



 GBF  
early action support

An aerial photograph of a tropical coastline, showing a dark blue ocean, a white sandy beach, and a lush green interior with a large white cloud formation.

# Integrated Spatial Planning

## Workbook

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Acronyms

BIOFIN	Biodiversity Finance Initiative
CBD	Convention on Biological Diversity
ELSA	Essential Life Support Areas
GIS	Geographic Information Systems
GEF	Global Environment Facility
GDP	Gross Domestic Product
IPBES	Intergovernmental Panel on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
MEAs	Multilateral Environmental Agreements
NBSAPs	National Biodiversity Strategies and Action Plans
NDC	Nationally Determined Contribution
OECMs	Other Effective Area-based Conservation Measures
SDGs	Sustainable Development Goals
SCP	Systematic Conservation Planning
PacMARa	Pacific Marine Analysis and Research Association
GBF	Kunming-Montreal Global Biodiversity Framework
UNBL	UN Biodiversity Lab
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNFCCC	United Nations Framework to Combat Climate Change
UNCCD	United Nations Convention to Combat Desertification



# Foreword

The world faces a dual nature-climate crisis, which when combined with rising inequality, presents an existential risk to the well-being of humankind and places the prospects for future generations in jeopardy. Since the early 1990s, the stock of natural capital per person has declined by nearly 40 percent. We need the resources of 1.6 Earths to maintain humanity’s current way of life. Nature-based human development allows us to tackle the three central challenges of the Anthropocene: mitigating and adapting to climate change, protecting biodiversity and ecosystems, and ensuring just and equitable development for all. This decade is humanity’s last best chance to turn the tide on the loss and degradation of nature, and to secure the hope of achieving the 2030 Agenda.

Unless governments, businesses, and individuals take bold steps to reduce the immense pressures that are being exerted on the environment, humanity’s progress towards achieving the Sustainable Development Goals (SDGs) will stall. Half of the SDGs are dependent on nature. Current trends in environmental degradation are

undermining up to 80 percent of progress to achieve the SDGs. The climate goal of the Paris Agreement to hold planetary warming at 1.5 degrees Celsius cannot be achieved without increasing the protection, restoration, and improved management of nature. Nature-based solutions comprise over one-third of our most cost-effective solution to climate catastrophe.

The project ‘Mapping Nature for People and Planet,’ led by United Nations Development Programme (UNDP), demonstrates how countries can use integrated spatial planning to reveal pathways toward the achievement of multiple nature-based goals at once. ‘Maps of Hope’ help countries identify where they can protect, manage, and restore their ecosystems for a better future for all – capitalizing on synergies between nature, climate, and sustainable development ambitions. Through the application of new spatial data technology, inclusive dialogue, strengthened capacity, and policy support, this flagship project inspires hope and a unified vision, coupled with coordinated action for nature.

National planning approaches must become nature-based, and place the preservation of ecosystem integrity at their core. We must also harness advances in technology to ensure that land use planning approaches are more integrated and data-driven. Furthermore, we must adopt a whole-of-society approach that helps governments work with stakeholders to put nature at the heart of achieving their nature-dependent sustainable development goals. This transformation will only be possible by harnessing the power of spatial data tools to support data-informed planning. This workbook provides a pathway.

Each of the pilot countries in the ‘Mapping Nature for People and Planet’ project deserve our recognition. Through efforts across Cambodia, Nepal, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, Haiti, Kazakhstan, Liberia, Peru, and South Africa, UNDP and national experts have co-developed a methodology that has the potential to support the achievement of the SDGs, the three Rio Conventions, and the Kunming-Montreal Global Biodiversity Framework. To make inroads toward

a future where nature is at the heart of development, I encourage countries and communities to explore how they too can create ‘Maps of Hope’ to achieve their nature, climate, and sustainable development goals. Join us in charting a new course for sustainable development by putting nature on the map.



**Usha Rao-Monari**  
UN Under Secretary-  
General and UNDP  
Associate Administrator





# Executive summary

## Key messages

- Awareness of nature’s pivotal role in sustaining human life and well-being has increased among governments and decision makers, leading to a wave of new commitments to safeguard the Earth’s ecosystems so they may continue to facilitate our well-being into the future.
- Despite efforts, countries are struggling to meet their targets on biodiversity, climate, and sustainable development. This is due, in part, to a lack of spatial data and tools that governments can readily apply to support decision-making.
- Spatial data and tools offer powerful means to help countries monitor the state of their ecosystems and determine how and where to intervene. UN Biodiversity Lab demonstrates how free access to state-of-the-art maps can enable countries to generate insights that transform outcomes for biodiversity, climate, and sustainable development.
- Through integrated spatial planning, countries can create custom analyses to determine where and how they can take action towards multiple national priority policy targets at once. Using a whole-of-government approach, integrated spatial planning can help diverse groups create a shared vision for the future and a pathway to achieve it.
- The project ‘Mapping Nature for People and Planet’ supports countries to use integrated spatial planning to identify Essential Life Support Areas (ELSAs) – critical regions where protection, management, and/or restoration could enable countries to achieve their unique nature-dependent goals. ELSA maps, also known as ‘Maps of Hope,’ empower planners and policymakers to collectively prioritize action to address many critical issues affecting nature, including biodiversity conservation, water security, afforestation, and agrobiodiversity; while also supporting protected area strategies, climate change adaptation, disaster risk reduction and early warning systems, and ecotourism.
- When the ELSA methodology is applied, governments are witnessing a paradigm shift where spatial data helps elevate and align the contributions of biodiversity during planning across many sectors. Countries are also finding that their policies are becoming more impactful as the data behind them becomes more robust.
- The ELSA methodology can provide Parties of the Convention on Biological Diversity (CBD) with the critical capacity to undertake more effective and widespread spatial planning to support the achievement of several targets in the Kunming-Montreal Global Biodiversity Framework (GBF), responding to their need to strengthen spatial data on biodiversity at the national, regional, and global level without intensive technical and financial resources.



## A new methodology for integrated spatial planning

Countries around the world are increasing their ambition for nature by making bold commitments to address the challenges of biodiversity loss and climate change while creating a runway for sustainable development. But with limited resources and many competing land uses, governments do not always know how and where to prioritize these commitments on the ground.

Integrated spatial planning is a whole-of-government and whole-of-society approach to create land use maps that show pathways to achieving multiple diverse outcomes at once, including goals around nature, climate, and sustainable development.

The UNDP-led project ‘Mapping Nature for People and Planet’ uses integrated spatial planning to support countries in creating ‘Maps of Hope’ to achieve their very own nature-related goals. Stakeholders use national and global spatial data to identify ELSAs, places where nature-based actions can sustain critical benefits to humanity, such as food and water security, sustainable livelihoods, disaster risk reduction, and carbon sequestration. The result of this process is a map that governments can use to harmonize nature, climate, and development policies, and to prioritize areas for protection, management, and restoration.

The Integrated Spatial Planning Workbook illustrates the methodology behind this project, also referred to as the ELSA methodology. This stepwise, innovative, and adaptable methodology enables stakeholders to:

- Develop a community of practice around the common objective of better environmental decision-making;
- Build consensus on a country’s most critical policy targets related to nature, climate, and sustainable development;
- Collect and facilitate access to and use of leading national and global spatial datasets on issues, such as water security, food provision, and climate change resilience;
- Use integrated spatial planning to develop ‘Maps of Hope’ that indicate where a country can protect, manage, and restore nature to achieve their targets related to nature, climate, and sustainable development; and
- Integrate spatial insights into decision-making processes to support nature’s central role in sustaining equitable development and planetary wellness into the future.

ELSA maps are created by and for national stakeholders, including those who might be affected by the policy decisions derived from the project. In this process, national data also takes precedence over global data in the construction of the map to improve accuracy and build confidence in the results. These practices support a wider uptake of the resulting ELSA maps and promote their equitable use.









# Chapter 1

## Introduction to key issues

### 1.1 Introduction

The planet’s rich ecosystems sustain a plethora of unique species and provide the foundation for human health and well-being. From the clean air we breathe to the food we eat, nature offers resources that sustain the lives of the 8 billion people inhabiting Earth. However, our continued overuse and mismanagement of the Earth’s resources for short-term gains are having long-term effects on our planetary safety net. Biodiversity loss

and climate change are making it harder for communities to secure adequate food and water, sustain their livelihoods, protect themselves from natural disasters, and ensure the well-being of future generations. This chapter explores further the value of nature for human and planetary wellness, and introduces key mechanisms and tools to safeguard nature, with a focus on the UN Biodiversity Convention (CBD).

We love and enjoy nature, use it and trade it, but we don’t really understand nature’s real value, nor how it is central to development, or that investment in biodiversity should be considered as development and growth.

Kiruben Naicker

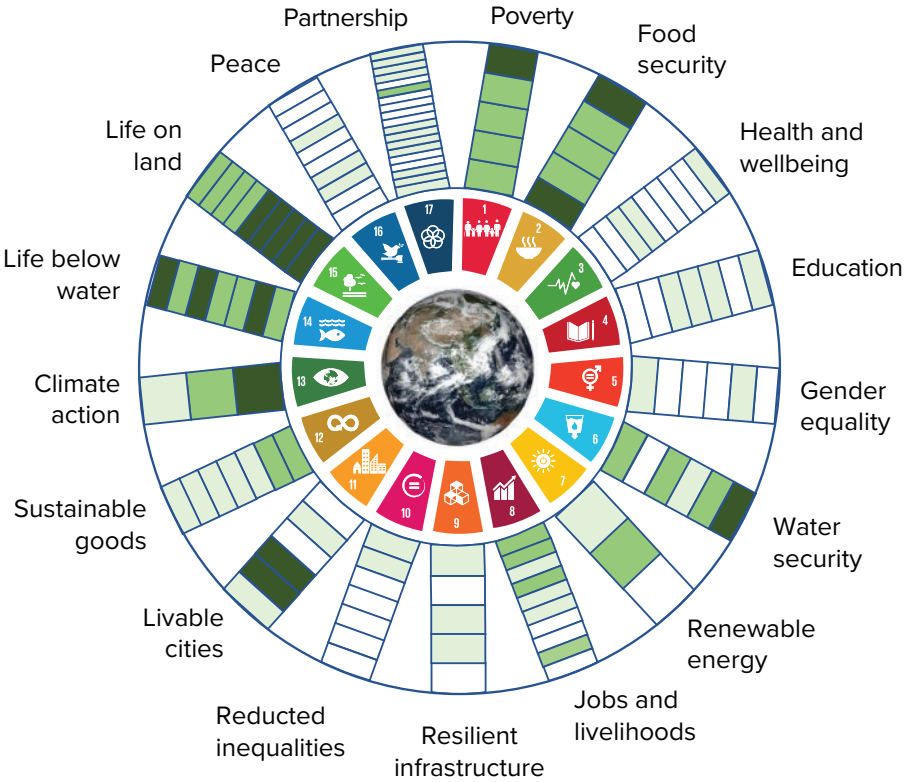
Former Acting Chief Director, Biodiversity Monitoring Specialist Services,  
Department of Forestry, Fisheries and the Environment, South Africa

### 1.2 The value of nature

Nature provides innumerable benefits to humanity by sustaining our well-being through food provision, water and air filtration, disaster risk reduction, climate change mitigation, and much more. Mangroves, for example, reduce annual flooding for more than 18 million people. Without mangroves, 39 percent more people would experience flooding annually, and flood damages would increase by more than 16 percent, and US\$82 billion annually.<sup>1</sup> The combined global carbon storage potential of healthy mangrove forests (21 gigatons) and restored mangroves (1.3 gigatons) equals about three years of carbon emissions for Australia.<sup>2</sup> The world’s forests absorb a net 7.6 billion metric tons of carbon dioxide from the atmosphere each year, thereby containing greenhouse gasses that would otherwise contribute to rising temperatures.<sup>3</sup> Additionally, the ocean produces over half of the world’s oxygen and stores 50 times more carbon dioxide than our atmosphere.<sup>4</sup>

Nature is also a cornerstone of the global economy. Forests support the livelihoods of about 350 million people, with households deriving as much as 22 percent of their income from forests. Forests produce more than 5,000 types of wood-based products and generate an annual gross value of just over US\$600 billion, about one percent of global Gross Domestic Product (GDP).<sup>5</sup> Over half the world’s total GDP, US\$44 trillion of economic value generation, is moderately or highly dependent on nature and its services.<sup>6</sup> Nature also underpins global economic activity that is presently worth an estimated US\$125 trillion.<sup>7</sup> By protecting, sustainably managing, and restoring nature, we can provide one-third of the solution to mitigate climate change,<sup>8</sup> and achieve the SDGs (Figure 1). Given that three out of every four people on earth directly depend on nature for their livelihoods, nature-based solutions provide a powerful pathway towards a more sustainable world.

FIGURE 1 |  
The Sustainable Development Goals and their connection to nature



The 17 SDGs call on countries to raise their ambition for people and the planet. Adopted by UNDP in 2015, the SDGs outline actions that must be taken to ensure human prosperity and planetary health by 2030. More than half of the SDG’ Targets are indivisible from nature. Healthy ecosystems are inextricably linked to poverty reduction, livable cities, climate action, and food security, and even play a role in supporting gender equality given that many women depend on nature for their livelihoods.

Independent	<b>Independent:</b> There is no clearly identifiable dependency of the Target on nature.
Co-beneficial	<b>Co-beneficial:</b> The Target does not have an explicit link to nature but identifies at least one nature-based pathway or is linked to at least one nature-based pathway for its achievement.
Dependent	<b>Dependent:</b> Achieving the Target requires the existence or use of a good or service provided by nature.
Indivisible	<b>Indivisible:</b> The Target’s objective is to protect or restore an aspect of nature.

### 1.3 Trends in biodiversity, climate, and sustainable development

We are witnessing our planet being pushed to its boundaries.<sup>9</sup> We face a global biodiversity emergency, a climate emergency, and a public health emergency, all stemming from a common thread: the destruction of nature.<sup>10</sup> Despite our best efforts, nations around the world collectively failed to fully meet a single global target to protect nature in the past decade.<sup>11</sup> The impact of this failure is undeniable and permeates our daily lives.

Nature underpins sustainable development and provides essential ecosystem services such as carbon storage, food, freshwater, and disaster risk reduction, without which humankind cannot exist.<sup>12</sup> However, nature’s

capacity to regulate environmental processes is declining globally.<sup>13</sup> Human-induced climate change is contributing to heatwaves, heavy precipitation, and droughts across the globe, which are predicted to increase in frequency and intensity as global warming patterns continue to accelerate.<sup>14,15</sup> Both the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) are impressing the importance of taking immediate action to combat climate change and the decline of nature, with data demonstrating that humanity has less than 10 years – until 2030 – to prevent planetary warming from exceeding 1.5 degrees Celsius.



The role of nature in the fight against climate change as well as sustainable development and human well-being cannot and should not be ignored. Nature-based solutions offer opportunities to live in harmony with nature, and we must recognize them and dedicate significant resources and capacity to implement them.

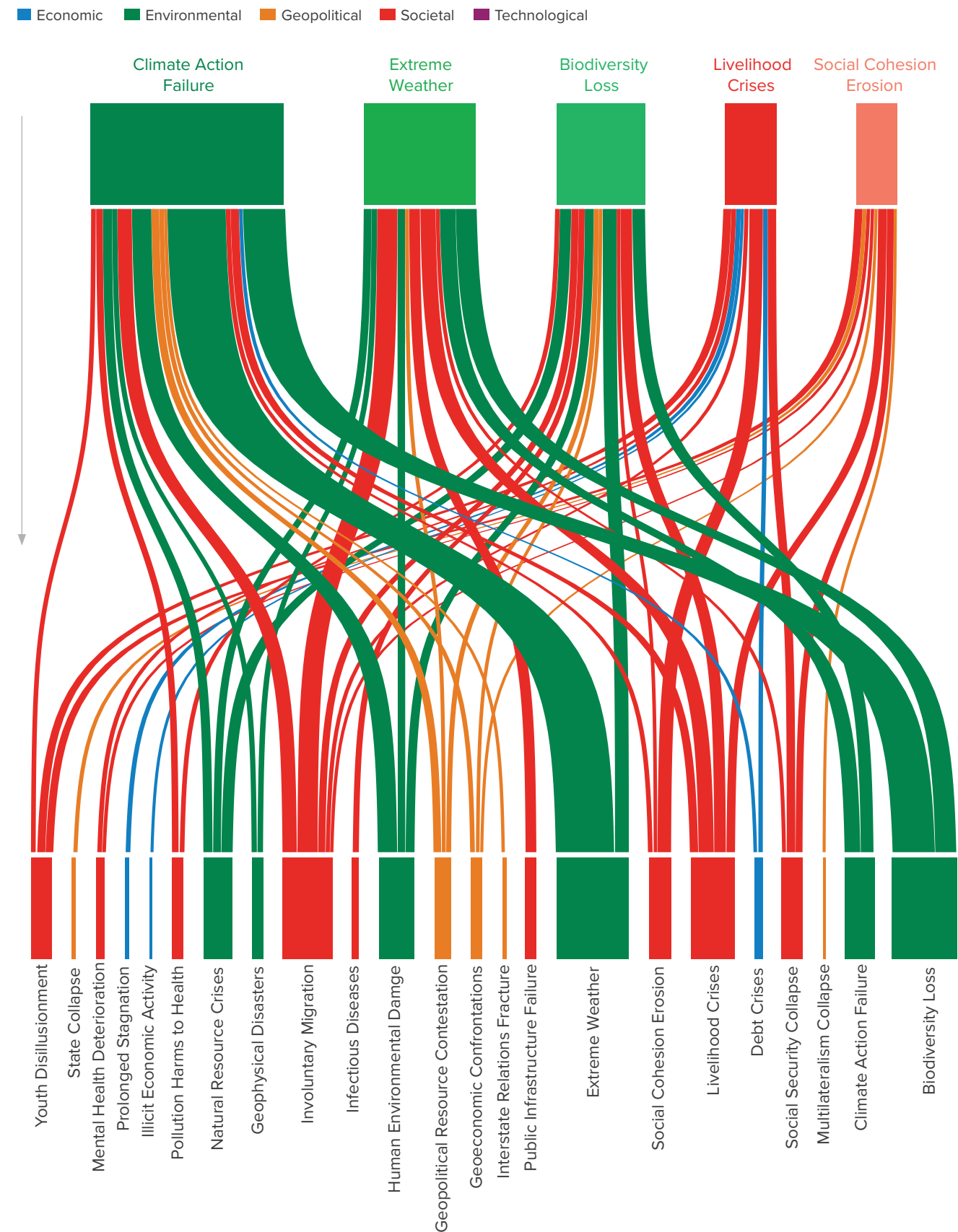
**Stephanie Ziebell**  
Resident Representative of UNDP Haiti

The resulting global biodiversity and climate crises are jeopardizing the livelihoods of over three billion people who depend on healthy soils, forests, and fisheries for their well-being.<sup>16</sup> Climate action failure and biodiversity loss compound other crises, including infectious diseases and extreme weather (Figure 2).<sup>17</sup> This trend is visible as we watched health systems unravel around the world, faced with crushing caseloads from a virus that inflicted humans due to increasing wildlife contact.<sup>18</sup> It is palpable as we watch our planet’s iconic animals face extinction, with many species declining by almost 70

percent since 1970,<sup>19</sup> and the average global extinction rate accelerating faster than at any time over the past 10 million years.<sup>20</sup> It is written on the faces of the over 10 million people living less than 10 meters above sea level<sup>21</sup> and the two billion people living within 100 kilometers of a coastline<sup>22</sup> who are witnessing sea levels rise at a rate of three millimeters per year.<sup>23</sup> It is undeniable to those living adjacent to nature whose livelihoods are increasingly threatened by fires, floods, and drought,<sup>24</sup> or those who struggle to make a living from severely diminished forests<sup>25</sup> and degraded soils.<sup>26</sup>



FIGURE 2 |  
Risks of climate inaction, extreme weather, and biodiversity loss from the 2022 Global Risks Report by the World Economic Forum<sup>27</sup>





It is essential to break the spiral of degradation of our natural and social heritage, with all the burden of despair and suffering it entails and move towards a virtuous cycle of sustainability and resilience in territories and communities. This cannot be done without the protection, restoration, and sustainable management of our ecosystems. No society has been able to and will be able to sustain itself over time without taking into account the limits of nature. No development model can prosper if it neglects this aspect.

