



# Use of spatial information in national climate strategies

An analysis of Nationally Determined Contributions (NDCs) and Long-Term Low-Emission Development Strategies (LT-LEDS)

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**Working Paper**

**September 2020**

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## **Abstract**

As biodiversity loss and ecosystem degradation continue largely unabated, it is becoming critical to strengthen nature-based solutions in national climate strategies, including Nationally Determined Contributions (NDCs) and Long-Term Low-Emission Development Strategies (LT-LEDS) under the UN Framework Convention on Climate Change (UNFCCC). With the upcoming COP15 of the UN Convention on Biodiversity and the COP26 of the UNFCCC, interest in nature-based solutions and their operationalization as part of national climate strategies is growing. Spatial data is necessary to identify priority areas for conservation and restoration that underpin nature-based solutions. In this working paper we determine to what extent governments incorporate maps and other spatial information in their climate strategies. We find that out of 196 NDCs a mere 4% include a map and only one NDC contains actionable maps but these do not focus on nature-based solutions. Similarly, there are few references to spatial planning in NDCs. Only 12% of available LT-LEDS include maps, of these only two are actionable. As countries review their NDCs and submit LT-LEDS before COP26 and the 2023 stocktake under the Paris Agreement, they should consider spatial information, including actionable maps, in their climate strategies. This will help deliver nature-based solutions and advance the integration of biodiversity and climate. Several international resources are available to support countries in the generation and use of such maps.

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## About the SDSN

The UN Sustainable Development Solutions Network (SDSN) mobilizes scientific and technical expertise from academia, civil society, and the private sector to support practical problem solving for sustainable development at local, national, and global scales. The SDSN has been operating since 2012 under the auspices of the UN Secretary-General. The SDSN is building national and regional networks of knowledge institutions, solution-focused thematic networks, and the SDG Academy, an online university for sustainable development.

## Acknowledgements

This work was funded with UK aid from the UK government; however the views expressed do not necessarily reflect the UK government's official policies. We are grateful to colleagues from the United Nations Development Programme for comments and support.



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## 1. Introduction

As biodiversity loss, ecosystem degradation, and climate change continue largely unabated, countries are focusing on the role nature-based solutions can play in achieving the objectives of the UN Framework Convention on Climate Change (UNFCCC) and the UN Convention on Biological Diversity (CBD). Nature-based solutions conserve and restore nature to achieve biodiversity, climate, and other societal objectives [1]. Recent research suggests that nature-based solutions can provide around one-third of the cost-effective climate mitigation needed by 2030 [2,3] and maximize co-benefits to society and biodiversity [4].

Political momentum behind nature-based solutions is growing. China and New Zealand led the nature-based solutions track for the 2019 Climate Action Summit [5]. The UK government has identified nature-based solutions as a priority for the COP26 of the climate convention, which will now be held in Glasgow in 2021. Prior to this, China will host the COP15 of the UN CBD, which will adopt a new 2030 framework for protecting and restoring nature. Clearly, these two processes need to be closely aligned and coordinated to promote nature-based solutions.

The challenge is to advance the implementation of nature-based solutions at scale. This will require a clear articulation of nature-based solutions as part of countries' national climate and biodiversity strategies. We focus here on national strategies under the UNFCCC, which comprise short-term Nationally Determined Contributions (NDCs), which all Parties are required to submit, as well as mid-century Long-Term Low-Emission Development Strategies (LT-LEDS), which Parties are invited to submit before COP26 pursuant to Article 4.19 of the Paris Agreement [6].

Several groups have analyzed non-energy mitigation and adaptation strategies in NDCs. Most NDCs cover only parts of emissions from land use and land-use change and forestry (LULUCF) often without quantitative targets or clear accounting [7,8] and with inadequate reference to agriculture [9]. Initial guidance for and analyses of LT-LEDS tend to focus on energy-related emissions [6,10,11].

Nature-based solutions are place-based, so their operationalization requires spatial planning tools that in turn draw on maps and other spatial information [12,13]. For example, reforestation efforts need to select the tree species that are native to a location and be mindful of local constraints, such as water availability or other competing land uses. The protection of peatlands and other high-carbon soils requires high-resolution maps for strategy formulation and monitoring. Finally, efforts to conserve biodiversity need to ensure minimal habitat sizes and avoid fragmentation.

