components of the NDC and identify concrete actions that capitalise on synergies. Specifically, coastal nations with mangroves, seagrass meadows, coral reefs, kelp beds and saltmarsh habitats may include restoration and/or protection of these habitats as both mitigation and adaptation solutions. They can also include the sustainable management of both marine and coastal fisheries as adaptation solutions.
- Aligning actions in the NDCs with other national policies (NAMAs, NAPAs/NAPs), such as highlighting how country NAPs/NAPAs are already managing, or will manage coastal ecosystems for climate adaptation and ensure these actions are reflected in the NDCs. Indonesia, the world's largest archipelago, for example,

BOX 3 | continued

offers a good illustration of recognising mangrove conservation in its National Action Plan for Climate Change Adaptation.

- Improve the national legal and regulatory context for coastal ecosystems.

Agencies revising the NDCs could also include key information about coastal ecosystems to raise their profile as effective Nature-based Solutions to both climate change mitigation and adaptation. In particular, they might consider including information about coastal ecosystem vulnerabilities to climate change (including secondary impacts of other mitigation or adaptation activities such as desalination plans), human dependencies on those ecosystems (in particular regulating ecosystem services), and actions that both address climate change impacts and help a nation meet its overall mitigation targets. It would be particularly beneficial to include measurable targets based on scientific and local understanding of the effectiveness of different nature-based (or other) interventions, and to be explicit about how these NDC targets align with those of other national policies (such as NAPs, NAPAs, and NBSAPs). Actions and targets that maximise synergies between mitigation and adaptation, as well as between sustainable development and biodiversity conservation, are most effective and need to be prioritised for funding and implementation.

The research community would benefit from working across different disciplines and forming close South-South and South-North collaborations to collate data and develop robust tools that:

- Clearly identify specific coastal ecosystem vulnerabilities i.e., state which ecosystems are impacted by climate change and how, and whether these effects influence specific economic or other sectors, drawing on science and local knowledge;
- Consolidate understanding of the cost-effectiveness of different NbS and hybrid solutions to both climate change mitigation and adaptation;
- Develop a common definition of blue carbon mitigation activities.

In general, much greater engagement of marine and coastal ecosystem scientists is needed to ensure blue carbon ecosystems are appropriately considered in national climate action plans. Note that the Intergovernmental Panel on Climate Change (IPCC) special report on the ocean and cryosphere (due out later in 2019) may provide additional guidance on marine impacts in time to inform the next round of NDC revision/ preparation.

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Annex 1 Review methods and comparison of analytical approach among studies

Methods

Literature review

We identified all available comparative studies of Nature-based Solutions in the NDCs. This includes recent analyses conducted by the authors (Nature-based Solutions Initiative 2018; Seddon et al. 2019c; IUCN 2018) as well as those identified from the academic and grey literature using Scopus, Web of Science and CAB and using a comprehensive search string (Table A1). This search included terms associated with the NDCs and keywords associated with the IUCN definition of NbS and built on that developed for a published systematic review of ecosystem-based adaptation (Munroe et al. 2012). The search was limited to studies published between 2015 (when the Paris Agreement was signed) and August 2018 (when the search was conducted). We also screened all the references in eligible studies to identify further relevant publications.

Table 1A. Nature-based Solutions and NDCs search string

Category	Terms
Focus on analysis	TS=(“Nationally Determined Contribution*) OR “NDC” OR “Paris Agreement” OR “United Nations Framework Convention for Climate Change” OR “UNFCCC”
NbS intervention terms	TS=(“ecosystem-based mitigation” or “ecosystem-based adaptation” OR "ecosystem approach*" OR "ecosystem-based" OR “natural climate solution” OR "community-based" OR "disaster risk reduction" OR mitigation OR (natur* NEAR/1 (solution* OR approach*)) OR "no-regret" OR (infrastructure NEAR/1 (green OR natural OR blue OR ecological)) OR (integrated NEAR/2 management) OR "natural resource management" OR (management NEAR/1 (protected OR coast* OR river OR wetland* OR flood* OR catchment OR watershed OR forest OR woodland OR landscape OR rangeland OR ecosystem OR water OR sustainable OR environment*)) OR restoration OR rehabilitation OR "protected-area" OR conservancy OR (protection AND measure*) OR (agriculture NEAR/1 (conservation OR resilient OR sustainable OR ecolog*)) OR "climate-smart" OR "adaptation services" OR (engineering NEAR/1 (ecological OR ecosystem OR natur*)) OR agroforest*) AND

Category	Terms
Direct NbS target or habitat type	TS=((infrastructure NEAR/1 (green OR natural OR blue OR ecological)) OR “carbon stock” OR “carbon storage” OR sequestration OR "natural resource*" OR ecosystem* OR vegetation OR *biodiversity OR "natural capital" OR "ecosystem service*" OR wetland* OR river OR forest* OR woodland* OR dryland* OR grassland* OR "coral reef*" OR coast* OR mangrove* OR tree* OR "sea grass*" OR seagrass* OR watershed* OR mountain* OR "agro-ecosystem*" OR agroecosystem* OR rangeland* OR "agro-forest*" OR agroforest* OR riparian OR estuar* OR lake* OR stream* OR aquifer* OR marsh* OR catchment* OR floodplain* OR "flood plain*" OR peatland* OR saltmarsh OR "salt marsh*" OR marshland* OR savanna OR tropic* OR floodplain* OR shrub* OR "dry-field*" OR intertidal OR dryfield* OR crop* OR wildlife) AND