Daniela Manuschevich

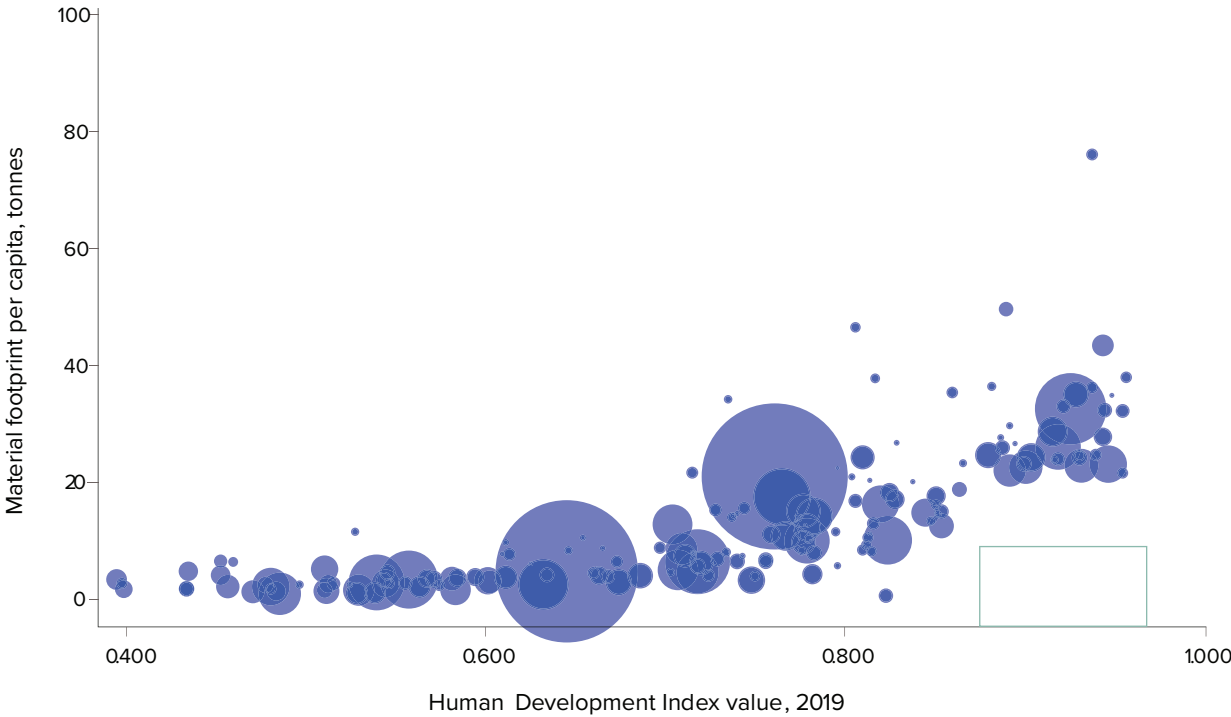
Head of the Natural Resources and Biodiversity Division of the Ministry of the Environment, Chile

1.4 Integration of nature into development planning

While the United Nations 2030 Agenda for Sustainable Development (2030 Agenda) and the three Rio Conventions (Table 1) each address the interrelated needs of nature, climate, and people, UNDP’s 2020 Human Development Report found that high human development remains dependent on negative environmental impacts

(Figure 3).<sup>28</sup> As low- and middle-income countries look to sustain population demands, economic growth is often favored over costs to the environment. Adopting a path-way towards development that works with nature instead of against it will help ensure future human well-being.

FIGURE 3 | Relationship between human development and resource use, per the 2020 Human Development Report by UNDP<sup>29</sup>



Note: The chart includes only countries with more than 1 million inhabitants. Bubble size is proportional to population.

The participation and knowledge of Indigenous peoples and local communities are critical to a just transition towards a green economy. Despite being often excluded from discussion on development and the environment, these groups can provide models of successful resource governance, drawn from thousands of years of experience. For many Indigenous groups, human well-being springs from the intersection of our relationships with each other and the natural environment.<sup>30</sup> As a result, Indigenous peoples are the stewards of at least 36 percent of the world’s intact forests.<sup>31</sup>

Following the lead of Indigenous peoples and local communities, it is imperative to recognize nature’s critical role in human development. Thriving ecosystems can protect us from natural disasters, sustain our livelihoods, provide us with fresh water and food, and much, much more. We must fortify our partnership with nature, with the shared goal of improving life on Earth. Using data to guide development planning is an important first step in improving national efforts to safeguard nature. The time to act is now.

1.5 UN Biodiversity Convention

The UN Biodiversity Convention (CBD), established in 1993, plays a key role in facilitating biodiversity conservation and sustainable development at the global level, along with the 2030 Agenda, United Nations Framework to Combat Climate Change (UNFCCC), and United Nations Convention to Combat Desertification (UNCCD)

(Table 1). Opened for signature at the 1992 Rio Earth Summit, and now with 196 government Parties, it has three pillars: biodiversity conservation, its sustainable use, and the fair and equitable sharing of the benefits arising from its use.<sup>32</sup>

TABLE 1 | Overview of key international, multilateral legally binding United Nations treaties related to nature, climate change, and sustainable development<sup>33</sup>

International Policy Instrument	Description
2030 Agenda for Sustainable Development	Nations agreed to the 2030 Agenda and a related set of 17 Sustainable Development Goals (SDGs) during the 70th Session of the UN General Assembly in 2015. The 2030 Agenda creates a plan of action to eradicate poverty through sustainable development. <sup>34</sup> At least half of the SDGs are dependent on nature. <sup>35</sup>
United Nations Biodiversity Convention	The UN Biodiversity Convention, also known as the Convention on Biological Diversity (CBD), established in 1993, plays a key role in facilitating biodiversity conservation and sustainable development at the global level. It has three pillars: biodiversity conservation, its sustainable use, and the fair and equitable sharing of the benefits arising from its use. National Biodiversity Strategies and Action Plans (NBSAPs) are the principal implementation mechanism at the national level, with periodic national reports also required. <sup>36</sup>
United Nations Convention to Combat Desertification	Established in 1994, the UNCCD is the only legally binding framework set up to address desertification and the effects of drought. There are 197 Parties to the Convention, including 196 country Parties and the European Union. Based on the principles of participation, partnership and decentralization, the Convention is a multilateral commitment to mitigate the impact of land degradation, and protect land so that it can continue to provide food, water, shelter and economic opportunity to people. <sup>37</sup>
United Nations Framework Convention on Climate Change	The UNFCCC intends to prevent dangerous human interference with climate systems. The Paris Agreement, ratified by 197 countries in 2015, is implemented in five-year cycles with the aim to hold warming ideally to 1.5 degrees Celsius. Countries submit Nationally Determined Contributions (NDCs), which outline their actions to achieve the Paris Agreement. New NDCs will be communicated in 2025 and 2030, with the ambition to reach net-zero emissions and climate resilience by 2050. The Kyoto Protocol operationalizes the UNFCCC by requiring industrialized and emerging economies to limit and reduce greenhouse gas emissions. <sup>38</sup>



The Kunming-Montreal Global Biodiversity Framework (GBF) of the CBD is an ambitious global plan to bring about a transformation in society's relationship with biodiversity by preserving and protecting nature and its essential services to people. Its 23 targets and 4 goals aim to put biodiversity on a path to recovery by 2030 at the latest, and toward the full realization of the 2050 Vision of "Living in Harmony with Nature."<sup>39</sup> The framework is action- and results-oriented and aims to guide and promote at all levels the revision, development, updating, and implementation of national policies, goals, and targets, and to facilitate monitoring and review of progress at all levels, in a more transparent and responsible manner. Parties agreed to revise or update their National Biodiversity Strategies and Action Plans (NBSAPs) by COP 16 as the main vehicle for the implementation of the GBF, including national targets. Nations use NBSAPs to prescribe concrete strategies and actions to take to achieve their global commitments to nature. NBSAPs have the potential to spur action on nature-based solutions across multiple biodiversity, climate, and sustainable development policies. Parties are also required to make national reports every four years to the CBD on their progress to meet the Convention's objectives, the effectiveness of their actions to do so, and

the status of biodiversity in their countries. These reports also provide an important assessment of global progress and challenges in meeting the commitments expressed in their NBSAPs.

Achieving the targets of the GBF will require sustained and concerted global, regional, and national action by all Parties to transform economic, social, and financial models, and stabilize trends in biodiversity loss by 2030. The framework also aims for the recovery of natural ecosystems, with net improvements by 2050. A whole-of-government and whole-of-society approach is explicitly recognized as necessary to make the changes required, with emphasis on determining priorities, allocating financial and other resources, determining the value of nature, and recognizing the cost of inaction. The framework also promotes coherence, complementarity, and cooperation between the CBD and its Protocols, other biodiversity related conventions, and other relevant Multilateral Environmental Agreements (MEAs) and international institutions, respecting their mandates, and creates opportunities for cooperation and partnerships among diverse actors to enhance implementation of the framework.<sup>40</sup>

## 1.6 Spatial planning and the UN Biodiversity Framework

ELSA is a spatial planning methodology that is founded on the principles of Systematic Conservation Planning (SCP). The methodology engages stakeholders through a whole-of-government and society approach to identify where protecting, managing, and restoring nature can help the country achieve national policy targets for nature, climate, and sustainable development. In doing so, the methodology can provide Parties with critical capacity to undertake more effective and widespread spatial planning to support the achievement of several targets in the GBF.<sup>41</sup>

These include:

- **Target 1** - Ensure that all areas are under participatory, integrated and biodiversity inclusive spatial planning and/or effective management processes addressing land- and sea-use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of indigenous peoples and local communities.

- **Target 2** - Ensure that by 2030 at least 30 percent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.
- **Target 3** - Ensure and enable that by 2030 at least 30 percent of terrestrial and inland water areas, and of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures, recognizing indigenous and traditional territories, where applicable, and integrated into wider landscapes, seascapes and the ocean, while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories.

- **Target 12** - Significantly increase the area and quality and connectivity of, access to, and benefits from green and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, and improving human health and well-being and connection to nature and contributing to inclusive and sustainable urbanization and the provision of ecosystem functions and services.
- **Target 14** - Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning and development processes, poverty eradication strategies, strategic environmental assessments, environmental impact assessments and, as appropriate, national accounting, within and across all levels of government and across all sectors, in particular those with significant impacts on biodiversity, progressively aligning all relevant public and private activities, and fiscal and financial flows with the goals and targets of this framework.<sup>42</sup>

The dependency of these five GBF targets on spatial data necessitates the availability of data and tools that support governments to identify a plausible pathway towards the desired outcomes, such as a net gain, or at a minimum no net loss, of ecosystems globally by 2030. Yet, constraints in spatial data access, accuracy, availability, and validation often leave Parties challenged to identify the best spatial and temporal distribution of protection, management, and restoration activities in a given environment in order to achieve social, ecological, and economic objectives for nature.

Data access is often limited due to information being stored across multiple ministries, data being held by external data providers, and data being governed by complicated data sharing agreements. Accessible data may be inaccurate due to low spatial resolutions, incompatible formats, and inappropriate time coverages. There is a common need for governments to nationally validate global data sources before they can be used for official decision-making purposes. Many nations also face limited access to the types of technology needed to process spatial data, as well as low technical capacity to apply the results to develop and implement biodiversity policy. These constraints often make it difficult for Parties to readily monitor and visualize the progress being made to achieve national targets using common indicators that can be represented using standard formats, using validated sources of data and indicators. There is an urgent need to strengthen national, regional, and global biodiversity information and data management systems, which requires technical and financial resources. Their capacity to develop and implement effective biodiversity strategies; monitor, and report progress to achieve them; and to make linkages to similar commitments under other MEAs will remain limited until these gaps are more comprehensively addressed.

Recognizing these challenges, the ELSA methodology can support Parties to overcome common challenges to developing and implementing data-driven biodiversity strategies and actions. For example, stakeholders are engaged to jointly identify and obtain spatial data from multiple data providers on key area-based targets for biodiversity and ecosystem services, their uses and importance for society, and related drivers of change. A web-based tool simplifies the need for complicated

Mapping ELSAs will be key to identifying where nature-based solutions should shape commitments to the post-2020 GBF. By using ELSA to run scenarios before entering negotiations or setting policy targets, countries can see what is achievable.

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trainings and technology, which helps governments overcome limited access to the types of technology needed to process spatial data, as well as low technical capacity to apply the results to develop and implement biodiversity policy. Inaccuracies are jointly resolved related to low spatial resolutions, incompatible formats, and inappropriate time coverages. A national data validation process is followed to ensure the necessary data sources can be used for official decision-making purposes. Platforms for multi-sectoral leadership, and coordination mechanisms to help integrate biodiversity into the plans of other ministries, and support the mainstreaming of biodiversity policy across sectors.

The methodology presented in this workbook responds to an urgent need to support CBD Parties to strengthen spatial data on biodiversity at the national, regional, and global level without intensive technical and financial resources. It also builds capacity to develop and implement effective biodiversity strategies; monitor, and report progress to achieve them; and to make linkages to similar commitments under other multilateral environmental agreements. This methodology supports Parties to make data-driven decisions using spatial data, and to identify actions that support achievement across related MEAs such as the GBF, UNFCCC, the UNCCD, and the 2030 Agenda.

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## Chapter 2

# Approaches to integrated biodiversity-inclusive spatial planning

### 2.1 Introduction

Spatial data and tools can play a transformative role in guiding policymakers to make data-driven decisions when identifying, planning, and implementing biodiversity policy. Decision makers can use spatial data to visualize the most effective strategies to achieve national targets, and to explore the additional positive benefits for other policy targets. Analyzing spatial data using Geographic Information Systems (GIS) can also guide policymakers to determine the most effective locations to protect, manage, and restore nature, at the scale of action needed to meet ambitious goals and targets. Monitoring trends from remotely sensed earth observations also allows policymakers to assess the outcomes, impacts, and effectiveness of policy decisions over time. These

types of analyses can also help countries to identify a suite of nature-based solutions that best address their diverse national commitments to complementary United Nations treaties related to biodiversity, climate change, and sustainable development. Many of the types of spatial datasets that governments require to develop and implement data-driven decisions already exist nationally or can be derived from globally available spatial datasets, including for national biodiversity targets, National Biodiversity Strategies and Action Plans (NBSAPs), and monitoring their implementation and impact. This chapter explores how advances in spatial planning can be harnessed to support better decision-making for people and the planet.

### 2.2 The data gap

Maintaining a healthy planet where people and ecosystems thrive requires reliable, timely, decision-relevant information. While the number of global, biodiversity-based information sources grows daily, few are accessible and curated in ways that meet the needs of policymakers at the national scale. In a review of over 120 post-2010 NBSAPs, United Nations Development Programme (UNDP) determined that Global Environment Facility (GEF)-eligible countries included an average of fewer than four maps per national biodiversity plan. Only one in three of these maps can be used to guide conservation and sustainable development decision-making and policy development.<sup>1</sup> As a result, development decisions that negatively affect biodiversity are often made without an awareness of its benefit to society, or potential impacts on the long-term delivery of ecosystem services. Meanwhile, other less harmful options may also be available.

In developing and middle-income nations, natural capital is typically high, while development needs are significant, and data on ecosystem services are often scarce or inaccessible. The number of global, biodiversity-based data sources and decision support systems grows daily,

but few are developed in consultation with those that need this scientific support. Therefore, they may not be officially validated for use by governments. Policymakers and land managers need access to accurate spatial data on ecosystem service conditions and trends, and guidance and tools to help transform commitments into action.