The need for spatial planning has been widely recognized in the scientific and policy communities. For example, the NBS Manifesto [5], the CBD Zero Draft [14], Campaign for Nature's economic report [15], and the China Council for International Cooperation on Environment and Development (CCICED) 2020 policy recommendations report [16] call for spatial planning in national strategies. Such spatial planning can also help integrate biodiversity and climate strategies [13]. As one recent example, the CBD's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) identified the need to address biodiversity loss and climate change in an integrated manner using comprehensive spatial planning [17].

Yet, a recent review of national biodiversity strategies under the CBD – so called National Biodiversity Strategy Action Plans (NBSAPs) – shows that countries make scant use of maps and spatial information. Some 40% of NBSAPs do not include any spatial data to inform policymaking [18]. Where spatial information is used, much of it is not actionable. A mere 15% of NBSAPs include maps that the United Nations Development Programme's (UNDP) considers 'actionable', i.e. that provide sufficient information to allow policymakers to take action [18].

It is widely expected that China will promote the use of spatial planning in the run-up to the CBD COP15. Through its Ecological Conservation Redlines (ECRL), the country has been a pioneer in using spatial information for biodiversity and ecosystem services management [19]. The government is now expanding this policy framework with the inclusion of carbon [13]. Once completed, this will provide an example for a spatial planning framework in support of nature-based solutions.

In this paper we ask to what extent climate strategies use spatial information that can guide the design and implementation of nature-based solutions. This information is urgently needed as governments complete the revision of their NDCs ahead of the Glasgow COP26. Many countries are also preparing their first LT-LEDS. The postponement of the CBD and UNFCCC COPs provides an opportunity to fill gaps in countries' NDCs and LT-LEDS, including the use of maps and other spatial information.

This working paper presents the first systematic analysis of all 196 NDCs and 17 LT-LEDS to understand if and how countries use maps and spatial information as part of their climate strategies. It fills a gap in our understanding of how countries are approaching nature-based solutions and which conditions are in place to scale up strategies that target nature and climate objectives.


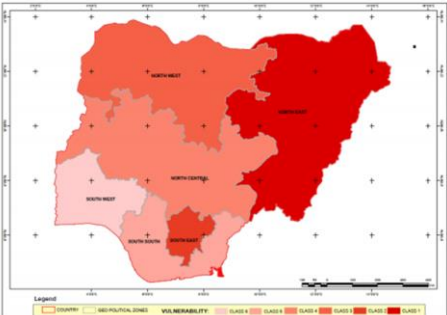
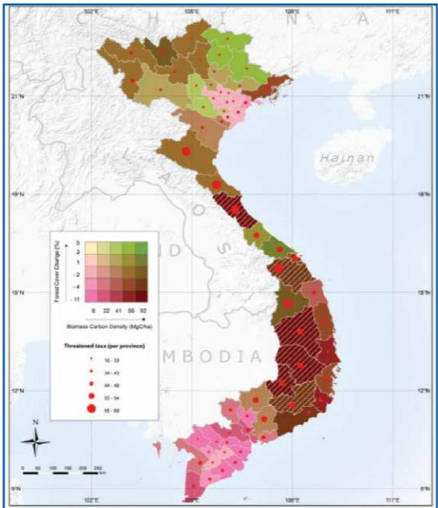
## 2. Approach

To evaluate the extent to which Parties incorporate spatial data to accelerate action on nature and climate, we first reviewed 196 NDCs from the UNFCCC NDC Registry [20] for the inclusion of actionable maps. The review was completed in early July, including all 2020 Second NDC and Revised NDC submissions available at that time. The registry comprises 174 First NDCs (including the European Union's NDC and those of its member states), 4 Second NDCs, 7 Revised First NDCs, and 12 Intended NDCs. Approximately 5 percent of NDCs did not have an English or French translation available. We used online translation tools to assess these NDCs.

Each NDC was manually surveyed for the inclusion of maps, references to the need for spatial planning, and explicit mentions of (1) biodiversity (2) maps or spatial planning (3) SDGs or the 2030 Agenda, and (4) food security. The data was collated into a database which we expanded to include additional data from the IGES v.7 NDC Database, including Parties mitigation targets and the sectoral scope for agriculture and LULUCF [21].

We categorized each map identified in an NDC using UNDP's taxonomy [18] (Table 2). To identify which maps can inform actions on land-use planning, they were grouped into the following three categories: (1) non-actionable, (2) potentially actionable, and (3) actionable.