The 10 selected studies were analysed and synthesised in two phases. First, we compared analytical approaches taken, extracting information on sample size (number of NDCs included) regional focus, overall aim, type(s) of NbS and ecosystems assessed, approach to textual analysis (e.g. was a detailed systematic content analysis conducted or simply a rapid appraisal using key word search?). Then we compared the results of the studies, arranging them with respect to their aims and NbS or ecosystem-focus and, where possible, converting all results into the same metric to facilitate comparison (i.e. percentage of NDCs included in the analysis). We highlight where there is broad agreement among studies and produce a set of common findings about the current and potential role of NbS in the NDCs, highlighting limitations and establishing lines of action policy and practice.

Results

Studies of NDCs included in this review

Our search string identified 174 studies: 67 by Scopus, 45 by Web of Science and 62 by CABs. Of these, 76 were unique but only 10 met our inclusion criteria, i.e. involved comparative assessment of NbS across multiple NDCs. Seven were global and three regional in scope. These are summarised in Table 2 in section 2. The remaining studies were either single country assessments and did not examine the role of NbS in meeting adaptation and mitigation goals. Many instead focussed on calculating the global and regional abatement costs of the NDCs, the role of the energy sector in meeting NDC targets, and modelling the implications of the NDCs.

Overview of sample and methods

The studies varied in terms of numbers and regional distribution of NDCs assessed, overall aims, study designs and methods of analysis (Table 2). The five global assessments included all NDCs (or intended NDCs[6]) available at the time when each

6 Initial submissions were ‘intended NDCs’; once a nation ratified they became NDCs.

study was conducted (i.e. 159 to 166). Of the five regional assessments, one included 29 NDCs covering 56 countries (chosen to reflect a broad geographical range, membership of different negotiating blocks and levels of economic development, WWF 2017); one assessed the NDCs submitted by the five BRICS nations (Brazil, Russia, India, China and South Africa, Bahn et al. 2017); one included five Mesoamerican nations (Mexico, Costa Rica, El Salvador, Guatemala and Honduras, IUCN 2018); and one examined the NDCs of Morocco and Tunisia (Rankovic et al. 2017); (Table 2). While most (seven) studies reviewed the content of both the mitigation and adaptation components of the NDCs, Bahn et al (2017) examined the mitigation component only and Nature-based Solutions Initiative (2018) and IUCN (2018) focussed on the adaptation component. Some studies used in-depth systematic quantitative content analysis validated by multiple observers (e.g. Nature-based Solutions Initiative 2018). Others adopted more rapid appraisal techniques involving keyword searches (e.g. WWF 2017), and others conducted in-depth systematic qualitative interpretation of NDCs' content (IUCN and Climate Focus, 2017). Prominence of NbS was reported in differing ways across the studies. Some used the number or percentage of NDCs/INDCs to include NbS (whether a target or action), some the number or percentage of NDCs/INDCs with adaptation components, and some the number or percentage of nations of signatories. Only two studies made their data open-access (Table A2).

Overview of NbS scope and ecosystems included

The 10 studies also varied in which types of NbS and ecosystems were considered (Table A2). Four broad (and non-mutually exclusive) groups of NbS approaches were considered: (1) restoration and protection forests, including afforestation, sustainable forest management, and agroforestry (Bahn et al. 2017; IUCN and Climate Focus 2017; FAO 2016); (2) restoration and protection of marine and coastal ecosystems (Herr and Landis 2016; Gallo et al. 2017); (3) biodiversity conservation in general (Laurans et al. 2016; Rankovic et al. 2017; WWF 2017); and (4) ecosystem-based adaptation (EbA; i.e. NbS aimed at helping people adapt to climate change impacts; Nature-based Solutions Initiative 2018; Seddon et al. 2019c; IUCN 2018).

Synopses of scope and analytical approach

Here we provide synopses of the NbS scope and analytical approach adopted by each of the 10 studies (including key definitions used, types of information extracted, etc.) organised with respect to four broad types of NbS.

1. Restoration and protection of forest landscapes (including sustainable management, and agroforestry)

IUCN and Climate Focus (2017) considered the prominence of forest landscape restoration (FLR) as 'a cost-effective NbS which can promote multifunctional landscapes and help regain a balance of ecological, social and economic benefits from forests and trees'. Information was extracted on types and conditionality of FLR targets (qualitative and quantitative) and non-target activities in both mitigation and adaptation components. For non-