In 2018, UNDP completed a user needs assessment with over 60 Parties to the Convention on Biological Diversity (CBD). Respondents identified four common challenges to accessing and applying spatial data when developing, implementing, and reporting on conservation and sustainable development policies. These include:

1. Data are inaccessible: Available data are often scattered among ministries or multiple data providers and require complicated sharing agreements.
2. Data are often unusable: Accessible data are often in unusable formats that are inconsistent, inaccurate, of low spatial resolution, incompatible in format, at the wrong timescale, or out-of-date.

Using spatial data to model our environment helps us to understand and have a much clearer idea of how environmental, economic, or social variables are interrelated.

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3. Data are not nationally validated: Accessible, usable data is often not validated. Internationally developed data must be nationally validated through collaborations between data providers and governments.
4. Governments lack capacity to use data: Government agencies often lack experience using software and equipment to process accessible, usable, validated data, analyze it, and apply results.

This ‘data gap’ takes a toll on national efforts to protect, manage, and restore nature and related ecosystem services. Regardless of how much data is generated at the global scale, countries need a mechanism to assess its relevance to their country, supplement it with national data, prioritize areas essential for protection and restoration, and engage with diverse stakeholders to demonstrate the importance of nature to society. As nations formulate plans to achieve the Kunming-Montreal Global Biodiversity Framework (GBF), there is an emerging opportunity to create large-scale support to accelerate the adoption of nature-based solutions for development, and to provide policymakers with the spatial data and insights necessary to identify where to protect, restore, and sustainably

manage biodiversity to achieve their nature, climate, and sustainable development commitments.

Accurate spatial data on the status and trends of biodiversity, ecosystems, and essential ecosystem services is of paramount importance for UNDP and the governments it works with. Yet the ability of countries to access and use spatial data to develop plans, take actions, and report results is extremely low. Without accurate data on the status and trends of biodiversity, ecosystems, and ecosystem services, decision makers will continue to be unable to fully understand the consequences of biodiversity loss to the SDGs, and their ability to achieve the 2030 Agenda for Sustainable Development (2030 Agenda) and their national Sustainable Development Goal (SDG) targets will be compromised. Providing stakeholders with map-based, credible, high-quality information and building their capacity to apply it toward data-driven decision making at the national level will drive change. To drive action on the ground, governments need access to nationally relevant, usable information to identify threats and implement policy changes that create solutions for nature and people.

### 2.3 UN Biodiversity Lab

UN Biodiversity Lab (UNBL) is a free, open-source platform that enables governments and others to access state-of-the-art maps and data on nature, climate change, and human development in new ways to generate insight for decision-making. Developed jointly by UNDP, United Nations Environment Programme (UNEP), the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), and the CBD Secretariat, UNBL is freely available online to governments and other stakeholders as a digital public

good.<sup>2</sup> Launched in 2018 to support governments in their commitments to the CBD, UNBL contributed to a 1,047 percent increase in actionable maps used in countries’ national reports on the state of biodiversity.<sup>3</sup>

UNBL responds to a known global gap in the types of available spatial data and tools, providing an invaluable resource to nations around the world to take transformative action. Users can access over 400 of the world’s best available global spatial data layers,



create secure workspaces to incorporate national data alongside global data, and use curated data collections to generate insight for action. Without specialized tools or training, decision makers can use UNBL to leverage the power of spatial data to support priority-setting and

the implementation of nature-based solutions. Dynamic metrics and indicators on the state of our planet are also available.<sup>4</sup> Boxes 1 and 2 provide examples of the impact of UNBL.

| BOX 1 |

**Haiti uses spatial data and aerial imagery to monitor protected areas**

In the biodiversity-rich Caribbean nation of Haiti, policymakers are using spatial data from the UNBL to increase protected areas and ecosystem monitoring, as well as to improve forestry-related policies. The National Agency for Protected Areas is using data on global forest cover to design more effective forest management. These data are supporting a 10-year project that has raised over 630 million seedlings and reforested 567,055 hectares in the country’s 10 major watersheds. Using global forest data through UNBL, the Government of Haiti has identified where forest restoration efforts need to be intensified and therefore where these seedlings should be planted for maximum impact.<sup>5</sup>



| BOX 2 |

**Colombia, Ecuador, and Peru work together to improve monitoring for SDG 15-Life on Land**

Spatial data and indicators offer a powerful means to help nations prioritize action, monitor results, and hold actors accountable across sectors. Colombia, Ecuador, and Peru are home to 17 percent of the world’s last remaining tropical forests of high ecological quality.<sup>6</sup> These forests provide a range of services, such as carbon sequestration, habitat for iconic vertebrate species, and water filtration, elements that are essential to the health of the planet and human well-being.

To combat the decline of the world’s life-sustaining ecosystems and promote sustainable development, the UN General Assembly agreed upon the 2030 Agenda in 2015. Of the 17 SDGs associated with this agenda, SDG 15 focuses on Life on Land, with robust targets around sustainably managing forests, combating desertification, halting and reversing land degradation, and disrupting the decline of biodiversity. SDG 15 is essential to bolster global ambition on nature and climate, but action must be taken based on this goal to develop policy, implement projects, and monitor and report on the outcomes of these actions.

In collaboration with UNDP, the National Aeronautics and Space Administration (NASA), and four leading academic institutions, policymakers from Colombia, Ecuador, and Peru are nationally validating spatial data to strengthen governmental implementation and reporting on SDG 15. The biological and cultural diversity across the pilot countries offers a unique opportunity to develop products useful for conservation and sustainable development in an array of landscapes. The final data and indicators developed through the project will be incorporated into an existing decision support system based on UNBL to support countries preserve their terrestrial landscapes. In 2021, the UNDP Country Offices in Colombia, Ecuador, and Peru received a Group on Earth Observations SDG Award for these outstanding efforts to bring together government leaders and academic institutions to improve the monitoring of progress on SDG 15.





## 2.4 Spatial optimization tools for conservation planning

Traditionally, conservation planning has focused on establishing protected areas. Other recognized conservation approaches and values have often been overlooked, such as other effective area-based conservation measures (OECMs) and establishing areas for sustainable management and restoration. Conservation has also often been based on iconic species, with little thought to ecosystem services to humans or non-iconic biodiversity. With the explosion of data from the fourth industrial revolution, we now have access to the types of spatial data layers that we need to map biodiversity, ecosystem services, and threats at all levels, engaging in a more data-driven type of conservation.

Experts in conservation planning now advocate for conservation areas that are connected, adequate, representative, and efficient. Connected conservation areas ensure that populations support each other, recolonization is possible, and animal movement occurs. Adequate conservation areas ensure that the total area under protection is enough to ensure the persistence of biodiversity features. Representative conservation areas support a full range of species, ecosystems, and ecosystem services, not just iconic species like koalas or mountain gorillas. Finally, efficient conservation areas achieve their objectives at a minimal cost.<sup>7</sup>

These criteria are designed to help people identify the best regions to place under protection. However, identify-

ing the ‘best’ regions is an inherently human and political process based on what is important in a given place – this could be natural resources, ecosystem services, traditional knowledge and heritage, and many other factors. Thus, to design an effective conservation plan, we must identify our broad goals, specific targets, and financial or political constraints.

Decision makers can use spatial optimization tools to identify potential areas where protection could reap high rewards with the least cost. Because of the variety of factors often involved in this type of analysis (ecosystem connectivity, species distribution, human impact, etc.), countries can use optimization software to analyze many data points to identify the best areas for action based on the parameters set and the data provided (Box 3).

Spatial optimization tools should not be used by themselves but should be embedded within a Systematic Conservation Planning (SCP) process. This multi-step process supports decision makers to identify and implement conservation areas and to devise management policy, with feedback, revision, and reiteration as needed.<sup>8</sup> Although SCP is a flexible approach, it usually includes several main steps: a scoping process, participatory planning and stakeholder consultations, the selection of new conservation areas using spatial optimization software, and the implementation and monitoring of new strategies.<sup>9</sup>

### | BOX 3 |

#### A deeper dive into spatial optimization tools for conservation planning

Spatial optimization tools provide a simple calculation to identify the optimal area to conserve based on the end goal and any financial or political constraints. It relies on setting some basic guidelines around four key components. First, it is essential to identify a quantifiable target (e.g., percentage of jaguar habitat, percentage of resplendent quetzal habitat, or percentage of watersheds). Second, planning units, or units of land or sea on which action can be selected for conservation action, need to be defined. Third, a boundary length modifier determines the compactness of the conservation area (values greater than 1 result in more connected reserve networks). Finally, in certain tools, a penalty factor is imposed for not meeting the target in a given scenario. Spatial optimization tools effectively ‘score’ different conservation options by adding together the cost of a planning unit, the boundary length of the conservation area, and the penalty factor for any unmet targets. Programs such as Marxan and prioritizr can quickly and effectively do this type of calculation to identify the most effective conservation areas – those with the lowest score. These types of approaches can be adapted to national priorities by changing the cost of planning units, the boundary length modifier, and the penalty factor. Likewise, by producing a range of top conservation options, they can facilitate dialogue around which is most appropriate for the national context.

## 2.5 Applying systematic conservation planning to support integrated spatial planning

The Essential Life Support Areas (ELSA) methodology uses principles of SCP to support countries to identify where they can take nature-based actions to best contribute to the achievement of their priority policy targets for biodiversity, climate change, and human well-being (Box 4). This integrated planning approach is unique from other SCP exercises because it focuses not just on protected areas, but considers how three different actions protection, restoration, and management – can together have the maximum impact across diverse policy priorities and development goals

(Figure 4). The approach begins with an understanding that each country is different, in terms of ecosystems, national priorities for biodiversity, climate change, and human well-being, and how it implements nature-based actions. The approach includes creating a multi-zone spatial prioritization map, based on the country’s unique features and goals. Integrated spatial planning is useful because it supports coordination across interest groups, thus showing a pathway to achieve multiple diverse outcomes at once.

### | BOX 4 |

#### How can Systematic Conservation Planning help us to see where nature-based actions will be most effective to meet national priorities?

The ELSA methodology uses SCP to identify where nature-based actions to protect, manage, and restore nature can lead to the best outcomes across the 10 priority policy targets identified through stakeholder consultations. SCP is a peer-reviewed, gold-standard approach for conservation that helps identify where nature-based actions can achieve maximum impact across multiple, often competing, priorities in a given study area, region of interest, or country.<sup>10</sup>

The value of using SCP to run the ELSA analysis is two-fold. First, it assesses all planning features that relate to the 10 priority targets at once, enabling capitalization on synergies to determine where actions can most effectively achieve the greatest impact across all policy targets. Second, the ELSA analysis enables diverse stakeholder groups to weigh the relative importance of the various planning features associated with the priority policy targets, view trade-offs that result from conflicting priorities, and foster dialogue around cross-sectoral collaboration and implementation.

Overall, the ELSA analysis provides countries with an outcome-orientated map to implement nature-based solutions that will contribute to the achievement of the 10 priority policy targets and support the country to achieve adaptive sustainable management of natural ecosystems.

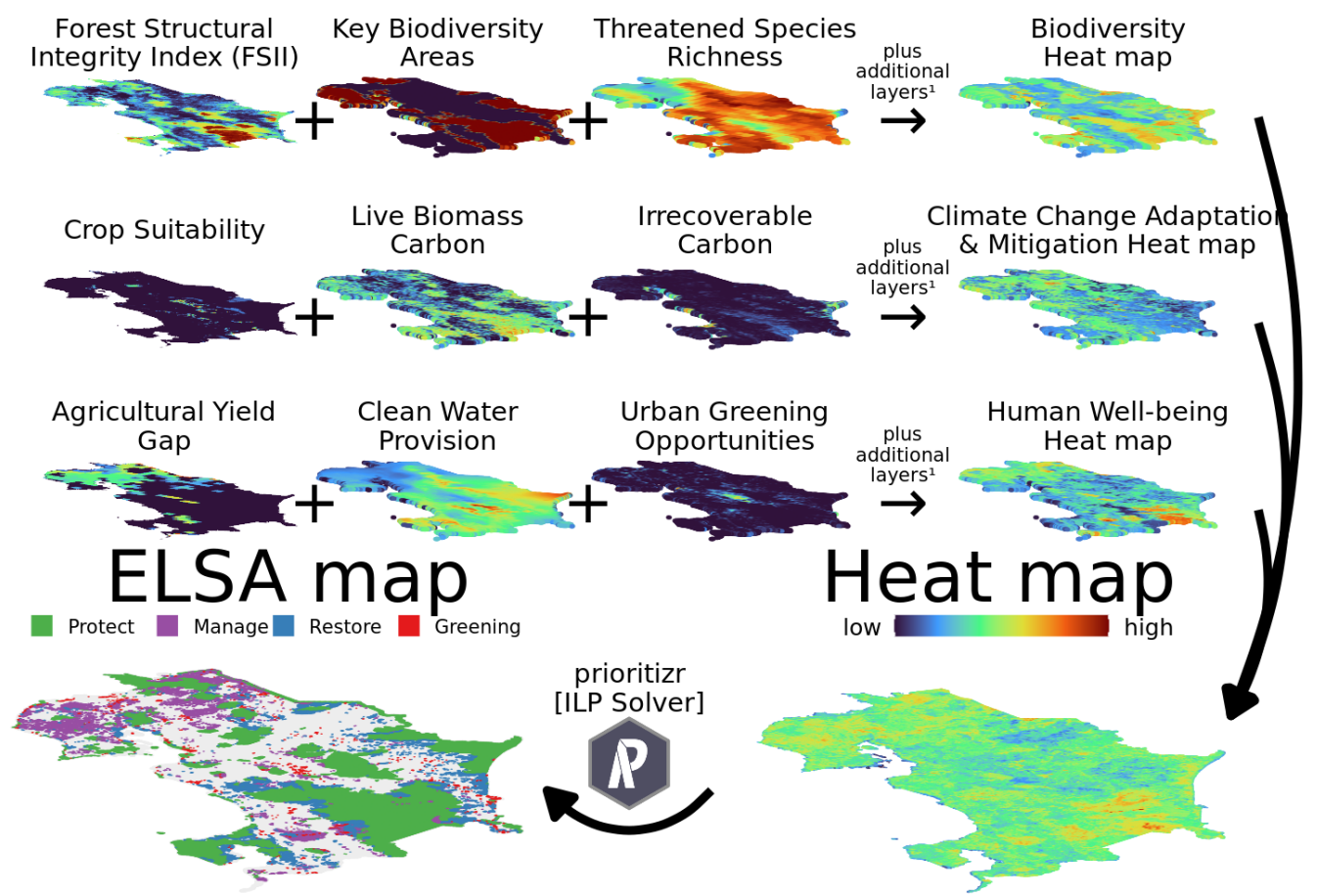




I FIGURE 4 I

Systematic conservation planning through ELSA

This diagram demonstrates how Costa Rica and the ELSA science team: 1) identified and created data layers that could speak to its unique national targets relating to nature, climate change, and sustainable development; 2) combined this information to calculate heat maps that indicate (spatially) the aggregate value across the country for each theme, as well as for all themes combined (i.e., ELSA); and, supplying this information to a mathematical optimization algorithm, 3) developed an ELSA map which shows optimal locations where the country can take nature-based actions to achieve its priority policy targets. Note that this diagram only shows some of the data layers that Costa Rica included in its ELSA map. Refer to Table 6 to see what a complete data stack could look like.



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Chapter 3

Introduction to the ELSA methodology for integrated spatial planning

3.1 Introduction

The Essential Life Support Areas (ELSA) methodology brings together scientists and policy experts to harness earth observations to deliver on national priorities. To do this, the project works closely with countries to identify areas where nature-based actions can safeguard essential ecosystem services, as well as maintain biodiversity. Nature-based action refers to land management that addresses the biodiversity crisis and climate change, while promoting sustainable development through the protection, management, and/or restoration of ecosystems.

The project has created a scientific framework and decision support system to bring together national data in a central repository, to create ‘Maps of Hope’ that show where nature-based actions could be taken based on national priorities, and to monitor the impact of these actions. The project enables countries to:

1.

Consolidate national data to create a national repository of spatial data relevant to environmental decision-making;
2.

Apply a rigorous scientific methodology based on the principles of Systematic Conservation Planning (SCP) to identify ELSAs; and
3.

Use maps to monitor and report on progress toward achieving national and international commitments.

The theory of change is that map-based, credible, high-quality information, combined with capacity building at the national level, will drive shifts in policy implementation and reporting to deliver on the 2030 Agenda for Sustainable Development (2030 Agenda) and the Rio Conventions. This chapter provides a comprehensive introduction to this methodology.