**Table 1 | Examples of non-actionable, potentially actionable, and actionable maps found in the NDCs and NBSAPs**

Map	Country	Map title	Map type
	Solomon Islands	Map of Solomon Islands (2009)	Non-actionable (NDC)
	Nigeria	Spatial variation in relative climate change vulnerability (Second National Communication, 2013)	Potentially actionable (NDC)
	Viet Nam	Relationship of forest biomass carbon, forest cover change and threatened species richness (2013)	Actionable (NBSAP)

Source: Nationally Determined Contributions, UNFCCC NDC Registry, and National Biodiversity Strategies and Action Plans, CBD NBSAPs and National Reports search portal.

Second, we analyzed 17 LT-LEDS for the inclusion of spatial information using the same approach as for the NDCs. All LT-LEDS were accessed from the UNFCCC long-term strategies registry by July 2020.

Each LT-LEDS was also manually surveyed for the inclusion of maps, references to the need for spatial planning, and explicit mentions of (1) biodiversity (2) maps or spatial planning (3) SDGs or the 2030 Agenda, and (4) food security.

### 3. Results

A mere 4% of all reviewed NDCs include a map. Only one NDC (Moldova) contains actionable maps but these do not address nature-based solutions (Box 1). All other maps contained in NDCs are non-actionable as they merely delineate a country’s political boundary or describe basic geographic features. Over a quarter of NDCs express a need for spatial data and mapping. Less than a quarter of NDCs mention the SDGs or the 2030 Agenda, and only half mention biodiversity (Table 2). This suggests that the interdependencies between climate and biodiversity strategies, including nature-based solutions, are inadequately addressed in NDCs.

All countries that include a map in their NDCs are tropical developing countries with extensive forests, with the exception of the Republic of Moldova. Of the eight NDCs that include maps, seven mention the need for spatial planning and biodiversity. Our findings are consistent with an OECD report, which highlights the lack of spatially-explicit data for biodiversity and ecosystem services to inform policy action [22].

**Box 1. Special Case: The Republic of Moldova**

The Republic of Moldova submitted its second NDC in March 2020, which includes maps to support medium- and long-term adaptation planning [23]. Yet, these maps do not cover nature-based solutions. The figure below, taken from the NDC, presents one of the three maps in the document, which depicts climate scenarios for air temperature using three Representative Concentration Pathways.

**Figure 1:** Projected CMIP5 21 GCMs ensemble annual mean air temperature, °C development throughout the Republic of Moldova

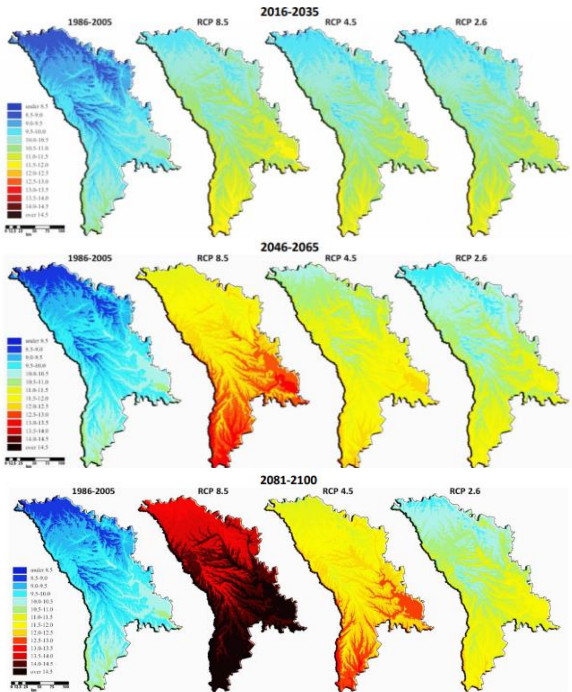


Figure 3.2-1: Projected CMIP5 21 GCMs ensemble annual mean air temperature, °C development throughout the Republic of Moldova.

Source: Republic of Moldova NDC (2020)

**Table 2 | Number of NDCs with maps per type, 196 NDCs in total**

Map type	Number of NDCs	Percent of NDCs	Definition
Actionable maps	1	0.5%	Map provided sufficient information for land use planners to take action.
Potentially actionable maps	1	0.5%	Map has the potential to guide land-use planning if combined with other data layers.
Non-actionable maps	6	3%	Map is not useful in isolation, or when combined with other data layers to inform policy.
No maps	188	96%	No maps found in the NDC.

Source: Authors' analysis.

Definitions obtained from UNDP's taxonomic classification, Cadena et al. [18].