target information, the analysis considered existing efforts, additional actions, and current policies presented as separate from official NDC target(s). Forest and land activities were assessed under the FLR approach and, reconciled with the REDD+ typology, were categorised as either planted forests and woodlots, silviculture, assisted regeneration, watershed protection, mangrove restoration, agroforestry, improved fallow, or other/non-specific restoration activities, in accordance with the FLR typology (IUCN and Climate Focus 2017). Quantitative targets were expressed as tons of sequestrated carbon per year and/or as hectares, as per textual content in NDCs. Each forest and FLR target under mitigation was evaluated according to how it is to be accounted for and reported. Targets were categorised as: (i) 'economy-wide/multisector' when including in greenhouse gas (GHG) emissions accounts across all or multiple sectors; (ii) 'excludes land/forest' explicitly for GHG accounts under the NDC target; or (iii) 'sectoral' refers to specific sectoral targets in LULUCF that fall under FLR and/or nature-based negative emissions (e.g. enhanced forest carbon stocks); (IUCN and Climate Focus 2017). A specific indicator described the conditionality of targets. When not explicit, the nature of targets is interpreted by examining NDC language and context which could suggest an implicit conditionality for achieving mitigation and adaptation targets, while also considering the practical implications for NDC revision, implementation, and reporting.

Bahn et al. (2017) conducted a qualitative assessment of the statements made about the forest and land sector in the mitigation components of the NDCs of the five BRICS nations (Brazil, Russia, India, China and South Africa), and relate these to the mitigation targets stated by these countries.

FAO (2016) determined the prominence of forestry and agro-forestry actions (amongst other aspects of agriculture and LULUCF) within the NDCs of nations that identify agriculture as being impacted by climate change. During full text reviews of both adaptation and mitigation components they conducted a cross-checked keyword search and extracted information on declared vulnerabilities, LULUCF-sector specific GHG and non-GHG targets, and the conditionality of actions and targets on financial support or capacity building, and knowledge or technology transfer. Results were reported as number of countries that submitted an NDC, along with UNFCCC INDCs Synthesis Report (2016) qualifiers (few, some, several, many, most).

2. Restoration and protection of marine and coastal ecosystems

Herr and Landis (2016) considered the prominence of the conservation and restoration of coastal ecosystems, assessing which NDCs included these ecosystems as part of LULUCF and other forest commitments (conservation and management, protection and reforestation as part of mitigation and adaptation plans). They also noted which NDCs make specific references to blue carbon, planning tools (e.g. ICZM), fisheries, synergies between mitigation and adaptation benefits of coastal ecosystems, and quote relevant text from individual NDCs.

Gallo et al. (2017) analysed the inclusion of 23 marine keywords using a text mining approach encompassing estuarine, coastal and open ocean ecosystems and producing a total marine word count for each NDC. Sections in which marine keywords appeared were extracted and used to determine whether Parties were including marine ecosystems as mitigation or adaptation contributions in their NDCs. Across all NDCS, 31 specific marine categories were identified. A Marine Focus Factor (MFF) was then calculated for each NDC using the tabulated marine keywords and categories. The MFF was used as a comparative metric for evaluating the extent to which marine ecosystems were included in the NDCs, with appropriate statistical tests (e.g. analysis of variance) to determine whether there were significant difference in marine inclusion between coastal and landlocked countries, and among Annex 1, Small Island Developing States (SIDS), and all other Parties for the whole NDC data set. A multiple linear regression analysis was used to investigate the impact of a number of explanatory variables on the MFF.

3. Conservation of biodiversity and ecosystems in general

Rankovic et al. (2017) reviewed and ranked the NbS actions in the NDCs of Morocco and Tunisia, based on their level of ambition for biodiversity protection. Actions and measures were considered equivalent; NbS actions were considered to be those where conservation issues were explicitly mentioned and quantified (e.g. number of hectares) or whether certain terms suggested that the action was 'biodiversity-oriented'. The study identified three types of NbS, according to their level of ambition for biodiversity: Type 1 included protection/ restoration of ecosystems; Type 2 included biological engineering actions aimed at specific processes or organisms (soil restoration, plant stabilisation of sand dunes); Type 3 included actions based partly on living organisms but incorporating territorial or sectoral reorganisation programmes (e.g. development of organic farming, the definition of new eco-tourism zones or better promotion of seafood products).

Laurans et al. (2016) examined how NDCs translate intentions in terms of nature and biodiversity policies, specifically identifying the countries which placed great emphasis on NbS in their adaptation and mitigation plans.

WWF (2017) considered broad biodiversity conservation actions in all ecosystems, including indigenous territories, with the aim of assessing how well integrated the NDCs are with the 20 Aichi Targets agreed by Parties under the Convention on Biological Diversity. Each NDC was rated for each Aichi Target as strong or less strong based on the level of relevant detail provided, taking into account whether the action was already enshrined in policies or laws, the level of detail given on the planned actions and whether the relevant information was included in the NDC, or in supplementary information. As only Colombia and Jordan made explicit links to the Aichi Targets, the analysis assessed alignment of the NDC with the content of the Aichi Targets, rather than exact reference of their wording. Symbols were used (forest, marine, indigenous, agriculture, ecosystems, mangroves,

freshwater and unspecified) to indicate the context in which the NDC relates to the respective Aichi Targets.