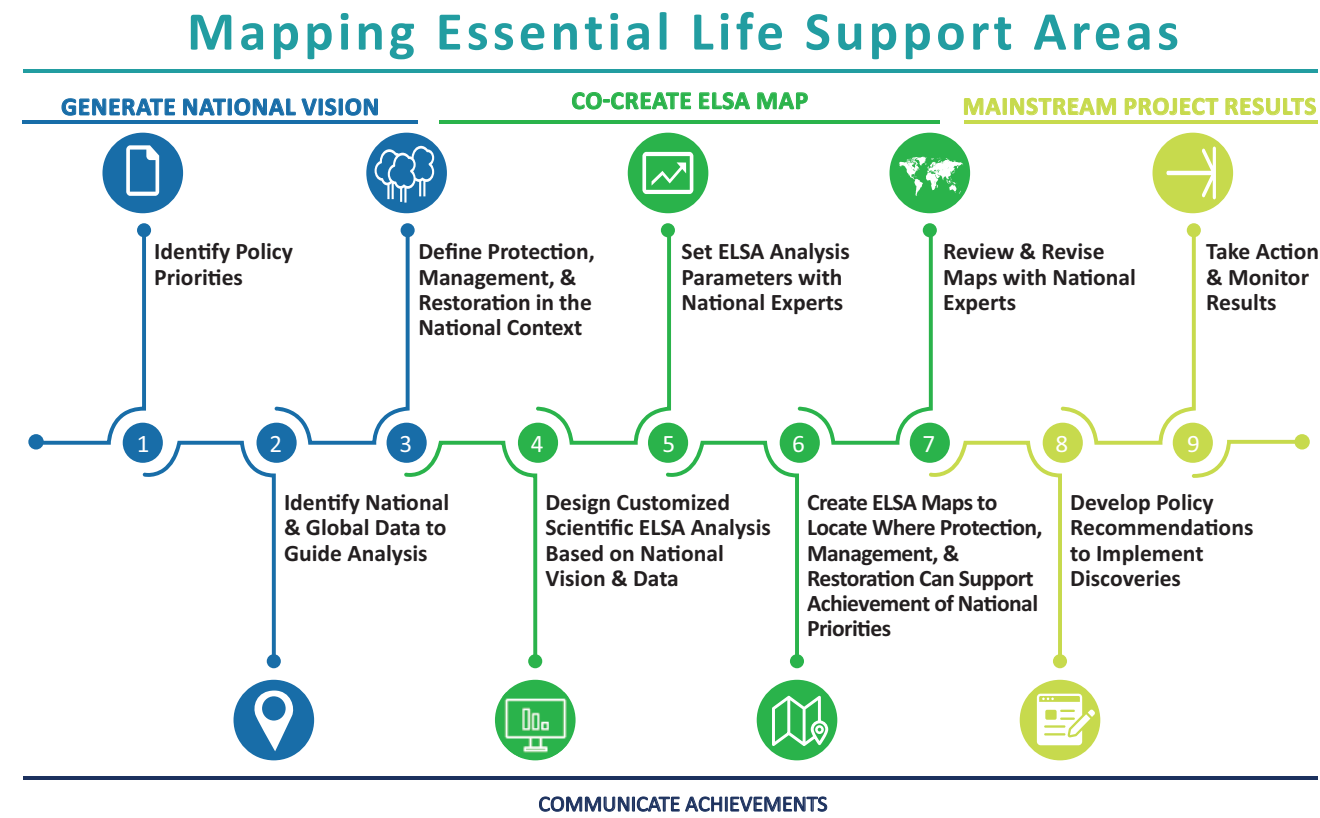
3.2 Overview of the ELSA methodology

To identify key nature-based actions that can support priority policy targets in countries, the ELSA methodology includes three broad areas of work: (1) generating a national vision; (2) co-creating an ELSA map; and (3)

mainstreaming project results. These areas of work include nine steps, as well as an overarching step of communicating the work throughout the project (Figure 5). This workbook covers each of these steps.

I FIGURE 5 I

The ELSA process in 9-steps



3.3 Foundations of the ELSA methodology

Before creating a ‘Map of Hope’, countries must first have a clear understanding of the principles behind the ELSA methodology project and its potential scope. While the methodology outlined in this workbook provides space

for a great deal of customization based on a country’s needs, following certain guidelines help ensure scientifically credible and robust ELSA maps.





3.3.a Different approaches to creating an ELSA map

There are two ways a country can approach the creation of a national ‘Map of Hope,’ based on national interests and available resources:

- **Standard national analysis:** The standard ELSA analysis is based on national goals and data captured through a stakeholder engagement process over several months. The ELSA map is conceptualized, developed, iterated, and shared with key stakeholders through two stakeholder consultations, an ELSA map validation meeting, a results-sharing meeting, and other events at the discretion of the country. The goal of this classic ELSA analysis is to create a map that shows where protecting, restoring, and sustainably managing nature can help a country achieve its top targets related to nature, climate, and sustainable development. Chapters 3 through 6 of this workbook outline how a national analysis can be created, although many of the

insights from these chapters can also be applied to a regional or fit-for purpose analysis.

- **Regional or fit-for-purpose analysis:** Countries can alter the scope of their ELSA analysis to focus on a specific region or application, such as water security, climate change adaptation, or disaster risk reduction. While the technical aspects of this process are similar to a standard analysis, the data, targets, and participating stakeholders may be adjusted to reflect the specific use case. For example, if the analysis focuses on just one region of the country, the participating stakeholders could be individuals who specialize in the region, live in the region, or have a vested interest in it. This map could also incorporate regional-level policies and data. Examples of this type of fit-for-purpose analysis in Costa Rica and Colombia can be found in Chapter 8 of this workbook.

3.3.b Principles of the ELSA project

**The project must be driven by national stakeholders.** For a ‘Map of Hope’ to be reflective of a country’s interests and widely adopted, the project must be led by national stakeholders. This means that the participating country should have full ownership over each step of the process, from project inception to the validation of the final ELSA map. While the global United Nations Development Programme (UNDP) team can offer logistical and technical support, national project leaders should take the lead in deciding who should participate in consultations, how to hold the consultations, and how to disseminate the project results, among other aspects.

**The project should take a whole-of-government, whole-of-society approach.** Consultation participants should be reflective of the diverse stakeholder groups that will use the final ELSA map and who may be affected by its potential use. The project relies on the expert opinion of diverse groups to create ELSA maps that are representative of stakeholder values. Therefore, it is critical to consult key

groups throughout the duration of the project, including women, Indigenous peoples and local communities, academic institutions, and government ministries with a focus on nature, climate, energy, natural resources, tourism, mining, and other sectors. Local, national, and global non-governmental organizations may also provide valuable insight.

**National data should take precedence over global-level data.** ELSA maps are built by combining different spatial data layers within a country, e.g., flood risk, protected areas, land use zoning, land degradation, etc. While the UN Biodiversity Lab can offer many global data layers to support the analysis, validated national data should be used whenever possible. These datasets are often at a finer resolution and are more trusted by national partners than global data layers. Ultimately, each country must decide which datasets take precedence in the process of creating an ELSA map.









Chapter 4

Getting started with the ELSA methodology

4.1 Introduction

This chapter explores the preliminary activities that a country must take before it can jump into mapping its Essential Life Support Areas (ELSAs). These activities ensure that a country has the ELSA core team in place with a shared agreement on the project timeline and

expectations. In addition, this chapter explains how the ELSA core team can begin to engage relevant stakeholders to lay the groundwork for meaningful collaboration across the project.

4.2 Establish an ELSA core team

Once a country formally decides to undertake an ELSA process, the first step is to build an ELSA core team. The ELSA core team will meet on a regular basis, usually weekly or bi-monthly, especially in the weeks before project consultations. While the members of the ELSA core team can vary depending on the specific needs of the country, the team usually includes the following individuals:

- **Ministry officer:** At least one person from the Ministry of Environment (or a comparable agency in the country) typically participates in the core team. This person is often in charge of liaising with and reporting to other staff within the Ministry; initiating engagement with national participants, stakeholders, and experts; shaping the stakeholder consultations; ensuring that the process stays on track; and communicating the results.
- **United Nations Development Programme (UNDP) Country Office staff:** At least one person from the UNDP Country Office typically supervises the implementation of the project. This person is usually in charge of finalizing the project budget; liaising with and reporting to other staff within UNDP Country Office; initiating engagement with national participants, stakeholders, and experts; and shaping the stakeholder consultations.
- **Knowledge management and capacity building specialist:** This person provides support in engaging relevant stakeholders in the country. This includes

various tasks, such as: facilitating the communication between UNDP and relevant government partners; identifying key agencies and institutions for the project; facilitating outreach; supporting the organization and implementation of the national consultations; and ensuring the preparation of supporting documents. This person is also tasked with writing communication pieces, such reports, press releases, blogs, and photo essays, and closely works with the spatial data specialist to prepare a final recommendation document, highlighting possibilities to use the ELSA map to guide, implement, and report on national policies. This person also supports the communication and strategy around the project and is regularly in touch with the global UNDP team to ensure the smooth implementation of the project.

- **Spatial data specialist:** This specialist provides support on tasks related to the preparation and use of spatial data. Over the course of the project, this individual helps determine what key national data are available to support the creation of the ELSA map; liaises with data owners to secure the use of this data; and provides expert review of the resulting analysis. This person also provides input for the final scientific documents produced for the country, including the science brief and webtool manual; and closely works with the knowledge management and capacity building specialist to prepare a final recommendation document, highlighting possibilities to use the project's results to guide, implement, and report on national policies. Similar to

the knowledge management and capacity building specialist, the spatial data specialist connects with the rest of the ELSA core team regularly to ensure coordinated project implementation.

The ELSA core team also includes experts from UNDP Nature for Development who provide guidance based on their experience with the ELSA methodology in other pilot

countries. They support the project from start to finish by explaining the steps detailed in this workbook, offering templates and tools to ease the process, preparing documents, and more. They also serve as the connector between the core team and the ELSA science team who set up the ELSA webtool and run the analysis. More clarification between these teams can be found in Box 5.

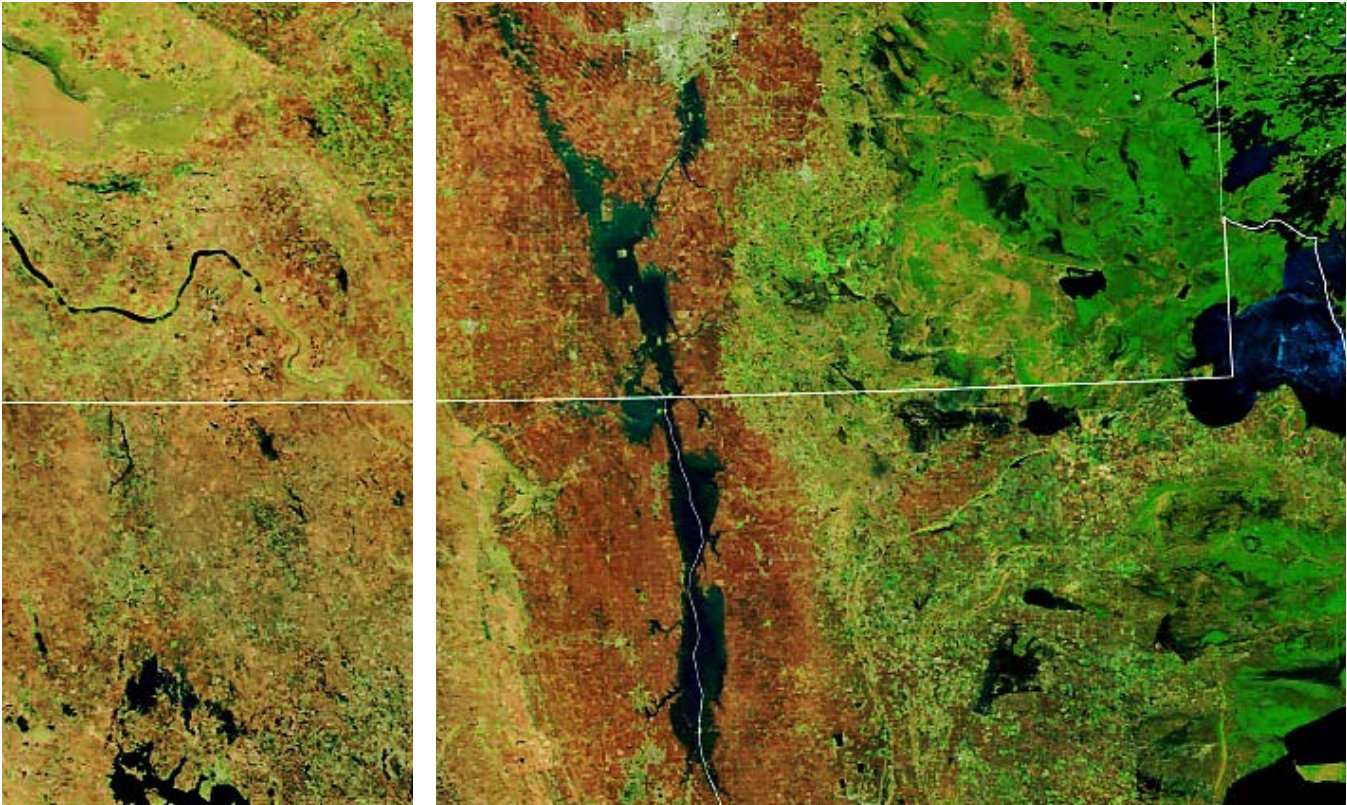
I BOX 5 I

Definition of teams involved in the project

**ELSA core team:** This term refers to the group that meets regularly to plan and execute the project. It often includes representatives from the UNDP Country Office, the Ministry of the Environment, national spatial data and knowledge management specialists, and project experts from the global UNDP team.

**ELSA science team:** This refers to individuals from the Global UNDP team who undertake many of the technical aspects of the project, such as: guiding the data hackathon, processing spatial data layers, creating the ELSA webtool, and facilitating working sessions to co-create the ELSA map.

**Global UNDP team:** This refers to members from the UNDP Global Programme on Nature for Development who support the ELSA project. It includes members of the ELSA science team and project other experts.





4.3 Set shared expectations through a timeline

A timeline helps facilitate smooth coordination between the ELSA core team, national stakeholders, and key policy actors, and helps to avoid any delay in the production of the ELSA map. When developing a timeline, the ELSA core team should avoid conflict with public holidays and anticipated ‘slow’ times in the country, as well as existing commitments on the side of the Ministry of Environment, UNDP Country Office, and any other key institutions that participate in the project activities. Table 2 provides an example project timeline.

TABLE 2 |  
Example project timeline

Project phase	Project steps	Average duration
Project inception	The ELSA core team is established, often consisting of a knowledge management and capacity building specialist, a spatial data specialist, project experts from the global UNDP team, and focal points from the Ministry of Environment and the UNDP Country Office.	2 months
	The ELSA core team determines shared expectations through a timeline and project document.	
	The ELSA core team conducts a rapid policy analysis to identify mappable policy targets related to nature, climate, and sustainable development across the country’s leading policy documents.	
First consultation	Stakeholders review the results of the rapid policy analysis and identify national priority policy targets through a policy hackathon.	Half-days across 2 weeks
	Stakeholders identify national and global spatial data to map selected national priority policy targets through a data hackathon.	
	Stakeholders define protection, management, and restoration (or other nature-based actions) in the national context and determine what percentage of land will be identified for each of these actions in the ELSA map.	

Project phase	Project steps	Average duration
Data collection and processing	The spatial data specialist collects and organizes necessary data from focal institutions.	3 months
	The ELSA science team processes data and inputs it into the country’s ELSA webtool.	
Second consultation	Stakeholders provide feedback to set the parameters of the ELSA analysis.	2 weeks
	Stakeholders work with the ELSA science team to create and refine the ELSA map via the ELSA webtool.	
Communicating project results	The ELSA core team holds a validation meeting to ensure the map is approved for national usage.	3 months
	The knowledge management and capacity building specialist documents potential applications for the ELSA map.	
	The Ministry of the Environment and UNDP Country Office hold a results-sharing meeting with decision makers to introduce them to the map and discuss potential applications.	
	The ELSA core team engages in a communications campaign to disseminate project results to a wider audience.	
Use of ELSA map to support decision-making	Decision makers use the ELSA map to support the creation, implementation, and monitoring of policies and initiatives.	Determined by country
	Decision makers create updated iterations of the ELSA map via the ELSA webtool as new policies and data are available. (optional)	
	Decision makers use the UNBL secure workspace to visualize the ELSA map, as well as its individual layers, on a secure spatial data platform, and run analyses.	





4.4 Connect with key stakeholders

Rich stakeholder engagement is a requirement for any successful Systematic Conservation Planning (SCP) efforts; the ELSA methodology is no different. In fact, national stakeholders drive the mapping process from start to finish to ensure that the map reflects their values.

Once the discussions around logistical aspects are finalized, the ELSA core team can then focus on involving relevant stakeholders considering a whole-of-government and whole-of-society approach (Box 6). These stakeholders should be representative of a variety of decision-mak-

ing groups, including but not limited to national ministries, universities, non-governmental organizations, and Indigenous peoples and local communities. Across two stakeholder consultations and other important touch points (Box 7), these individuals will provide essential information to guide the creation of the ELSA map. The result is an analysis that has a strong footing within the national context and speaks to the concerns of decision makers. Sustained stakeholder engagement will not only strengthen the final map, but will also increase its legitimacy and uptake by key players.

I BOX 6 I

List of organizations invited to the first consultation in Cambodia

- BirdLife International
- Conservation International
- Flora and Fauna International
- Food and Agriculture Organization
- Ministry of Agriculture Forestry and Fisheries
- Ministry of Environment: General Directorate of Administration for Natural Protected Areas
- Ministry of Environment: General Directorate of Environment Knowledge and Information
- Ministry of Environment: General Directorate of Environment Protection
- Ministry of Environment: General Directorate of Local Community
- Ministry of Environment: General Secretariat of National Council for Sustainable Development
- National Committee for Sub-National Democratic Development Secretariat
- Royal University of Agriculture
- Royal University of Phnom Penh
- Servir-Mekong
- United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
- UNDP Cambodia
- U.S. Agency for International Development - Greening Prey Lang
- World Conservation Society
- World Wildlife Foundation

The Ministry of Environment and other governmental bodies

The Ministry of the Environment can play the role of integrating relevant governmental ministries into the project, including the Ministry of External Cooperation, the Ministry of Agriculture, the Ministry of Natural Resources, and the Ministry of Water Management. Collaboration across and within ministries enables the project to identify areas of alignment across seemingly competing priorities, e.g., agriculture versus protected areas. The Ministry of Environment is responsible for selecting the other groups that should be consulted in the project. These often include those below.

Academia

Universities often produce and maintain some of the country’s best spatial data and therefore may be able to facilitate its access. In addition, universities might be knowledgeable about the country’s biodiversity commitments and could provide information to shape the parameters of the ELSA map to reflect national targets. Finally, students and researchers might be end users of the ELSA map. Therefore, their participation could help make connections to resources and existing projects and mainstream the results.