**Table 3 | Spatial planning references and explicit mentions of key terms found in 196 NDCs**

Key Terms	Percent found in NDCs	Frequency
Reference the need for spatial planning	26%	51
Biodiversity	55%	107
Food security	52%	101
Sustainable Development Goals or 2030 Agenda	23%	45

Source: Authors' analysis.

**Table 4 | NDCs with maps by region and income group**

Region	Income classification				Total
	Low income	Lower middle income	Upper middle income	High income	
East Asia and Pacific	0/1	1/13	0/11	0/7	1/32
Europe and Central Asia	0/1	1/4	0/14	0/33	1/52
Latin America & the Caribbean	0/1	1/4	1/20	0/8	2/33
Middle East and North Africa	0/2	0/4	0/6	0/7	0/19
North America	0/0	0/0	0/0	0/2	0/2
South Asia	0/2	0/4	0/2	0/0	0/8
Sub-Saharan Africa	1/24	1/18	2/6	0/1	4/49
<b>Total</b>	<b>1/31</b>	<b>4/47</b>	<b>3/59</b>	<b>0/58</b>	<b>8/195</b>

Source: Author's analysis.

Note: Regions are classified using The World Bank Income Classification. Classification does not include the European Union; thus 195 countries are analyzed.



Out of 17 available LT-LEDS, 12% include maps that are actionable and potentially-actionable (Table 5). Eighty-six percent of the maps in LT-LEDS depict disaster risk areas and climate change vulnerability. Three-quarters of LT-LEDS mention biodiversity and more than half reference the SDGs (Table 6).

Two countries, Benin and Mexico, include maps in their long-term strategies; with 7 maps in total identified (Table 8). Benin's LT-LEDS includes two actionable maps and one potentially-actionable map. Mexico's LT-LEDS contains two actionable maps and two potentially actionable maps. None of the actionable maps address nature-based solutions. Benin and Mexico are low income and upper middle-income countries, respectively (Table 7), and both reference the need for spatial planning frameworks.

**Table 5 | LT-LEDS with maps per type, 17 LT-LEDS in total**

Map type	Number of LT-LEDS	Percent of LT-LEDS	Definition
Actionable maps	2	12%	Map is used for land-use planning and nature-based solutions.
Potentially actionable maps	2	12%	Map has the potential to guide land-use planning if combined with other data layers.
Non-actionable maps	0	0%	Map is not useful in isolation, or when combined with other data layers to inform policy.
No maps	15	88%	No maps found in the LT-LEDS

Source: Authors' analysis.

Definitions obtained from UNDP's taxonomic classification, Cadena et al. [18].

**Table 6 | Spatial planning references and explicit mentions of key terms found in 17 LT-LEDS**

Key Terms	Percent found in NDCs	Frequency
Reference the need for spatial planning	41%	7
Biodiversity	76%	13
Food security	53%	9
Sustainable Development Goals or 2030 Agenda	65%	11

Source: Authors' analysis.

**Table 7 | LT-LEDS with maps by region and income group**

Region	Income classification				Total
	Low income	Lower middle income	Upper middle income	High income	
East Asia and Pacific	0/0	0/0	0/2	0/2	0/4
Europe and Central Asia	0/0	0/1	0/0	0/6	0/7

<b>Latin America &amp; the Caribbean</b>	0/0	0/0	1/2	0/0	<b>1/2</b>
<b>North America</b>	0/0	0/0	0/0	0/2	<b>0/2</b>
<b>Sub-Saharan Africa</b>	1/1	0/0	0/0	0/0	<b>1/1</b>
<b>Total</b>	<b>1/1</b>	<b>0/1</b>	<b>1/4</b>	<b>0/10</b>	<b>2/16</b>

Source: Author's analysis.

Note: Regions are classified using The World Bank Income Classification. Classification does not include the European Union; thus 16 LT-LEDS are analyzed.

**Table 8 | Summary of the total number of maps found in NDCs, LT-LEDS and NBSAPs**

<b>Strategy</b>	<b>Number of countries</b>	<b>Total number of maps</b>	<b>Percent of actionable maps</b>	<b>Percent with no maps</b>
<b>NDCs</b>	195	8	0.5%	95%
<b>LT-LEDS</b>	16	7	13%	88%
<b>NBSAPs</b>	188	683	15%	40%

Source: Author's analysis for NDCs and LT-LEDS.

NBSAP data obtained from Cadena et al. [18]. Classification does not include the European Union; thus 195 NDCs are analyzed and 16 LT-LEDS.