4. NbS for adaptation or Ecosystem-based Adaptation

Nature-based Solutions Initiative (2018) assessed the prominence of NbS in the adaptation components of all NDCs, with a particular focus on ecosystem-based adaptation (EbA), classifying statements in the adaptation component of the NDCs with respect to whether they described adaptation 'visions', 'actions' or 'targets' (see glossary for definitions of these terms) (see also: Seddon et al. 2019c). Actions were allocated to one or more of five non-mutually exclusive broad habitat types; targets were coded with respect to whether they were quantitative and measurable. The review process was undertaken by three observers who agreed on the coding and classification process at the outset. Throughout the reviews, queries and uncertain coding were highlighted and collated for discussion between the observers and final decisions made after team discussions. The lead observer conducted an audit process of the other two observers' reviews to achieve a degree of replicability; discrepancies were discussed and resolved. The final dataset comprising coded adaptation plans as described in the current versions of the NDCs is publicly available on the Nature-based Solutions Policy Platform (www.nbspolicyplatform.org).

IUCN (2018) identified how EbA is being incorporated in country adaptation efforts in Mesoamerica. Combining the Biagini et al. (2014) typology with on-the-ground experience, they assigned adaptation actions with respect to two overarching adaptation categories and 10 adaptation types: *enabling conditions* (policy and law, management and planning, financing, capacity building and awareness, information systems and research) and *actions on the ground* (grey infrastructure, natural infrastructure, sustainable practices and behaviour, adoption of technologies, early warning systems).

Summary

Studies varied widely in terms of scope and analytical approaches, numbers and geographical distribution of NDCs analysed. However all used some form of textual qualitative analysis and provided basic statistics on numbers or percentages of NDCs containing NbS pledges/actions or targets about ecosystems and biodiversity. These statistics are not comparable in their raw form as, apart from analysing different concepts, some studies cited percentages as part of overall NDCs submitted, while others included percentages of the countries that submitted I/NDCs. While all studies explored both mitigation and adaptation components of the NDCs, these were not given equal weight across the studies, with some having a stronger focus on adaptation while others providing a stronger focus on mitigation in the context of agriculture and forestry. All studies except IUCN (2017) and WWF (2017) provided specific regional analysis, with Nature-based Solutions Initiative (2018) being the only one that also conducted an NDC analysis based on country income group. Finally, not all studies provided clear recommendations and conclusions. These findings

underscore the need for a single study on the importance of NbS in the NDCs, which would include all submitted NDCs, an agreed method of codifying the text (typology), and analysing the widest possible range of ecosystems with respect to both mitigation and adaptation.

Table A2. Comparison of NbS scope, ecosystem focus and types of information extracted across all 10 studies of NbS in the NDCs

	Studies[1]:	1	2	3	4	5	6	7	8	9	10
NbS considered	Ecosystem restoration (general)	X	X	X	X	X	X	X	X	X	X
	Forest Landscape Restoration			X		X					
	Ecosystem protection	X	X	X	X	X	X	X	X		X
	Ecosystem-based management	X			X	X	X				X
	Green/natural infrastructure	X			X						
	Ecosystem-based Adaptation	X	X			X			X		
	Community-based Adaptation	X									
Ecosystems explicitly considered	Ecosystems in general (non-specific)		X			X		X			X
	Indigenous lands (non-specific)							X			X
	Coastal and/or marine ecosystems	X			X	X	X	X	X		X
	Terrestrial forests or woodlands	X		X		X	X	X		X	X
	River catchments or wetlands	X				X	X	X			X
	Grasslands and rangelands	X				X					
	Montane habitats	X				X					
	Agroforestry systems	X				X		X		X	

	Studies[1]:	1	2	3	4	5	6	7	8	9	10
Types of information extracted	Ecosystem vulnerabilities	X								X	
	Overall NbS vision for mitigation and/or adaptation	X				X	X				
	Direct mitigation actions/targets	X		X		X	X		X	X	
	Direct adaptation actions/targets	X	X			X	X		X	X	
	Enabling conditions	X	X			X					
	Conditionality of actions/targets	X				X				X	
	Measurable nature actions/targets	X				X				X	
	Estimates of implementing actions	X				X					
	Linkages with other policy frameworks	X						X			
Open access dataset?		X[2]			X[3]	X[4]					

1. Numbers refer to studies listed in Table 2
2. Nature-based Solutions Policy Platform: www.nbspolicyplatform.org
3. https://media.nature.com/original/nature-assets/nclimate/journal/v7/n11/extref/nclimate3422-s1.pdf
4. https://infoflr.org/what-flr/increasing-ambition-and-action-ndcs-through-flr

Synopsis of policy recommendations

1. Forest restoration and/or protection

The key recommendation from **IUCN and Climate Focus (2017)**, based on their analysis of forests within NDCs and also the mapping of these against the forest landscape restoration pledges made under the Bonn Challenge, is to draw on the Bonn Challenge pledges to raise further NDC ambition in relation to forests and thereby advance the implementation of the Paris Agreement. The study also suggested using the 2018 Talanoa Dialogue[7] as an opportunity to strengthen collaboration and learning among state and non-state actors on this topic to 'enable, facilitate and encourage action'. It emphasises that 'effective and coherent alignment of national policies and international commitments requires efficient cross-sectoral coordination at the national level, and consistency and ambitious international support that fosters faster and ambitious climate action'.

7 This was a process mandated under the UNFCCC to take stock of the collective efforts of Parties in relation to progress on the long-term goals of the Paris Agreement, and to inform the preparation of future NDCs.