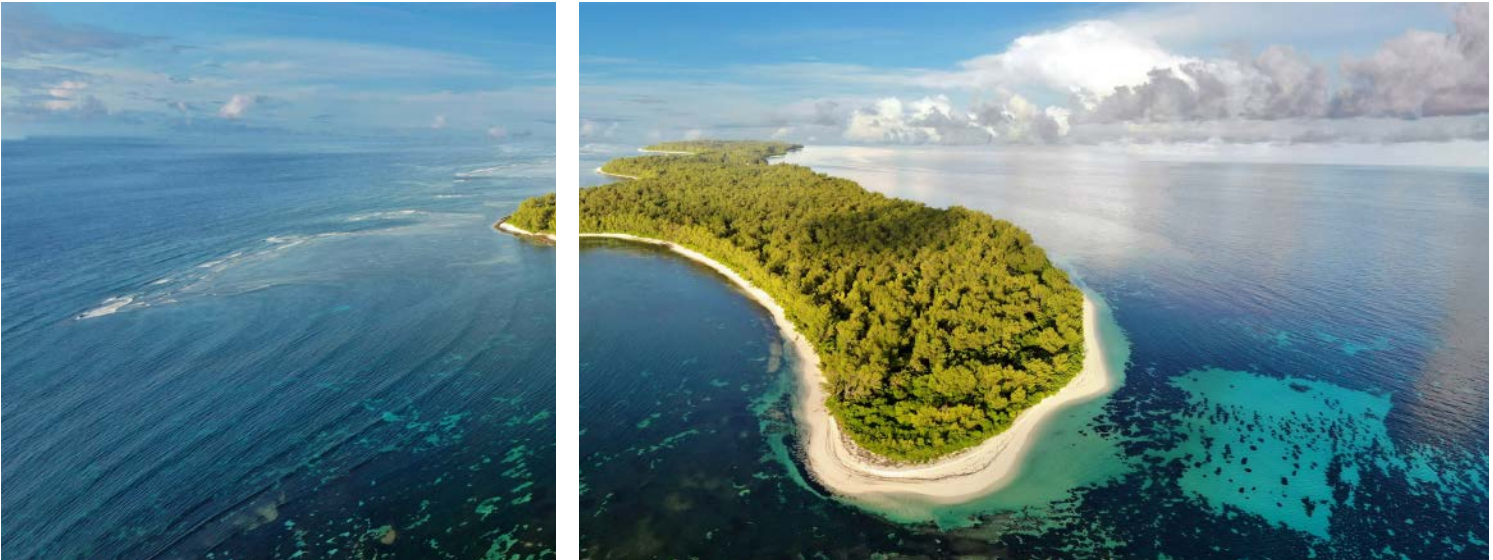
Non-governmental organizations

In most countries, there are typically many non-governmental organizations that work in parallel to the UN,

pursuing similar goals around nature, climate, and development. It is important to unify efforts and build on existing work with these organizations. Collaboration between the ELSA core team and non-governmental organizations can also help streamline communications with stakeholders on differences and overlaps between workstreams and the intended impact of different projects.

Indigenous peoples and local communities

Indigenous peoples and local communities are critical to the project as they often have a deep knowledge of the land accrued through centuries of land stewardship. They will likely be able to provide insights that can support the creation of the ELSA map. They could also be impacted by potential decisions that the country makes based on the ELSA map. With an understanding of historic and continued injustices perpetrated against Indigenous peoples, care must be taken to ensure that they have a voice in the project and can use the results to support their work around biodiversity, climate change, and sustainable livelihoods. In countries with a strong presence of Indigenous peoples, UNDP strongly encourages the Ministry of Environment to include them as key stakeholders. For example, as Indigenous peoples comprise about 14 percent of the population,<sup>1</sup> the Ministry of Environment, Water and Ecological Transition of Ecuador took care to ensure that Indigenous groups were involved in the project, including the Confederation of Indigenous Nationalities of the Ecuadorian Amazon who helped to identify the policy targets to base the analysis and approved the final map.





ELSA stakeholder consultations and meetings

- **First national consultation:** This consultation represents the first opportunity for national stakeholders to meet with each other and set a vision for the application of the ELSA methodology in their country. The consultation usually spans four days with three distinct parts:
  - **Introduction and vision:** During the introduction and vision segment, stakeholders learn about the ELSA methodology and discuss how it can support the use of spatial data to achieve national priorities. Stakeholders envision how integrated spatial planning can be applied to meet the country’s unique goals around nature, climate, and sustainable development.
  - **Policy hackathon:** During the policy hackathon, stakeholders review the nature-based targets identified during the rapid policy analysis and vote on the most important targets for inclusion in the ELSA map. This mechanism enables stakeholders to explore synergies between existing national policy documents and come up with a list of up to 10 priority policy targets that will guide the ELSA analysis. See section 5.2 for more details on the policy hackathon.
  - **Data hackathon:** Once the priority policy targets are identified, stakeholders undertake a stocktake of existing national datasets that relate to the country’s priority policy targets. See section 5.3 for more details on the data hackathon.
- **Second national consultation:** After the spatial data has been collected and input into the ELSA webtool (usually a few months after the first consultation), stakeholders meet again to co-create the country’s ELSA map. This consultation is more technical than the first and is often attended more heavily by spatial data experts than policy advisers. The second consultation usually spans three days and has three parts:
  - **Overview of progress made since the last consultation and ELSA parameter setting:** On the first day of the second consultation, stakeholders learn about the progress made by the ELSA core team since the first consultation. Then, stakeholders have the opportunity to review the parameters for the ELSA map, including definitions of protection, restoration, and sustainable management (and any other nature-based action chosen for the analysis), clarify the zoning and lock-in constraints, and define the percentage of the national territory to be allocated to each nature-based action.
  - **Exercise to determine weights of data layers within ELSA map:** On the second day, the stakeholders undertake a weighting exercise to determine how each data layer, or planning feature, will be reflected in the ELSA map. Each stakeholder will provide a weight for each data layer, from 1 to 5, reflecting the level of confidence they have in the layer, as well as the relevance of the layer to this analysis. At the end of the session, each data layer will be assigned a composite weight (the average of all stakeholders’ individual weights). These weights will determine the influence that each data layer will have on the final ELSA map. See section 6.3 for more details.
  - **Co-creation of the ELSA map:** On the last day of the consultation, stakeholders co-create the first iteration of the ELSA map based on the results of the weighting exercise. Then, stakeholders review the map and consider tradeoffs between data layers. If a data layer is under-represented in the map, stakeholders have the opportunity to re-weight the data layers and create a new map. The core project team concludes the consultation with a feedback exercise and a review of the next steps. See section 6.4 for more details.
- **Validation meeting:** After the ELSA map is co-created during the second consultation, the ELSA core team holds a meeting with a smaller group of key stakeholders to finalize the ELSA map and address remaining questions. Once the Ministry of Environment (or equivalent national organization) and the UNDP Country Office validate the ELSA map, the ELSA core team can begin to release communications around the project results. See section 6.4.
- **Result-sharing meeting:** As a final stakeholder engagement step within the project, countries may choose to hold a meeting to formally share the final ELSA map with decision-makers. This meeting serves to make key organizations that were not part of the process aware of the project results and its potential applications. See section 7.2.b.

Endnotes

1 MacLeod, M. J. and others (2021). Ecuador. People of Ecuador. Ethnic groups. *Encyclopedia Britannica*. <https://www.britannica.com/place/Ecuador/People>







Chapter 5

Generating a national ELSA vision

5.1 Introduction

This chapter explores the essential steps to generating a national Essential Life Support Areas (ELSA) vision for the country. These steps include: 1) identifying priority policy targets related to nature, climate, and sustainable development through a rapid policy analysis and a policy

hackathon; 2) identifying relevant spatial data that can represent these targets through a data hackathon; and 3) defining protection, management, and restoration in the national context. Relevant stakeholders should have a significant role in each step of this process.

5.2 Step 1: Identify priority policy targets

The ELSA methodology uses spatial data to locate and optimize where nature-based actions will have maximum impact for biodiversity, climate change, and human well-being across a country's priority policy targets. To do this, the decision makers first need to arrive at a consensus on the country's most important nature-based policy targets for inclusion in the ELSA analysis (Figure 5, Step 1).

First, the national focal points identify approximately 10 key national policy documents to guide the analysis. These documents might include the full scope of the country's priorities for biodiversity, climate change, and human well-being, such as national development or biodiversity plans. A country might also choose to focus on documents related to a particular predetermined interest, such as water security.

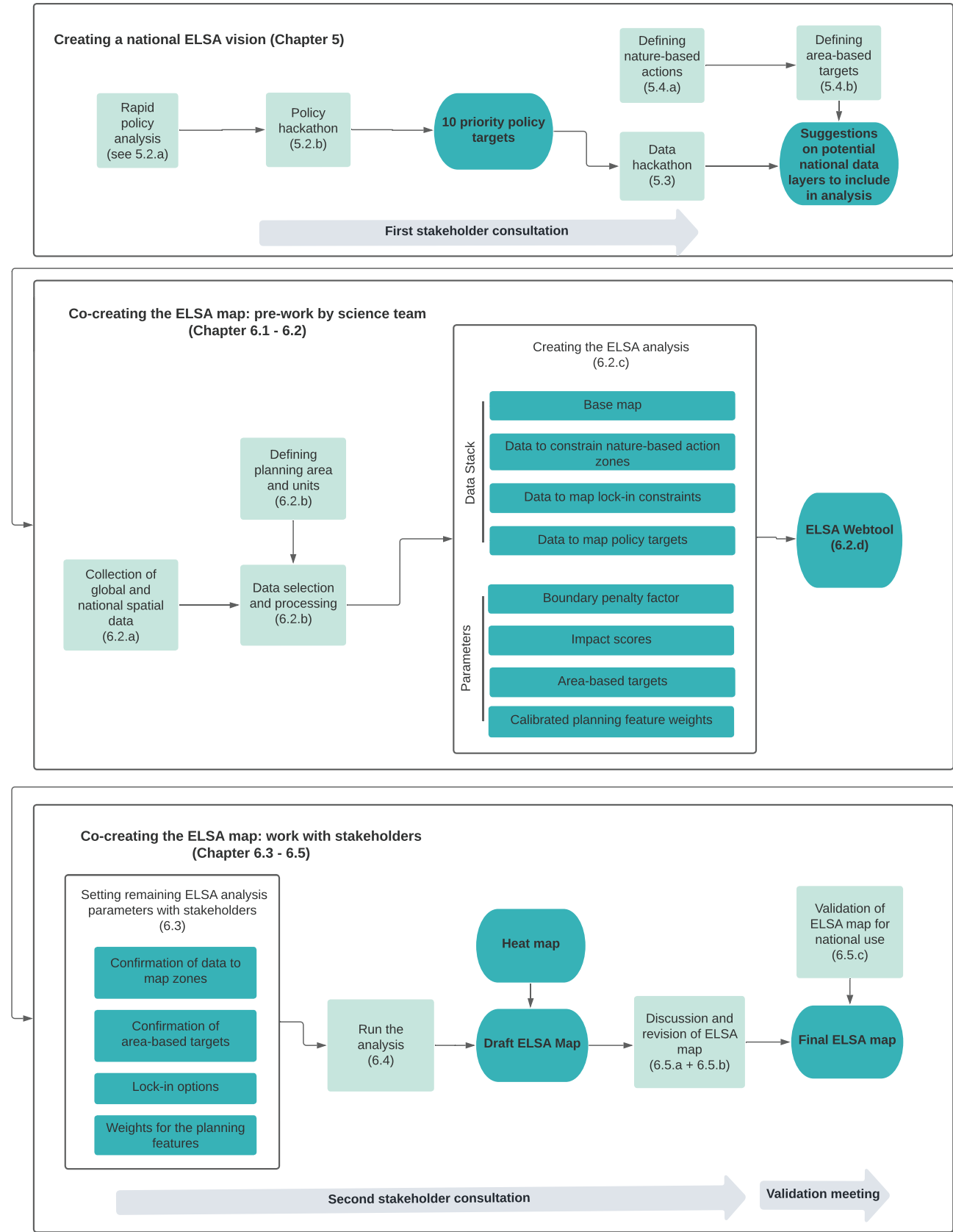
To help stakeholders come to a common understanding of the country's policy landscape related to nature, climate, and sustainable development, the ELSA core team conducts a rapid policy analysis to identify nature-based policy targets within the selected national policies and discover synergies and themes among the documents. Then, during the first stakeholder consultation, the ELSA core team works with a diverse group of national stakeholders to determine which of these nature-based policy targets are the most critical to the nation's vision for nature, climate, and sustainable development. These steps, among others, can be found in the detailed workflow to create ELSA maps found in Figure 6, covering Chapters 5 and 6 of the ELSA Workbook.



I FIGURE 6 I

Process to create ELSA maps

Light green boxes refer to processes and teal boxes refer to outputs.





5.2.a Conduct a rapid policy analysis

The ELSA rapid policy analysis covers the key policy documents selected by national focal points (potentially the representatives of the Ministry of the Environment or the United Nations Development Programme (UNDP) Country Office on the core team). The objective of the analysis is to identify national nature-based policy targets that can be spatialized, or represented on a map. During the policy hackathon, described in 5.2.b, stakeholders will review the resulting list of nature-based policy targets and select 10 priority policy targets that can serve as the basis of their ELSA map.

Method to conduct the rapid policy analysis

1. **Identify and collect approximately ten nature-based policy documents.** These should be the country’s most important policy documents related to nature, climate, and sustainable development. In addition, the documents should contain mappable

nature-based targets. Documents often reviewed in the analysis include:

- National Adaptation Plan
- National Biodiversity Strategies and Action Plans (NBSAP)
- National Development Plan
- Nationally Determined Contributions (NDC)
- National Plan for Disaster Management, or the equivalent
- National Water Policy, or the equivalent
- REDD+ National Strategy

Laws are often less useful for the analyses as they normally set the legal framework but not specific policy targets. Boxes 8 and 9 provide examples of the suite of policy documents used in two ELSA pilot countries.

| BOX 8 |

Policy documents included in Uganda’s rapid policy analysis

- National REDD+ Strategy and Action Plan<sup>1</sup> from the Ministry of Water and Environment
- Uganda National Biodiversity Strategy and Action Plan<sup>2</sup> from the National Environment Management Authority
- National Water Plan<sup>3</sup> from the Ministry of Water, Lands, and Environment
- National Disaster Risk Reduction Plan<sup>4</sup> from the Directorate of Relief, Disaster Preparedness and Refugees, and Office of the Prime Minister
- National Development Plan II<sup>5</sup> from the The Republic of Uganda
- National Development Plan III (draft)<sup>6</sup> from the National Planning Authority
- National Adaptation Programmes of Action for Climate<sup>7</sup> from the Government of the Republic of Uganda
- Green Growth Development Strategy 2017/2018 to 2030/2031<sup>8</sup> from the National Planning Authority

| BOX 9 |

Policy documents included in Chile’s rapid policy analysis

- Long Term Climate Strategy<sup>9</sup> from the Government of Chile
- National Strategy on Climate Change and Vegetation Resources<sup>10</sup> from the Ministry of Agriculture and the National Forestry Corporation
- Nationally Determined Contribution<sup>11</sup> from the Ministry of Environment
- Climate Change Adaptation Plan on Biodiversity<sup>12</sup> from the Ministry of Environment
- National Biodiversity Strategy<sup>13</sup> from the Ministry of Environment
- National Wetland Protection Plan<sup>14</sup> from the Ministry of Environment
- National Landscape Restoration Plan<sup>15</sup> from the Ministry of Environment, Ministry of Agriculture, and National Forestry Corporation
- National Land Use Planning Policy<sup>16</sup> from the Ministry of Housing and Urbanism
- National Policy for Disaster Risk Reduction<sup>17</sup> from the Ministry of Interior and Public Security
- Energy Policy of 2050<sup>18</sup> from the Ministry of Energy
- Forestry Policy of 2050<sup>19</sup> from the Ministry of Agriculture
- National Rural Development Policy<sup>20</sup> from the Interministerial Technical Committee of the Government of Chile
- National Urban Parks Policy<sup>21</sup> from the Ministry of Housing and Urbanism and UNDP
- Environmental Sustainability of Public Works Policy<sup>22</sup> from the Ministry of Public Works
- Sustainability and Climate Change Policy MINVU 2050<sup>23</sup> from the Ministry of Housing and Urbanism
- Sustainable Tourism Adaptation Plan<sup>24</sup> from the Ministry of Environment and the Ministry of Economy, Development, and Tourism
- Agri-Food Sustainability Strategy 2020 to 2030<sup>25</sup> from the Ministry of Agriculture
- National Policy for Sustainable Management in the Mountains<sup>26</sup> from the National Mountain Committee
- National Policy for the Use of the Coastal Edge<sup>27</sup> from the Ministry of National Defense
- National Strategic Plan for Disaster Risk Reduction in the Sanitation Sector 2020 to 2030<sup>28</sup> from the Superintendency of Sanitary Services

2. **Set up an ELSA rapid policy analysis Excel spreadsheet<sup>29</sup> for your country.** The recommended rapid policy analysis template spreadsheet (linked in the endnotes) is designed to help you capture national nature-based targets across policy documents in a consistent manner. Keep in mind that targets will be expressed differently across policy documents. Some have a structure of theme → objective → actions → baseline → targets, while other policy documents may have a structure of targets → objectives → interventions, or other formats. Therefore, you may wish to adjust the column titles of the policy analysis spreadsheet so they reflect the way your country’s policy documents are set up.

3. **Perform a keyword search to identify national targets that are nature-based.** A keyword search can be used to help identify nature-based targets in the country’s policy documents. To perform a keyword search, use the control + f function to search for the suggested keywords included in Box 10, as well as other keywords that may be relevant to your country. Additionally, not every keyword found in this process is related to a target. Where possible, you should ensure that they refer to the actions in parentheses next to them.