We recognize that some countries may use spatial data to inform policy without including or referencing this information in their NDCs or LT-LEDS. For this reason, the actual use of spatial data in the design of national climate strategies may be greater than reported in our analysis. Yet, the absence of references to the use of such data in national climate strategies suggests that spatial data plays a limited role in their development, implementation, and monitoring.

## 4. Policy Implications

Our analysis shows that national climate strategies generally lack maps and other spatial information, which are critical for implementing and monitoring nature-based solutions. The limited use of maps is notable and worrying as nature-based solutions are projected to account for around one third of mitigation needed to achieve the objectives of the Paris Agreement [2]. Similarly, the lack of spatial information in climate strategies makes it difficult to pursue co-benefits with biodiversity objectives and to identify potential trade-offs [13].

The upcoming COP15 of the CBD in China and COP26 of the UNFCCC in the UK offer important opportunities to promote spatial information in climate and biodiversity strategies. The UK has already announced its commitment to promote nature-based solutions in the run-up to COP26, and several European governments have pledged to support the integration of nature and climate under the UNFCCC. Similarly, China has conveyed its commitment to hold an ambitious COP15 and to advance the implementation of biodiversity strategies. Through its ECRL and integrated spatial planning under the Five-Year Plan [13,19], the country has become a global leader in using maps to support nature-based solutions.

As a first, practical step, countries might commit to include maps of biodiversity and nature-based solutions as part of their climate strategies. A good first entry point are LT-LEDS, which countries are

invited to submit to the UNFCCC ahead of COP26. These LT-LEDS describe long-term visions and are therefore easier to change than NDCs. One objective for the 2021 COPs under the two conventions might therefore be to encourage as many countries as possible to include maps (or to commit to their inclusion) in their LT-LEDS. This can be done at the initiative of individual countries within the existing rules of the Paris Agreement and the CBD. Such spatially explicit strategies would then set an example that other countries would likely follow.

Drawing on lessons from the use of actionable maps in Sixth National Reports (6NR) (Cadena et al., 2019), countries should also reconsider their NDCs and NBSAPs. Over time, all NDCs should include maps, and the 2023 stock-take under the Paris Agreement provides a natural and sensible timeline for completing this process.

The inclusion of maps in climate strategies will also contribute greatly to the implementation of the CBD objectives. Today's NBSAPs struggle to address agriculture and other major drivers of biodiversity loss, which lie outside the scope of the CBD. By including nature-based solutions, including through the greater use of maps, in climate strategies, countries can design and pursue more integrated strategies for halting the loss of nature. This will benefit and strengthen both conventions. Perhaps countries should consider developing one integrated strategy for climate and nature, which can then be submitted as an NDC to the UNFCCC and as an NBSAP to the CBD.

China and the UK can play special roles in advancing the use of maps and the integration of nature and climate in national strategies. China is one of the few countries that has developed a full spatial planning framework around biodiversity and ecosystem services, which will be included in the country's 14<sup>th</sup> Five-Year Plan. China can reference these existing policies in its climate strategy without requiring any new domestic commitments or policy tools. Recently exiting the European Union and its Common Agricultural Policy, the UK is now designing its own land-use policy framework. This might provide a good opportunity for including maps in its climate strategy, which would strengthen the country's international leadership in the run-up to COP26. Other countries would undoubtedly follow these examples, particularly since the inclusion of spatial information in climate strategies is possible with existing instruments and does not require the negotiation of new text.

A number of international resources are available to support countries in integrating spatial information into their climate and biodiversity strategies. These include Nature Map [24], available at [www.naturemap.earth](http://www.naturemap.earth). Another important resource is the Natural Capital Project [25], which maps nature's contribution to people (or ecosystem services) <https://naturalcapitalproject.stanford.edu/>. UNDP supports countries in mapping nature through its Essential Life Support Areas initiative (<https://www.undp.org/content/undp/en/home/2030-agenda-for-sustainable-development/planet/environment-and-natural-capital/biodiversity-and-ecosystems-management.html>).

In closing we underscore that maps and spatial planning frameworks are necessary but not sufficient on their own to promote nature-based solutions. Without them, countries will be unable to identify and manage conflicting land uses, so particular attention should be placed on integrating maps in climate strategies (LT-LEDS and NDCs) as well as biodiversity strategies (NBSAPs). While this would constitute a major improvement, these frameworks must also be accompanied by better financing, effective monitoring, stakeholder engagement, and other tools for conserving and restoring nature.

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