It also acknowledges the 'need for further analysing and understanding the technical, financial and governance opportunities and challenges that countries face will be crucial to enable countries to move from ambition to actual targets under NDCs'.

2. Restoration and protection of marine and coastal ecosystems

Herr and Landis (2016) argue that one of the most significant mitigation opportunities is for countries to include coastal wetlands in national carbon inventories, while NAPs/NAPAs should better highlight management of coastal ecosystems for climate adaptation and include these actions in the NDCs. They recommend that revised NDCs of all coastal nations should include and expand blue carbon ecosystems in the mitigation section, include actions that enhance the adaptation co-benefits of mitigation actions in coastal ecosystems and place these actions within the broader context of integrated coastal zone management and national REDD+ strategies. **Gallo et al (2017)** recommend a greater emphasis on the protection of marine and coastal ecosystems, especially in the mitigation section of the NDCs and in NDCs from Annex I countries. They argue that this can be achieved through greater engagement of ocean scientists in NDC revision and increased collaboration between marine institutions in developing and developed countries to address capacity challenges. They also recommend that secondary impacts from climate mitigation and adaptation plans should be considered, such as seawater desalination plants which can degrade coastal and marine ecosystems and reduce their integrity and resilience to change (Elimelech & Phillip 2011). Further, because the high seas remain outside the jurisdiction of the UNFCCC, it is important to consider how action under the Paris Agreement interacts with other UN treaties, including the UN Convention on the Law of the Sea, the Convention on Biological Diversity, and the Sustainable Development Goals. A list of specific recommendations for marine and coastal ecosystems is provided in Box 3 (Section 3).

3. Conservation of biodiversity and ecosystems in general

At the international policy level, **WWF (2017)** recommends that future NDCs should note whether and how mitigation and adaptation actions help achieve the SDGs, CBD and UNCCD goals and that common indicators for reporting between the conventions should be developed. WWF also notes that the UNFCCC requires reporting on the role of nature in adaptation planning in each country's NDC to help demonstrate integrated thinking, including measurable targets, and that countries share knowledge and ideas. At the national level, WWF argues for greater recognition by national governments of synergies between mitigation and adaptation actions, and sustainable development and biodiversity conservation, with a view to developing integrated plans of action and investing in capacity-building at all levels while taking into account local and indigenous knowledge. When it comes to implementation and planning of NDCs, non-state actors (for example the Global Climate Action Agenda) should be encouraged to embrace integrated action on climate, development and nature,

and acknowledge that addressing biodiversity loss is important in helping to stay well below 2°C warming and essential to achieve the 1.5°C target.

To better support biodiversity in implementing the NDC, **Rankovic et al. (2017)** recommend prioritising NbS measures that involve existing policies for ecosystem protection or restoration targets, while integrating biodiversity targets into NbS that do not give them explicit attention. They also highlight the need to identify additional resources to implement biodiversity-friendly climate policy and support project leaders capable of intersectoral implementation of NbS. **Laurans et al. (2016)** recommend the establishment of integrated and consistent policy networks.

4. NbS for adaptation (i.e. Ecosystem-based Adaptation)

Nature-based Solutions Initiative (2018) provides a set of recommendations for scaling-up and mainstreaming NbS and EbA into national policy targeted at four groups of actors. These are relevant to NbS in general and broadly align with the conclusions of the other studies. (i) **national governments** are advised to establish measurable NbS targets in national plans, drawn on best available scientific evidence, local knowledge and best practice, to report on progress towards these targets in the NDCs, NAPs and other national climate and development policy, and to rank NbS alongside other key elements of sustainable development. (ii) **researchers** from the natural and social sciences and economists are encouraged to work together to build a strong evidence base for socio-economic and ecological effectiveness of EbA compared to other adaptation options to help develop targets and costed plans. (iii) ***practitioners*** are asked to share best practice and learning on what makes EbA effective (or otherwise) and ensure that this knowledge informs the development of robust targets and shapes the redrafting of the NDCs in 2020. (iv) **leading platforms funding climate action** (such as UN-REDD Carbon Fund, Green Climate Fund and associated bilateral initiatives) are encouraged to adopt a more holistic approach by highlighting and promoting EbA and its **co-benefits** for sustainable development. And finally (v) **agencies revising NDCs** are advised to increase transparency and comparability of adaptation plans and better align them with mitigation plans. Several specific recommendations are made around how to improve rigour such as using consistent terminology for NbS based on scientific consensus, aligning commitments to EbA in the mitigation and adaptation components and harmonising the content of the NDCs with NAPs and other climate and development policy processes. **IUCN (2018)** meanwhile strongly emphasised the dual importance of action on the ground and creating the enabling conditions for effective EbA implementation and hence the need to recognise both in all NDCs and funding programmes.

Annex 2 Case studies: Good practice around including NbS in the NDCs

The following examples of NDCs were chosen to demonstrate a diversity of approaches to incorporating NbS, geographic coverage, and lessons for other countries. They also had most if not all of the broad characteristics indicating a strong commitment to NbS.