Suggested keywords for keyword search

Agri (looking for sustainable agriculture practices), agro (looking for agroecology and agroforestry), avoid (looking for avoid deforestation, degradation), biodiversity, carbon, catchment, cattle (same as grazing), climate change, coastal, connectivity, conservation, conversion, decline, degrad (looking for degradation and degraded), desertification, disaster, ecosystem (looking for ecosystem protection or restoration actions), fire (looking for fire management), flood and/or drought (looking for nature-based solutions that support countering desertification), food security, forest (looking for reforestation, deforestation, forest conversion, and forest management), grazing (looking for optimal grazing actions), greening, improve (looking for improved agricultural, rise, etc. practices), logging (looking for anti-logging actions), mangrove, nutrient (looking for improved nutrient management), peat, protect, manage and/or restore (looking for protect, manage or restore ecosystems, forest, species), silvopastoral, soil, species (looking for preventing species extinction, reducing threatened species, restricting invasive species), threat, water, watershed (looking for nature-based solutions that support watershed restoration or protection), wetland, and wood.

This keyword search will help you to locate the country’s nature-based targets. These are action-oriented goals around nature that often, but not always, include a quantitative indicator and a completion date.

Examples of nature-based policy targets include the following:

- Improve protection and conservation measures in 30 percent of mangrove ecosystems.
- Increase forest, tree, and wetland coverage, restore bare hills, and protect mountainous areas and rangelands.
- Reduce the national deforestation rate by 50 percent by 2030.
- By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes
- Promote and restore rare, endangered, endemic, and threatened species by 2030.
- By 2020, put at least 50 percent of production in forests under sustainable management.

- Increase urban forest coverage and conserve ecosystems so that they are stable and sustainable by 2025.
- Double the hectares under sustainable production and conservation to 1.4 million hectares.
- By 2030, 17 percent of the total area of terrestrial ecosystems, including inland aquatic ecosystems, will be 100 percent conserved through protected areas and other effective area-based measures.
- By 2022, protect glaciers, regardless of their form, prohibiting any type of activity that involves their removal, transfer, or covering with clearing material and/or debris.

**4. Review targets to ensure that the targets support net gains to biodiversity and ecosystem integrity.** One last but important consideration when identifying nature-based policy targets is that not all nature-related targets result in net gains to biodiversity and ecosystem integrity. Therefore, it is critical to eliminate nature-based policy targets that potentially suggest actions that might harm biodiversity and ecosystem integrity (e.g., forestry development in primary forests). It is a good practice to flag these cases when developing a report on the rapid policy analysis.

**5. Perform a visual scan of the documents to ensure that no critical elements were missed.** This step could help you find important nature-based policy targets that were not identified during the keyword search.

**6. Categorize each nature-based policy target into the Excel spreadsheet under its relevant theme.** The template rapid policy analysis spreadsheet includes tabs to separate targets into three themes:

- a. Human well-being** – These policy targets are related to nature’s services to people, such as disaster risk reduction, food security, water security, jobs, and livelihoods.
- b. Natural climate solutions** – These policy targets are related to nature-based solutions for climate change, such as mitigation or adaptation measures.
- c. Nature** – These policy targets are related to biodiversity conservation, such as species persistence and ecosystem intactness.

Place the nature-based policy targets that you have found within these tabs. Note that some targets may be relevant to multiple themes. For the purpose of this analysis, please choose the most relevant theme and add it to that tab.

If the number of nature-based policy targets is considerably large, it is recommended to create a tab that further breaks down the targets into additional themes, such as agriculture, carbon, disaster risk reduction, climate adaptation, forests, restoration, protected areas, water, urban greening, and land degradation neutrality. To create the categories, first, analyze the thematic content of the targets and identify categories that can cluster many targets together. Then add an extra tab in the rapid policy analysis template excel spreadsheet with the themes in the first row and each of the nature-based policies below in their respective categories.

Note that this tab with the targets sorted by granular theme can also be used during the policy hackathon (see section 5.2.b) to show participants all the nature-based policy targets related to specific themes.

**7. Document any policy documents that could not be included in the analysis.** Some policy documents may not have nature-based policy targets, serving more as a conceptual guide on what the country can or cannot do pertaining to certain topics. It is recommended to note these types of recommendations in the report.

**8. Create a report summarizing your findings.** A succinct summary of common themes or interesting elements of the analysis will be useful to guide conversation during the first stakeholder consultation. An example report from Uganda can be found in the endnotes.<sup>30</sup> The report should:

- **Include a list of the policy documents analyzed.** Note if any of the documents provided by the country were removed because they were solely conceptual and lacked nature-based targets.
- **Highlight closely related targets that appear in different policy documents.** Often, different policy documents include nature-based policy targets around the same theme (e.g., reducing deforestation), but the quantitative indicators vary across these policies (e.g., the percent decline in forestation). It is helpful to flag this.
- **Identify targets that are not aligned.** In some cases, nature-based policy targets are not fully aligned, and this should be noted. For example, a country may have one target for forest restoration in its biodiversity strategy, and another target in its climate adaptation plan.
- **Highlight the most ambitious targets.** These can be qualitative or quantitative targets. Keep in mind that some targets might express relevant aspirations but lack quantitative indicators. Qualitative targets can still guide the ELSA analysis.
- **Identify which nature-based solutions are most prominent in the documents.** This could include issues such as reforestation, sustainable management, agroecology, protection, or other nature-based solutions related to the keywords in Box 9. A simple count of the number of times



a keyword occurs across the policy documents can provide insight into the relative weight of certain issues.

– **Summarize any elements that stood out to you while completing the analysis.** Don’t forget to summarize any remaining reflections from the analysis, including observations on nature-based policy targets that could be harmful to biodiversity and gaps.

5.2.b Identification of the top 10 priority policy targets

The result of the rapid policy analysis is a list of nature-based targets pulled from key policy documents related to nature, climate, and sustainable development. From this list, the country must identify around 10 priority policy targets to be visually represented in the ELSA map.

Policy hackathon

During the first stakeholder consultation, the project team brings together diverse stakeholders to review the results of the rapid policy analysis and identify the priority policy targets that will be the foundation of the ELSA analysis. After reviewing all of the country’s mappable nature-based policy targets that were identified during the rapid

Note that some of the nature-based targets that you find may not be mappable. For example, a target on increasing gender balance in the field of biodiversity might not be mappable if: 1) there isn’t data on the topic, or 2) available data isn’t related to specific geographic locations (e.g., women who work in biodiversity per square mile). Typically, the ELSA science team will ensure that all of the nature-based targets found through the rapid policy analysis are mappable before moving on to the next step in the process.

policy analysis, stakeholders must select approximately 10 priority policy targets that together summarize the country’s priorities at the intersection of nature, climate, and sustainable development. While there are many ways to identify these priority policy targets, often the ELSA core team will first group the targets by themes, such as urban greening, water security, ecosystem conservation and restoration, invasive alien species, management of coastal ecosystems, and climate change mitigation. Then stakeholders will vote for the targets they would like to keep related to each theme, reducing the list until they have just 10 targets dispersed across the themes. Box 11 provides an example of this process, while Table 3 demonstrates possible results.

BOX 11 | Example of the process to vote for priority policy targets in South Africa

The image below demonstrates how stakeholders used Zoom’s whiteboard function to vote for priority policy targets related to the theme of water security. The board shows eight nature-based targets from the Medium Term Strategic Framework (MTSF) 2019-2024, the National Water Resource Strategy (NWRS), and the Strategic Plan of the Department of Forestry, Fisheries and the Environment (SPDFFE) 2019/20 to 2023/24. Through Zoom, stakeholders put green check marks next to national policy targets related to water security that they wished to use in the ELSA analysis and red exes next to ones that they wished to take out of consideration. Through this voting process and a subsequent discussion, stakeholders selected two priority policy targets from the list: “Maintain and rehabilitate water ecosystems”, found on the top left of the grid; and “Rehabilitate strategic water ecosystems to maintain water quality and quantity”, found on the bottom left.

Water security	
NWRS: Maintain and rehabilitate water ecosystems ✓✓✓✓✓✓✓✓✓✓ ✕	SPDFFE: By 2023/2024, 5 wetlands of international significance (Ramsar sites) designated ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕
NWRS: Maintain Fresh Water Ecosystem Priority Alerts (FEPAS) in good ecological state ✓✓✓✓✓✓✓ ✕ ✕ ✕ ✕	SPDFFE: By 2023/2024, 11 of 22 strategic water source areas secured ✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓ ✕
NWRS: Protect riparian and wetland buffers and groundwater recharge areas ✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	SPDFFE: By 2023/2024, the number of wetlands under rehabilitation is brought to 203 (919) ✓✓✓✓✓✓✓✓✓✓ ✕ ✕
NWRS: Rehabilitate strategic water ecosystems to maintain water quality and quantity ✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓✓	SPDFFE: 850 wetland under rehabilitation/restoration by 2024 ✓✓✓✓✓✓✓✓✓✓✓✓✓ ✕





I TABLE 3 |  
Priority policy targets selected in Haiti

The participants in Haiti’s first stakeholder consultation reviewed nature-based policy targets from 11 policy documents during their policy hackathon. However, the priority policy targets that they selected came from four documents: the National Adaptation Action Plan, NBSAP 2030, NDC, and the National Strategy of the National Protected Areas Agency of Haiti. The list below shows all of Haiti’s final priority policy targets, the documents that they come from, and the themes they relate to.

Number	Theme	Selected policy targets
1	Sustainable management	NBSAP 2030: By 2030, the country's coastal and marine zones are managed according to the principles and foundations of the ecosystem approach, managed according to a trajectory prioritizing blue growth in order to make them healthy ecosystems providing equitable services and benefits for the well-being of the Haitian population.
2	Sustainable management	NDC: By 2030, develop the 15 strategic watersheds most vulnerable to extreme climatic events according to the land use plan.
3	Protection	NBSAP 2030: By 2025, pressures on inland water ecosystems - including water towers, waterfalls, and other inland wetlands (lakes and ponds) - are significantly reduced.
4	Protection	NBSAP 2030: By 2025, rare, threatened, and vulnerable species benefit from a targeted intervention regime, focusing, where appropriate, on recovery, reproduction, and reintroduction.
5	Reforestation	National Adaptation Action Plan: Approximately 2,095,000 fruit and forestry seedlings are planted.
6	Control of invasive species	NBSAP 2030: By 2027, terrestrial alien invasive species are mostly reduced on the main satellite islands and in the country's terrestrial protected areas and the pathways and processes of invasion of aquatic alien invasive species are identified and controlled at the level of the mainland.
7	Biodiversity representation	National Strategy of the National Protected Areas Agency of Haiti: Ensure the representativeness of the diversity of Haitian biotopes in the network. Strengthen the protection of national parks and natural resources, the exceptional historical and cultural heritage, the protection and development of natural areas and landscapes of general interest.
8	Ecological corridors	National Strategy of the National Protected Areas Agency of Haiti: Develop, reassess, restore and/or maintain ecological corridors or relay points between protected areas in response to climate change, taking into account possible changes in species distribution and ecosystem condition.
9	Sustainable incomes	National Strategy of the National Protected Areas Agency of Haiti: Develop alternative sustainable income-generating economic sectors (agriculture [agroforestry: cocoa, castor oil, sisal], livestock, aquaculture, trade [handicrafts], cultural) in the buffer zones (areas of use rights).
10	Agricultural biodiversity	NBSAP 2030: By 2030, the consideration of agricultural biodiversity is systematically encouraged and strengthened to support the sustainable development of Haitian agriculture and better food security.

5.3 Step 2: Identify national and global spatial data to guide the analysis

Based on the outcomes of the policy hackathon, stakeholders and the ELSA core team work together to identify the best geospatial data that can: (1) spatially represent these targets on the ELSA map; and (2) constrain each nature-based action zone, delineating where each nature-based action (often protection, management, and restoration) can be implemented according to the land capacity and political zoning of the country.

Data hackathon

After stakeholders identify the 10 priority policy targets related to nature, climate, and sustainable development, they work together during a data hackathon to begin to locate the spatial data that can be used to represent each target (Table 4). For example, a target on expanding

protected areas could be represented by a combination of spatial data sets, including Key Biodiversity Areas, threatened species habitat, species richness, threatened ecosystems, and internationally important wetlands, among others. The stakeholders also discuss useful data that could be used to constrain the nature-based action zones, which delineate where each nature-based action (often protection, management, and restoration) could be implemented according to the land capacity and political zoning of the country. The ELSA core team then uses this information to begin collecting spatial data after the consultation. More information on the following steps in this process and the types of data to look for can be found in section 6.2.

I TABLE 4 |  
Data suggested during the data hackathon in South Africa

Number	Priority policy target	Policy document name	Theme	Suggested types of data
1	Maintain and rehabilitate water ecosystems	National Water Resource Strategy	Water security	Condition data available from National Freshwater Ecosystem Priority Areas
				Working for Wetlands data for each Province for wetland rehabilitation
2	Rehabilitate strategic water ecosystems to maintain water quality and quantity	National Water Resource Strategy	Water security	Data available from census data and ecosystem-based adaptation analysis
				Strategic Water Source Area data prioritization (South African National Biodiversity Institute natural capital accounting)
				Department of Water and Sanitation
3	By 2023/2024, 11 of 22 strategic water source areas secured	Strategic Plan of the Department of Forestry, Fisheries, and the Environment	Water security	Strategic Water Source Areas



Number	Priority policy target	Policy document name	Theme	Suggested types of data
4	By 2028, protect and conserve South Africa’s most vulnerable ecosystems, landscapes, and wildlife, and monitor and control the spread of alien invasives	National Climate Change Adaptation Strategy	Invasive alien species	National Biodiversity Assessment 2018 and International Union for Conservation of Nature threat assessments
				Threatened animal species layers for Department of Forestry, Fisheries, and Environment screening tool
				Derived layer from the inverse relationship of fragmentation
				Woody invasive layer from ecosystem-based adaptation
5	15.7 percent increase in conservation estate by 2024	Medium Term Strategic Framework	Ecosystems conservation and restoration	Protected Areas and Conservation Areas Database
				Agricultural land proclamation
				National Protected Area Expansion Strategy
6	Increase in Rehabilitated land: 80 percent of degraded ecological infrastructure restored by 2024	Medium Term Strategic Framework	Ecosystems conservation and restoration	Agricultural Research Council Dongas layer
				Department of Agriculture, Land Reform and Rural Development’s updated wind and erosion layers and hard-compaction layers
7	Land Degradation Neutrality is achieved by 2030 as compared to 2015 and an additional 5 percent of the national territory has improved (net gain)	Land Degradation Neutrality Targets	Ecosystems conservation and restoration	See above
8	Protecting and preserving existing carbon stocks in other ecosystems (those with high organic soil carbon, wetlands, and some grasslands)	Low Emission Development Strategy	Climate change mitigation	Soil organic carbon assessment

Number	Priority policy target	Policy document name	Theme	Suggested types of data
9	100 percent reduction of losses (human life; livestock/ crop yield; houses/ shelter; infrastructure; species) due to climate change disasters	Medium Term Strategic Framework	Climate change adaptation	Climate Changes Risk Atlas and Greenbook. Meteorological hazards
				Species refugia with changing climate from Spatial Planning for Area Conservation in Response to Climate Change
10	Have an average annual increase of 10 percent to the GDP while creating 100,000 new jobs in the wildlife sectors	Medium Term Strategic Framework	Biodiversity economy	Range data on spatial location and data used for modeling

5.3.a Data specifications

The goal of the data hackathon is to gather suggestions on spatial data that seem relevant to the priority policy targets and nature-based actions (usually protecting, managing, and restoring nature). It should also provide information on the official national boundary and national network of protected areas. When suggesting data, national experts should keep the scale, source, and format of the spatial data in mind, as only certain types of spatial data can be used in the analysis.

The scale of the data

For national-level ELSA analyses, spatial data should only be at the national scale, meaning it should include data on the whole country. Data that is already aggregated into subnational administrative units is less useful. If the ELSA analysis only focuses on one region of the country, then the data should at least fully cover the targeted region, with the rest of the requirements staying the same.

The source of the data

Both national and global sourced datasets can be considered for the analysis. At the initial stage of data collection, national data will be prioritized as they generally have finer resolution and are more closely aligned more with the national content. Globally sourced

datasets can only be used as a proxy or supplement when national data is not available.

The format of the data

Data should be collected in either vector format (Esri shapefiles, GeoPackage, GeoJSON, etc.) or raster format (.tif).

Spatial data that is collected should be explicitly related to one of the following areas:

- Natural values, including biodiversity, carbon, and land cover;
- Human well-being resulting from the maintenance of natural systems, e.g., ecosystem services such as clean water and pollination; and
- Demographic and population data, such as areas of greater poverty or dependence on natural systems, e.g., food stress.

Data on physical infrastructure (e.g., roadways and electrical infrastructure) is generally less useful for the purposes of the ELSA methodology.



5.4 Step 3: Define protection, management, and restoration in the national context

After the policy and data hackathons, the ELSA core team consults relevant stakeholders to set parameters for the protection, sustainable management, and restoration of land within the ELSA analysis. These are the nature-based actions that could be taken to achieve the 10 national priority policy targets around nature, climate,

and sustainable development. Participants must define what these nature-based actions mean in the country and determine the maximum percentage of land area that should be assigned to each nature-based action in the ELSA analysis.