Specifically, the examples:

- declared climate impacts on ecosystems
- listed the protection of these ecosystems and their biodiversity as a major motivation for developing adaptation plans
- articulated an overarching vision for climate change policy that included NbS
- outlined NbS actions that met at least some if not all of the nation's declared vulnerabilities to climate change
- included NbS actions in both mitigation and adaptation components that were broadly measurable, time bound, and
- acknowledged synergies between mitigation and adaptation actions.

Some examples also included costed plans for NbS. Additional examples are available as country factsheets, which can be downloaded from the Nature-based Policy Platform (NBS Policy Platform 2018).

Examples of nations that emphasised NbS in their NDCs, annotated with respect to six broad attributes.

Region	Nation	Eco-system vulner-ability	NbS vision	Aligned vision and actions	NbS actions	Measurable NbS targets	Mitigation-adaptation synergies	Costed plan
Asia	Mongolia	X	X	X	X	X	X	X
	Vietnam	X	X	X	X	X		
	Nepal	X	X	X	X		X	
Americas	Bolivia	X	X	X	X	X	X	
	Costa Rica	X	X	X	X	X	X	
	Mexico	X	X	X	X	X	X	
	Colombia					X	X	
Africa	Morocco	X	X	X	X	X		
	Rwanda	X	X	X	X	X		
	Madagascar	X	X	X	X	X		

To review this information directly, visit: www.nbspolicyplatform.org

Examples of good practice from Asia

MONGOLIA

NbS vision: 'Increased adaptive capacity to overcome negative impacts of climate change, and to strengthen resilience of ecosystem and socio-economic sectors'.

Planned NbS actions: (i) To build capacity of community forestry groups to conduct modern technologies for forest seedlings and tree plantations; (ii) to make forests resilient to climate change by improving their productivity and changing their composition and structure; (iii) to train human resources for forest management practices; and (iv) to maintain availability of water resources through protection of runoff formation zones and their native ecosystems in river basins.

NbS target or measure: Increase forest area to 9% by 2030 through reforestation activities.

VIETNAM

NbS vision: 'Implement ecosystem-based adaptation through the development of ecosystem services and biodiversity conservation, with a focus on the preservation of genetic resources, species at risk of extinction, and important ecosystems'.

Planned NbS actions: (i) Implement sustainable forest management; (ii) improve the quality of poor natural forests; (iii) implement afforestation and reforestation measures, focusing on large timber plantations; (iv) prevent forest deforestation and degradation; (v) protect, restore, plant and improve the quality of coastal forests, including mangroves, especially in coastal estuaries and the Mekong and Red River deltas.

NbS target or measure: '(i) Forest coverage increased to 45%; and (ii) area of protection forest in coastal areas is increased to 380,000 ha, including 20,000 to 50,000 ha of additional mangrove planting'.

NEPAL

NbS vision: 'The Government of Nepal […] realizes the importance of reducing climate change impacts and implements climate adaptation actions to protect life and improve livelihoods of the climate vulnerable communities and also improve ecosystem services.' Nepal's goal is to ensure the country is 'spared from the adverse impacts of climate change, by considering climate justice, through the pursuit of environmental conservation, human development, and sustainable development – all contributing towards a prosperous society'.

Planned NbS actions: Nepal's broad NbS adaptation actions are to (i) undertake scientific (bio-physical as well as social sciences) approaches to understand and deal with the impacts of climate change in mountains, hills and lowland ecosystems and landscapes; (ii) develop and implement adaptation strategies for climate change affected sectors; and (iii) sustainably manage forest with equal emphasis on enhancing forest carbon sequestration and storage and improving forest governance. NbS target or measure: To (i) mainstream community/ecosystem-based adaptation

by 2025; (ii) maintain 40% of the total area of the country under forest cover and forest productivity; (iii) enhance Nepal's forest carbon stock by at least 5% by 2025 compared to 2015 level (as per the Forestry Sector Strategy 2016-2025); (iv) decrease mean annual deforestation rate by 0.05% from about 0.44% and 0.18% in the Terai and Siwalik hills respectively; and (v) put in place a forest carbon trade and payment mechanism and mainstream community/ecosystem-based adaptation by 2025. These actions and targets derive directly from Nepal's NAPA.

Examples of good practice from the Americas

BOLIVIA

NbS vision: NbS are central to climate change action in the Bolivian NDC. It states: 'The fight against climate change for sustainable and harmonious development with nature on the basis of management systems life is present in this vision. Construction of a climate system based on responsibility to Mother Earth, the culture of life and the full realization of humanity in their holistic development, humanizing the economy, surpassing the simplistic approach to de-carbonization of the economy'.

Planned NbS actions: '(i) consolidation of agroforestry systems; (ii) transition to semi-intensive systems of livestock management and integrated management of agroforestry and silviculture techniques; (iii) strengthening community-based stewardship in forest management and farming systems; (iv) reduction of vulnerabilities in agricultural, fisheries, and agro-forestry systems of production; (v) measures of agricultural and livestock production insurance to include additional conservation actions, making resilient agricultural and forestry production systems; (vi) restoration of vegetation cover (trees, grasslands, wetlands and others) to prevent erosion and reduce damage due to adverse climatic events; (vii) restoration and recovery of degraded soils and forests; and (viii) conservation of areas with high environmental functions.'

NbS target or measure: Actions are followed with some key quantifiable NbS targets, more numerous than those provided in any other NDC. '(i) timber and non-timber production has increased by 40%, doubling food production from the integrated management of forest and agricultural systems in 2030. (ii) increased forest areas with integrated and sustainable community management approaches with 16.9 million hectares in 2030, in reference to 3.1 million hectares by 2010. (iii) strengthened environmental functions (carbon capture and storage, organic matter and soil fertility, biodiversity conservation and water availability) in about 29 million hectares by 2030. (iv) contribution to Gross Domestic Product (GDP) growth of 5.4% in 2030, boosted by agricultural and forestry production complementary to conservation. (v) reducing extreme poverty to zero in the population dependent on forests by 2030, based on approximately 350 thousand people by 2010. (vi) joint mitigation and adaptation capacity has increased in areas covered by forests, agricultural and forestry systems from 0.35 units in 2010 to 0.78 in 2030, as measured by the Index of Sustainable Forest Life, achieving productivity and conservation systems that are both complementary and resilient. (vii) community forest management has increased

sevenfold in the area of forest management in 2030. (viii) increased reforestation by six million hectares by 2030.'

COLOMBIA

NbS vision: 'Socio-ecosystem based adaptation with a view to move towards economies, societies and ecosystems resilient to climate change impacts'.

Planned NbS actions: 'Colombia reaffirms its commitment to reduce deforestation in the country and to preserve nine important ecosystems such as the Amazon region, given its huge potential to contribute to the stabilisation of greenhouse gases in the atmosphere.'

NbS target or measure: 'The following are specific prioritised actions by 2030: (i) increase of more than 2.5 million hectares in coverage of newly protected areas in the National System of Protected Areas (SINAP), in coordination with local and regional stakeholders; and (ii) delimitation and protection of Colombia's 36 paramo areas (high mountain Andean ecosystems, approximately three million hectares).'

COSTA RICA

NbS vision: 'The country will continue with its Green and Inclusive Development policy through local actions in adaptation, such as, inter alia, the strengthening of conservation programs and expanding the environmental services payments program to include Ecosystem-based Adaptation. Ongoing efforts to develop adaptation measures for the water and biodiversity sectors, including the National Conservation Areas System (SINAC), have resulted in the launch of a National Ecosystem-based Adaptation Strategy. Increase focus will be given to building resilience from a sustainable development, food security and rural productivity perspective'.

Planned NbS actions: 'Costa Rica is committed to develop its adaptation practice from an ecosystem-based adaptation focus. There are opportunities for exploring synergies between adaptation practices and the reduction of emissions through avoided deforestation. These include, inter alia, the consolidation of FONAFIFO's Environmental Services Payments program and the Forest Certification program as a mechanism to promote the sustainable development of forest resources and effective protection of water sources for all 81 counties of Costa Rica; the promotion of the National Biological Corridor System and the National Protected Areas System (SINAC)'.

NbS target or measure: Increase forest cover to 60%.

MEXICO

NbS vision: 'The protection of communities from adverse impacts of climate change, such as extreme hydro meteorological events related to global changes in temperature; as well as the increment in the resilience of strategic infrastructure and of the ecosystems that host national biodiversity'.

Planned NbS actions: '(i) guarantee food security and water access in light of growing climate threats through integral watershed management, biodiversity and land

conservation. (ii) reforest high, medium and low watersheds with special attention to riparian zones and taking into account native species in the area. (iii) conserve and restore ecosystems in order to increase ecological connectivity of all natural protected areas and other conservation schemes, through biological corridors and sustainable productive activities. This approach will take into account the equitable participation of the population and will have a territorial approach. (iv) increase carbon capture and strengthen coastal protection with the implementation of a scheme of conservation and recovery of coastal and marine ecosystems such as coral reefs, mangroves, sea grass and dunes. (v) substantially increase the Programs of Action and Conservation of Species in order to strengthen the protection of priority species from the negative impacts of climate change. Some of the adaptation actions presented foster positive synergies with mitigation actions'.

NbS target or measure: '(i) strengthen the adaptive capacity of at least by 50% the number of municipalities in the category of 'most vulnerable'; (ii) establish early warning systems and risk management at every level of government, and (iii) reach a rate of 0% deforestation by 2030.'

Examples of good practice from Africa

MOROCCO

NbS vision: 'The protection of natural heritage, biodiversity, forestry and fishery resources through an ecosystem-based adaptation approach. Morocco [also] commits to restoring ecosystems and strengthening their resilience, to combat soil erosion and prevent flooding'.

Planned NbS actions: '(i) rehabilitate ecosystems and protect and promote natural areas as well as endangered species as resources. (ii) protect water basins against erosion and siltation of dams. (iii) develop forestry and surrounding areas. Finalize land demarcation and registry of forested areas.'

NbS target or measure: '(i) renewal or afforestation of approximately 50,000 ha per year. (ii) Conversion of nearly 1 million ha of grain crops to fruit plantations that are likely to protect agricultural areas from all forms of erosion, especially water erosion.'