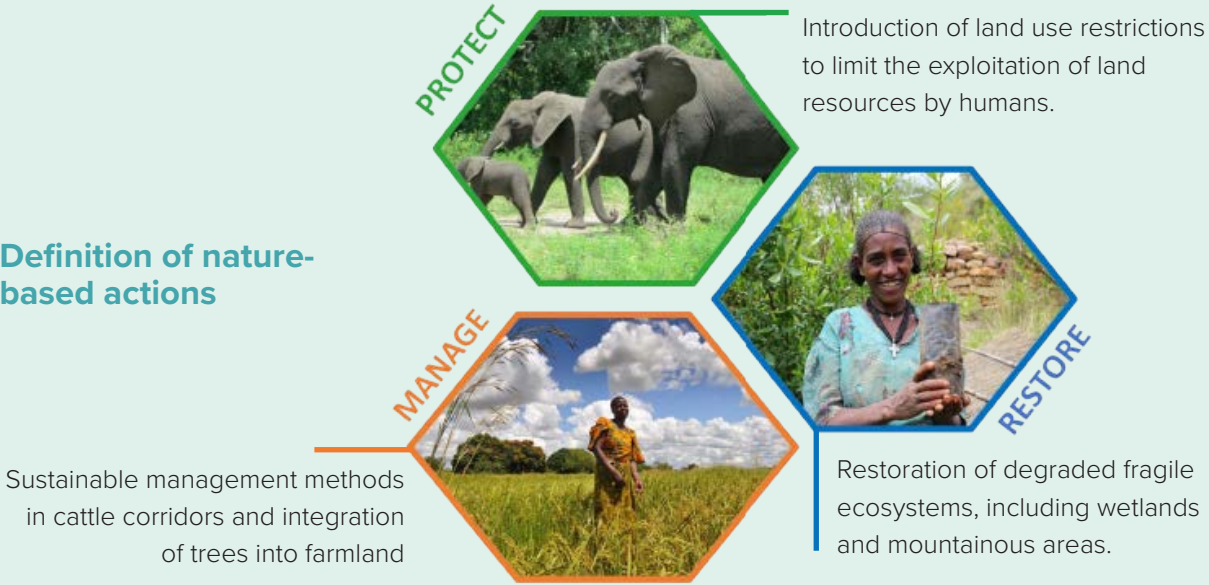
5.4.a Define what these nature-based actions typically mean in the country

ELSA maps typically delineate areas that are suitable for three broad nature-based actions: protect, manage, and restore. The typical definitions for these actions used for this analysis can be found in Box 12. However, protection, management, and restoration hold different meanings in different countries. For example, in Uganda, protection includes land-use restrictions that limit the exploitation of

land resources by humans. In Haiti, protection still allows for low-impact agroforestry. Therefore, the ELSA core team must consult with relevant national stakeholders to define what protection, restoration, and management mean in their national context, and where these actions can be implemented in the country.

Note that countries are not restricted to using just these three types of actions in their ELSA maps. Countries can use their ELSA analysis to also identify areas for other types of nature-based actions. Boxes 13 and 14 summarize the unique nature-based actions that South Africa and Costa Rica decided to use in their analysis.

62 | BOX 12 | Typical definitions for nature-based actions and how they are used<sup>31</sup>



The definitions of nature-based actions in the country will be used to determine the nature-based action zones where each action could take place in the country. These zones are created based on “rules”, or constraints, that help the algorithm to identify viable locations for each action. The ELSA analysis optimizes across these zones, along with the planning features, lock-in constraints, and additional parameters, to identify ELSAs

63 | BOX 13 | South Africa’s nature-based actions and their definitions

- Protect**
- This should take place in areas that are, or should be, formally protected by law and managed mainly for biodiversity conservation. A management authority and a management plan focused on maintaining or improving the state of biodiversity and ecological functions must be in place, supporting the benefits and opportunities people derive from nature. This will entail restrictions on certain land uses.
- Avoid loss**
- This should take place in areas where the loss of natural or semi-natural ecosystems, and their associated species, must be avoided in order to retain priority biodiversity assets and ecological infrastructure.
- Restore**
- The passive or active restoration of ecosystems, where the loss of natural ecosystem functioning (damage to an ecosystem) must be reversed. This may require an improvement in the structure of the habitat and an increase or decrease of vegetative cover as ecologically appropriate. Areas where ecosystems must be rehabilitated (at least) to the degree to which they function sufficiently well to deliver ecosystem services. This may involve:
- The removal of biomass, for example from invasive plant species;
  - Structural/engineering intervention in aquatic (freshwater/wetland) ecosystems;
  - For degraded wetland ecosystems, active structural/engineering interventions may be required; and
  - Change in land use from intensive/commercial land uses to lower impact land uses.
- Reduce pressures**
- This should occur in areas where the cumulative or historic loss of natural ecosystems must be mitigated. In addition, this action should occur where the intensity of the use of natural resources must be reduced and managed for sustainable use, and unsustainable practices and/or degradation must be remedied.
- Urban adapt**
- This action occurs in areas where ecosystem-based adaptation should be undertaken in urban environments, or the ecological infrastructure in adjacent or upstream areas on which they rely, to reduce vulnerability to disasters associated with climate change, including wildfires, flooding, and drought.



| BOX 14 |

**Costa Rica’s nature-based actions and their definitions**

**Protect**

Protection is the introduction of land use restrictions equivalent to those in protected areas. It should support natural ecosystem processes and limit the exploitation of natural resources by humans. It will not occur in urban or agricultural areas.

**Manage**

This action refers to the sustainable management of agricultural areas, especially livestock management, and the integration of trees in cultivated lands. These practices should increase the content of organic material in the soil, reduce erosion, diminish the waste of resources from agricultural production, including fertilizers and pesticides, and increase the structure of the habitat.

**Restore**

This action refers to the active or passive restoration of fragile or degraded ecosystems.

**Urban greening**

This action refers to ecological restoration and reforestation in urban areas that increase carbon sequestration, reduce urban heating, and/or provide protection from extreme weather phenomena.

**5.4.b Identify percentage of land that will be identified for protection, management, and restoration in the ELSA analysis**

The next set of elements to define are area-based targets. These are the maximum land area, expressed as the percentage of total country land area, that can be

allocated to each nature-based action zone in the ELSA map. During the first stakeholder consultation, national experts should propose area-based targets based on

existing relevant policies (Box 15). Later in the problem formulation stage of the ELSA process (see section 6.2.c), the ELSA science team reviews the suggested

area-based targets and selects targets that they consider to be the most appropriate. These targets are then confirmed in the second consultation (see section 6.4).

| BOX 15 |

**Area-based targets in Cambodia**

**Protect**

Proposed area-based target: 40.9 percent. This is based on two policy targets: “Percentage of important sites for terrestrial and freshwater biodiversity that are covered by protected areas and fisheries conservation: 2030: 70 percent” from the Cambodia SDGs Framework 2016-2030; and “Flooded Forest and Mangrove Forest Areas Protected (thousand hectares/year) 2019: 75 / 2020: 122 / 2021: 135 / 2022: 300 / 2023: 370” from the Agriculture Sector Strategic Development Plan 2019 – 2023.

**Manage**

Proposed area-based target: 3 percent. This is based on two policy targets: “Forest areas and ecosystems sustainably utilized: 2030: 190 hectares” from the Cambodia SDGs Framework 2016-2030; and “By 2020, the majority of areas under agriculture, animal production, aquaculture, and forestry are managed sustainably” from the NBSAP 2016.

**Restore**

Proposed area-based target: 3.13 percent. This is based on the two policy targets: “Forest area as a percentage of total land area: 2030: 50 percent” from the Cambodia SDGs Framework 2016-2030; and “Maintain the forest cover to more than 60 percent of the country land area” from the Rectangular Strategy for Growth, Employment, Equity, and Efficiency: Building the Foundation Toward Realizing the Cambodia Vision 2050, Phase Four.





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28 Government of Chile, Superintendency of Sanitary Services (2020). National Strategic Plan for Disaster Risk Reduction in the Sanitation Sector 2020 - 2030. [https://www.siss.gob.cl/586/articles-9353\\_Plan\\_Estrategico.pdf](https://www.siss.gob.cl/586/articles-9353_Plan_Estrategico.pdf)

29 Policy analysis template spreadsheet. <https://www.dropbox.com/s/6zf9nshzaz26rxj/ELSA%20-%20Policy%20Analysis%20Template.xlsx?dl=0>

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Chapter 6

Co-creating an ELSA map

6.1 Introduction

After designing the national Essential Life Support Area (ELSA) vision, the ELSA core team, ELSA science team, and stakeholders can turn to the most exciting part of the project: co-creating the ELSA map. This chapter first explores the data collection, selection, and processing steps needed to develop a data stack and the ELSA

webtool. Then, the chapter outlines how stakeholders provide their expert feedback to develop an ELSA map that locates where protection, management, and restoration can support the achievement of national priority policy targets.

6.2 Step 4: Design customized scientific ELSA analysis based on national vision and data

After the first consultation with national stakeholders, the Essential Life Support Areas (ELSA) core team will work closely together to design the ELSA analysis, prepare the data, and develop the online webtool which can be

used to co-create the ELSA map. Figure 6 provides an overview of the workflow from spatial data collection to the co-creation of an ELSA map.

6.2.a Collection of national data

Using the outputs from the data hackathon, the ELSA core team starts to collect spatial data that can best represent the 10 priority policy targets. The collection process takes one to three months (explore Table 5), including the following steps:

1. The ELSA core team finalizes the list of national data that they would like to request access to from focal institutions, including data layers identified through the data hackathon and the literature review.
2. The spatial data specialist contacts focal institutions to ask for permission (where needed) to access and use data.
3. The spatial data specialist receives and organizes data and transfers it to the ELSA science team to be processed.

As part of the data collection process, the ELSA core team conducts a literature review to identify additional data to supplementthatwhichwasidentifiedbynationalstakeholders during the data hackathon. This step involves finding relevant publications (from scholarly and non-scholarly sources, such as technical reports from government and non-government institutions) that contain national maps that could serve as inputs into the ELSA analysis. The literature may include studies that created a map of priority areas, for instance, for biodiversity conservation, climate change adaptation and/or mitigation, water security, and disaster risk reduction, among other topics.

If the country has an abundance of available data, an additional step may be needed to determine which data to request from the focal institutions. In this case, the team can conduct consultations with a core group of national experts to curate the best layers to use, with a consideration of the data accuracy, resolution, completeness, and consistency (Table 9 and Box 16).

I TABLE 5 I

Example of data collection in South Africa

In the project in South Africa, the ELSA core team decided to take a more comprehensive approach to data collection. Over two months, the project team held weekly meetings that focused on identifying the best data around the country's 10 priority policy targets. The core project team invited national experts related to the subject matter of each of the 10 targets to these meetings and gathered their suggestions on the spatial datasets that could best represent each of the 10 priority policy targets. In some cases, the recommended datasets could be used “as is”, in other cases they were filtered or combined in order to better represent the specific policy target. In a few cases, experts recommended creating novel datasets through spatial modeling or analysis (e.g., opportunities for expansion of the wildlife economy, and under-protected species habitat richness). Through this process, the national experts compiled 60 data layers for use in the ELSA analysis, which were used to create 21 composite layers for in the final ELSA data stack.

#	General theme	Policy Doc Name	Selected 'Top 10' Priority Targets	Date	Notes re Action
1	Human - DRR, Food, Water, Jobs	National Water Resource Strategy	Maintain and rehabilitate water ecosystems	15 July	Maintain & rehabilitate
2	Human - DRR, Food, Water, Jobs	National Water Resource Strategy	Rehabilitate strategic water ecosystems to maintain water quality and quantity	15 July	Rehabilitate
3	Human - DRR, Food, Water, Jobs	Strategic Plan of DFFE	By 2023/2024, 11 of 22 strategic water source areas secured	15 July	Secure (implies Protect and avoid loss)
6	Nature - Species & Ecosystems	Medium Term Strategic Framework	Increase in Rehabilitated land: 80% of degraded ecological infrastructure restored by 2024	15 July	Rehabilitate
4	Natural Climate Solutions	National Climate Change Adaptation Strategy	By 2028, protect and conserve South Africa's most vulnerable ecosystems, landscapes and wildlife, and monitor and control the spread of alien invasives	26 Aug	Protect, Monitor & Control
5	Nature - Species & Ecosystems	MTSF & DFFE Strategic Plan	Increase in conservation estate by 2024 to 15.7% (from 13.2%)	12 Aug	Protect E.g., could be limited to CBAs & KBAs
7	Nature - Species & Ecosystems	Land Degradation Neutrality Targets	LDN is achieved by 2030 as compared to 2015 and an additional 5% of the national territory has improved (net gain)	09 Sept	Implies rehabilitation & avoidance (of degradation)
8	Natural Climate Solutions	Low Emission Development Strategy	Protecting and preserving existing carbon stocks in other ecosystems (those with high organic soil carbon, wetlands and some grasslands)	02 Sept	Protect & preserve
9	Natural Climate Solutions	Medium Term Strategic Framework	100% reduction of losses (human life; livestock/ crop yield; houses/ shelter; infrastructure; species) due to climate change disasters	19 Aug	Implies avoidance (of loss)
10	Human - DRR, Food, Water, Jobs	Medium Term Strategic Framework	Have an average annual increase of 10 percent to the GDP while creating 100 000 new jobs in the wildlife sectors.	29 July	Create new jobs; expand commercial activity; implies land use expansion

6.2.b Select and process data received from the national team

Once the ELSA science team receives the collected data, they conduct an initial round of data screening, processing, and selection. This first round focuses on the technical quality of the data layers, including their accuracy, resolution, completeness, consistency, and currentness (Box 16), in addition to their scale and general relevance to the ELSA analysis. Spatial data layers that meet these criteria are processed into a unified format, following two steps (plus one optional step):

1. Define planning area and planning units;
2. Transform and adjust input data into planning units; and
3. Produce derived or composite layers as needed (optional).

For more technical details on each of these steps, explore Box 17.

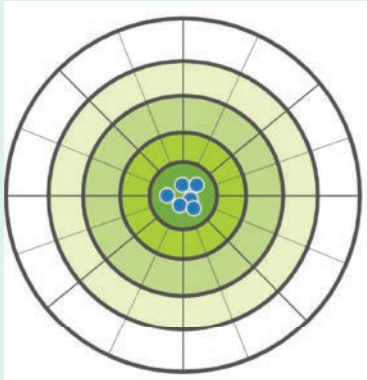


| BOX 16 |

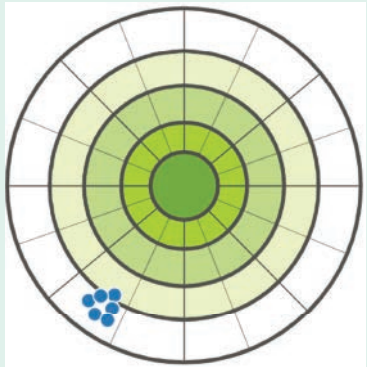
Considerations for data quality

Spatial optimization tools will generate an output, regardless of the quality of the data inputs. Therefore, it is important to understand and evaluate the quality and limitations of input data. Spatial datasets should be evaluated based on five metrics: accuracy, resolution, completeness, consistency, and currentness. In the project, the ELSA science team works closely with national experts to understand the limitations of available data based on these four metrics.

**Accuracy:** Accuracy is how closely the spatial data reflects reality over time and space. For example, a dataset is accurate if the forest on the map exists in the same location in the field. Understanding the accuracy of a particular dataset will therefore allow you to understand how reliable it is for the ELSA process.<sup>1</sup>



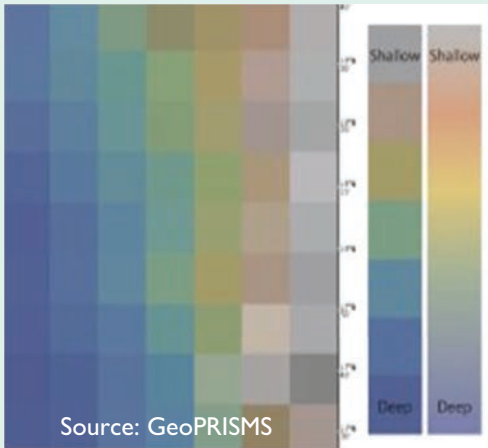
High accuracy



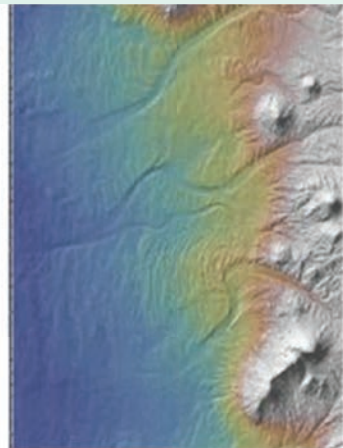
Low accuracy

**Resolution:** Resolution refers to the amount of detail that can be discerned from the dataset. In general, practitioners need to compile data from different sources, meaning that data will come in a range of spatial resolutions. A higher resolution is always preferred to ensure that the final map provides as much information as possible. During the data processing phase, the ELSA science team will adjust the spatial datasets to be in a common scale in preparation for the analysis.<sup>2</sup>

Coarse resolution

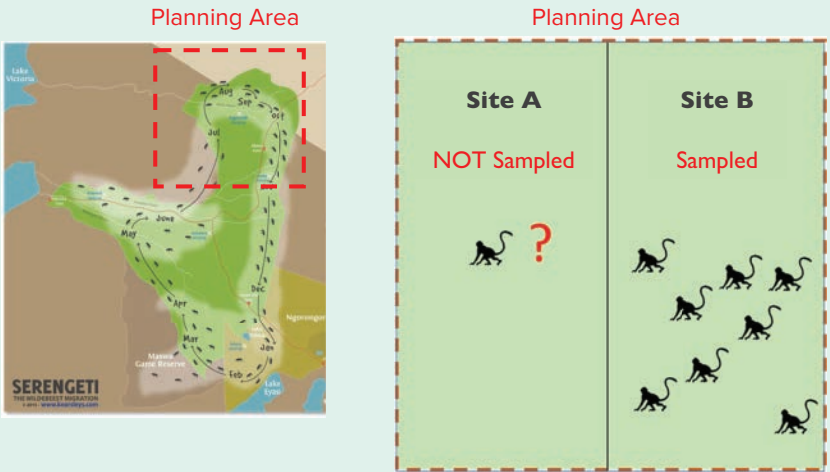


Fine resolution



Source: GeoPRISMS

**Completeness:** Completeness is typically defined in terms of errors of omission. The ELSA science team works with the ELSA core team to ensure that the data used to represent a particular feature is consistent across the study region. For example, a layer depicting national forest cover would be incomplete if it only includes forest cover in one province. When datasets are inconsistent, unintended biases may be introduced. The team also needs to account for sampling methods, which can introduce different degrees of completeness in a dataset. This is important because spatial optimization tools do not differentiate between a site that was not sampled and the absence of a planning feature.<sup>3</sup>



**Consistency:** Consistency refers to conformity with certain topological rules. For example, non-closed polygons are considered geometric errors, and therefore all polygons must be closed. Errors in spatial attributes can also make a dataset inconsistent. For example, if an entity has the value “Colombia” for the attribute “country”, but the value “New York City” for the attribute “city”, it would be considered inconsistent since New York is not within Colombia.<sup>4</sup>

**Currentness:** Currentness refers to the degree to which a data layer is up to date. This measure might not be critical to all spatial analyses, but is relevant for the ELSA analysis as the ELSA map should reflect the current state of a country’s ecosystems. Note that some non-current data can still be considered for the analysis. Examples include data that predicts future changes in agriculture suitability under climate change or data on the historical distribution of forests to indicate suitable areas for reforestation.