RWANDA

NbS vision: 'Rwanda's long term vision is to become a climate resilient economy, with strategic objectives to achieve energy security and a low carbon energy supply that supports the development of green industry and services; sustainable land use and water resource management that result in food security, appropriate urban development and preservation of biodiversity and ecosystem services, as well as to ensure social protection, improved health and disaster risk reduction that reduces vulnerability to climate change impacts'.

Planned NbS actions: To achieve this vision, Rwanda intends to '(i) improve the management of its forest resources by increasing efforts in using quality germplasm, planting trees at the right time (rain season) and improving post-planting care; (ii)

use mixed-species approaches which contribute greatly to the achievement of both mitigation objectives and adaptation benefits of ecosystem resilience and biodiversity; (iii) employ Improved Forest Management for degraded forest resources; (iv) maximise the productivity of its many degraded forest plantations; (v) mainstream agro ecology technologies in its current agriculture intensification programme and other natural resource-based livelihood programmes.'

NbS target or measure: '(i) to achieve an overall 30% sustained forest cover of the total national land surface by 2030 from 28.8% in 2013. (ii) by 2030, Rwanda will implement public-private partnerships to sustainably manage all forestry plantations through multiyear contracts with forest operators (in cooperatives) who will plant and maintain young plantations until they reach commercial viability. (iii) development and implementation of an intensive agroforestry programme with a target of covering 100% of arable land by 2030.'

MOZAMBIQUE

NbS vision: 'Rehabilitation of degraded forests and restoration of local ecosystems for people affected due to extreme weather events [and to] reduce soil degradation and promote mechanisms for the planting of trees for local use'.

Planned NbS actions: 'Increase the effectiveness of land use and spatial planning (protection of floodplains, coastal and other areas vulnerable to floods); increase the resilience of agriculture, livestock and fisheries, guaranteeing adequate levels of food security and nutrition; ensure biodiversity protection. All these strategic actions are to be included in the National Adaptation Plan.'

Annex 3 Definition of key terms for potential inclusion in revised or new NDCs (from Figure 5)

Key terms	General definitions
	Adaptation component
Adaptation component	Component of NDC describing vision, actions and targets for dealing with the impacts of climate change
Socioeconomic and ecological vulnerabilities	Impacts of climate change on society, economy and environment assessed by sector and/or economy-wide
Other national policies	Policies such as National Adaptation Plans (NAPs), National Biodiversity Strategies and Actions Plans (NBSAPs) with which adaptation or mitigation actions and targets in the NDCs may be aligned
Adaptation vision	A high-level pledge or statement of recognition of the importance of a particular adaptation approach such as NBS (can be either implicit or explicit)
Adaptation action	A tangible, locally relevant action or intervention in a particular habitat or the development/implementation of a specific and relevant policy or process
Synergies	Where co-benefits of mitigation are adaptation and vice versa, realised through NbS
Nature-based action	An intervention involving the restoration, management or protection of ecosystems or nature-based agricultural practices
Hybrid adaptation action	A direct action that includes elements of different adaptation approaches including NbS, engineered approaches and/or indirect actions or enabling conditions
NbS	'Nature-based solutions are actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits' (Cohen-Shacham et al. 2016).
EbA	Ecosystem-based Adaptation – 'Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. EbA aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of the adverse effects of climate change.' (CBD 2009)
Engineered	A direct action involving static man-made/engineered structures, such as sea walls, levees, wells and irrigation infrastructure

Key terms	General definitions
	Adaptation component
Ecosystems	Six broad categories: forests and woodlands, river catchments, marine and coastal habitats, grasslands and rangelands, montane habitats and urban habitats
Target	A time-bound, quantitative or qualitative target linked to an action
Actions in cities	Adaptation actions including both actions in cities as well as actions in the catchment or wider landscape
Strategic/long term	Targets outlined for beyond 2020 (unrelated to specific funded projects)
Current	Related to current initiatives or projects
Planned	Related to planned measures/actions not currently in place. These could be conditional (i.e. on external funding, capacity building, knowledge/technology transfer or any other external input) or unconditional
Potential	Related to unplanned measures with a substantial potential. For example, very few countries include actions related to peatlands in their NDCs, despite their large mitigation potential
Knowledge base	Body of knowledge on which the target draws, including whether the protective services of ecosystems are included in vulnerability and risk assessments, and scenario-planning
Science-indigenous/ local knowledge	Targets drawing on best available scientific evidence, local/ indigenous knowledge, ideally as a co-created body of understanding about ecosystems and how to manage them in the face of climate change. Ideally, information would be included as to whether there are explicit intentions to collaborate/partner with indigenous peoples and local communities in the formulation and implementation of NDCs
Enabling actions (or indirect adaptation action)	Includes actions that facilitate interventions including research and monitoring, capacity development, awareness raising, insurance schemes; can all involve NbS in some way and all enable direct actions to take place
Finance	Depending on external funding needs
Key terms	**Mitigation component**
Mitigation	Component of the NDC describing vision, actions and targets around dealing with the impacts of climate change
Emissions reduction/ Avoidance	Reducing emissions from industry and transport, e.g. by shifting to renewables (tech) or FLR/LULUCF (nature-based)
Carbon sequestration	Can be technological (carbon capture and storage) or nature-based (conservation, including FLR and LULUCF)
Technology	For example, Negative Emissions Technology (NETs)

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