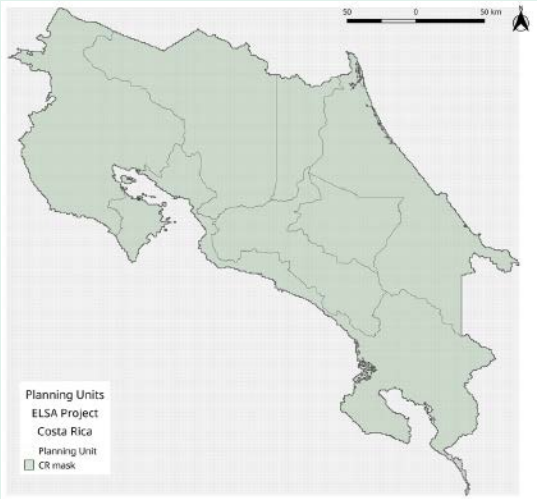
Data processing methods

1. Define planning area and planning units

In data processing for spatial optimization, the first step is to define the planning area. The ELSA analysis is usually designed at the national scale, so the planning area tends to be the country.

Next, the planning area is divided into a set of discrete areas, called planning units, that can be independently managed, calculated, selected, and/or manipulated. In a typical spatial optimization analysis, the size of the planning units is determined according to the scale of the conservation actions, and the data resolution.<sup>56</sup> In the ELSA process, the optimization speed of the software used is also considered in order to generate results within the span of three to five minutes to support live stakeholder consultations. Based on this need for a quick optimization time, the ideal number of planning units is approximately 800,000, which balances the optimization speed of the software and the map resolution. The ELSA science team uses this number as a reference for determining the size of the planning units, while also considering the envisioned project application within the country.

Once the planning area and planning unit size have been defined, a geospatial data layer needs to be created as the base map of the planning units. The planning unit layer is a raster produced using the official national terrestrial boundary layer provided by the country, with the defined planning unit size and equal-area projection (typically a Mollweide projection customized for each country). Sometimes, in order to improve the coverage of important mangrove ecosystems and other coastal features, the planning units also extend to include one or two pixels outside the national terrestrial boundary.



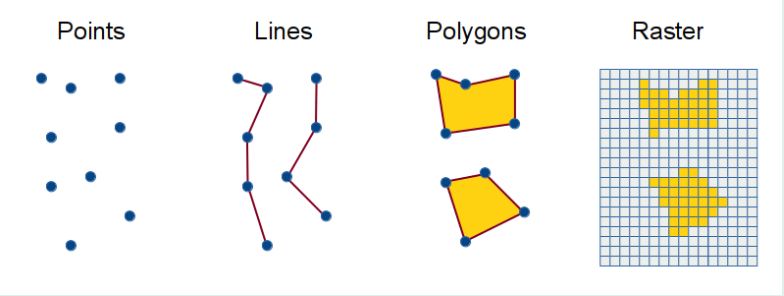
An example of planning units of Costa Rica.

2. Transform and adjust input data into planning units

All input data used in the ELSA analysis must have the same spatial properties as the planning units, including the coordinate reference system, map projection, layer extent (min X, min Y, max X, max Y), and resolution (cell size). After the planning unit layer has been created, the second step is to transform and adjust all the input data to have the same spatial properties.

There are two types of geospatial input layers:

- Vector layers: data comprised of vertices and paths, including points, lines, and polygons (among these, only polygons can be used in the ELSA process); and
- Raster layers: data made of pixels, usually regularly spaced and square, where each pixel has its own value or class.



Types of data<sup>7</sup>

The ELSA science team generates two main scripts to process vector and raster files. An explanation of these two types of processes can be found below. Please note that each layer is different and might require additional steps.

2.a Transforming vector layers into the planning unit

Vector layers used in the ELSA process are often composed of simple non-overlapping multi-polygons. Vector layers have a better resolution than planning units, so in order to transform vector layers into planning units, the ELSA science team calculates where the polygons within the vector layer intersect with a planning unit and to what degree they cover it (also referred to as coverage). Vector layers can contain a single value for a given attribute (just showing its presence or absence), multiple categorical values for a given attribute, or multiple continuous values for a given attribute. Each of these must be processed differently.

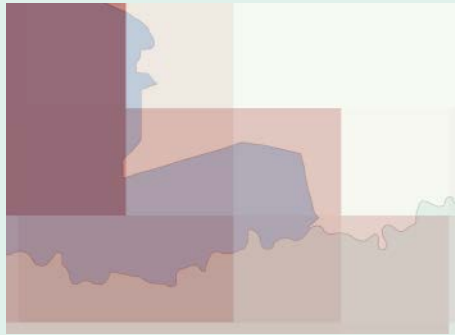
- *Single value (presence/absence):* An example of a single value layer is a map of mangrove extent that shows where mangroves are present and where they are absent. To convert this to a planning unit, the ELSA science team calculates the coverage of the original polygon within the planning unit. The planning unit values range from zero to one, visualized by increasingly intense shades of blue, where one means the original polygon fully covered the planning unit and zero means there were no polygons in the planning unit.<sup>8</sup>



Example of a mangrove vector layer (the red layer in the background, showing the presence/absence of mangroves) converted to planning units (squares with darker shades representing a higher percentage of mangroves within a given planning unit).

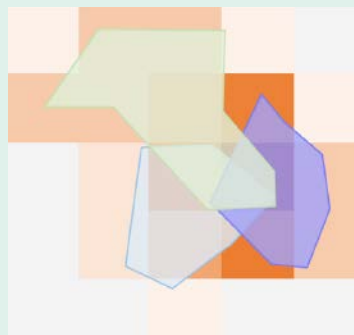


- **Categorical:** An example of a vector dataset with categorical attributes is drought risk, measured as low, medium or high risk. When converting this type of vector data to a planning unit, each different attribute value must be considered. In the case of drought risk, polygons that are identified as high risk in the original vector will be assigned a numeric value of one, medium assigned a numeric value of .5, and low assigned a numeric value of zero. The value of the converted raster is the numeric value multiplied by the coverage of the original polygon, and then rescaled to a range of zero to one. In this way, the processed layer maintains two dimensions of information (value gradient and coverage fraction) from the original vector.



Example of drought risk vector data layer with multiple categorical attribute values (blue, with darker shades representing higher values) converted to planning units (red, with darker shades representing higher value and coverage).

- **Continuous:** An example of a vector dataset with continuous attributes is the species richness index, which shows the number of species within a polygon on a scale of zero to X (integer). To convert this type of vector layer to planning units, the science team will keep this value gradient, multiply it by the coverage of the original polygon, and then rescale it to a range of zero to one.

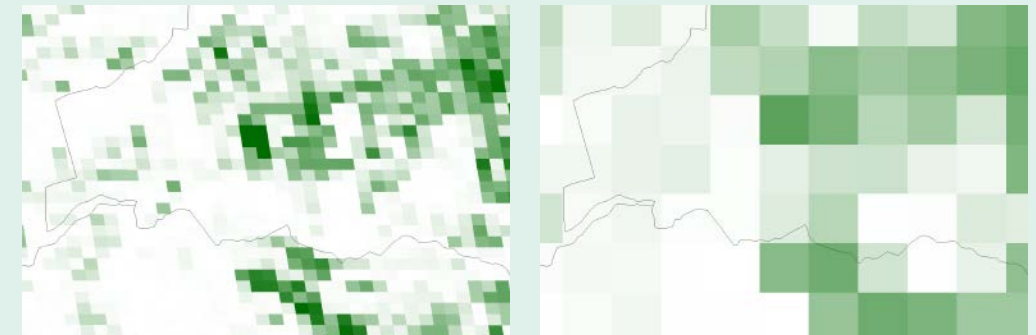


Example of multiple species habitat range data (light green, blue, and purple polygons), converted to a species richness layer (dark orange to light gray, with dark orange representing higher species richness).

## 2.b Transforming raster layers into planning unit

Most raster data used in the ELSA analysis require only spatial adjustments. These include: (1) reprojecting layers to the same projection as the planning units (typically a Mollweide projection customized for each country); (2) resampling the cell size and clipping layer extent to the same as the planning units; and (3) rescaling the original value to a unified value range of zero to one.

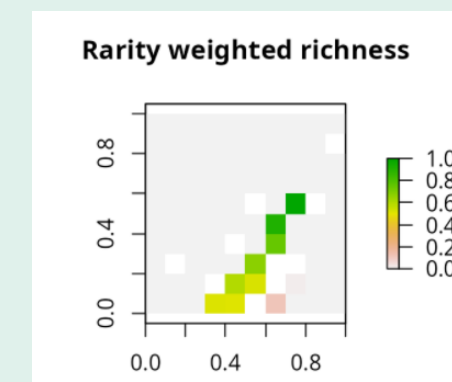
In some cases, the ELSA science team will process the layer to reverse the value gradient of the original raster in accordance with the policy targets. For example, in layers indicating areas suitable for taking urban greening actions, the ELSA science team used a reversed value of the normalized difference vegetation index to highlight areas lacking green vegetation.



Example of raster layer processing (left: original raster; right: processed layer with the same projection and resolution as the planning units, with the value rescaled to a zero to one scale).<sup>9</sup>

## 3. Produce derived or composite layers as needed

In addition to the original data collected by countries, in many cases, the science team also creates composite layers generated or calculated from the original layers to better speak to the priority policy targets. For example, the science team often combines multiple species distribution range layers into one species richness layer that helps to map the relative importance of areas that contribute to species diversity. In some cases, species rarity richness will also be used to highlight endemic and range-restricted species in the country. The resulting composite layer is then rescaled to a value range from zero to one.



Example of the rescaled raster layer on species rarity weighted richness. Planning units colored in red to green represent species rarity weighted richness from low to high. Green planning units have the highest rarity richness, meaning that those units contain a high number of species with restricted habitat range / likely endemic species.<sup>10</sup>

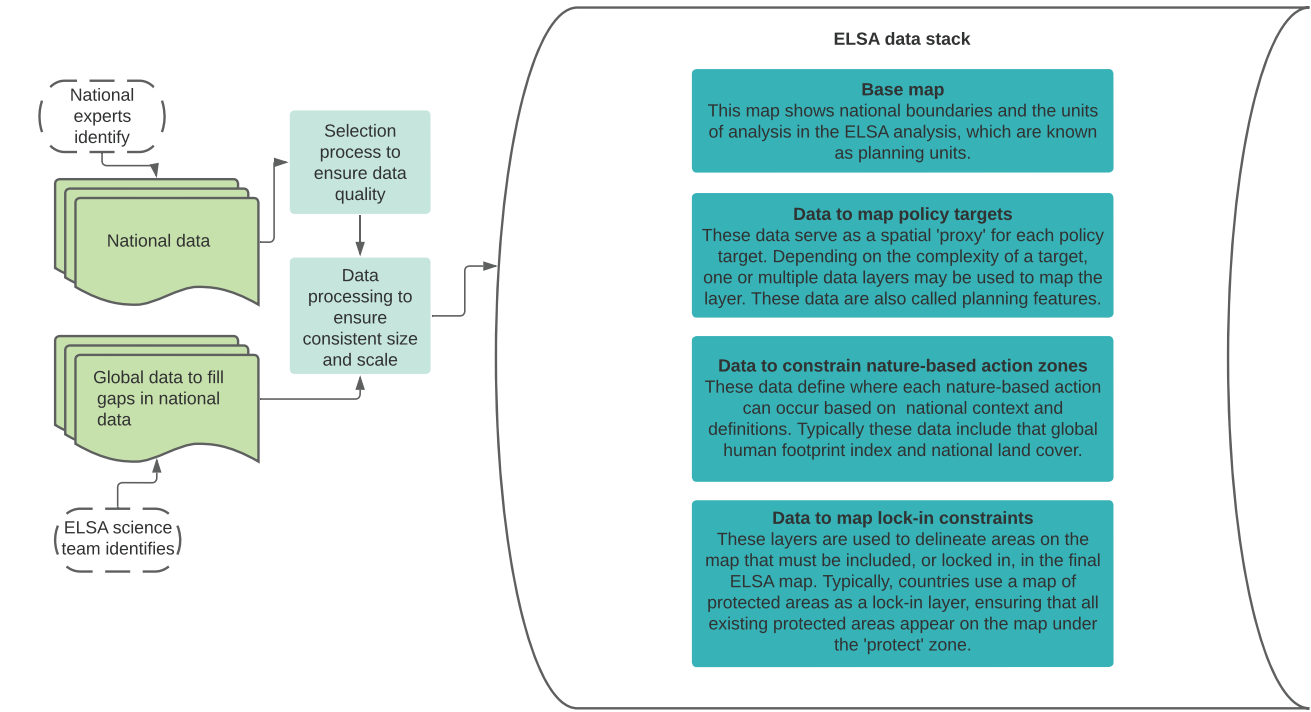


Data stack

The second round of data screening, processing, and selection is conducted by the ELSA science team to create what is called the ELSA data stack (Figure 7). This round focuses on identifying how the preprocessed

layers can best be used to: (1) serve as a proxy for the 10 priority policy targets, (2) constrain the zones where each nature-based action can take place, and (3) create lock-in constraints for areas that must be included in the final map. Each ELSA data stack is unique based on the national context, data, and priorities.

FIGURE 7 | Overview of the workflow in building the ELSA data stack



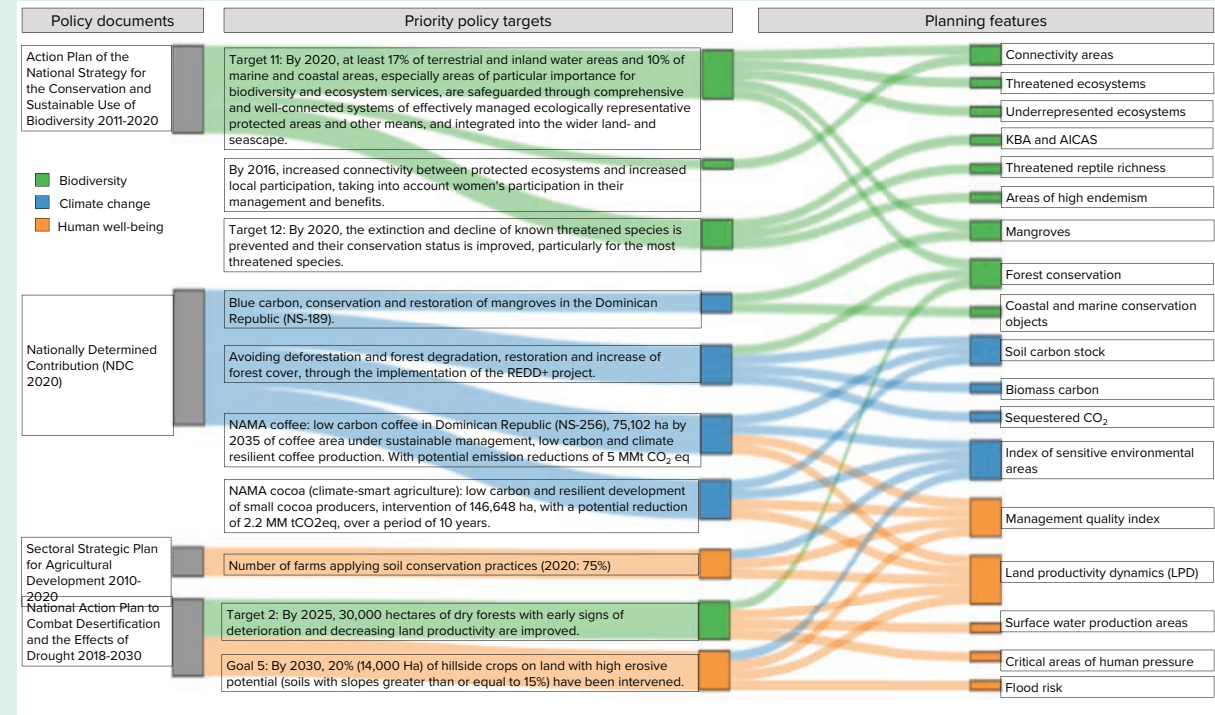
Layers in the data stack include:

1. The base map for the ELSA analysis. The base map defines the planning area and the smallest planning units in the ELSA analysis. For national scale projects, the official national terrestrial boundary is used as the range of the planning area. The planning area is divided into planning units, which are smaller geographic parcels of regular or irregular shapes, including squares, hexagons, cadastral parcels, and hydrological units.
2. Data to map priority policy targets. The ELSA science team evaluates each of the policy targets to determine which spatial datasets can be used as their 'proxy'. These spatial proxy datasets are known as planning features. A dataset might correspond to one

or multiple planning targets (Box 18). For example, a policy target for biodiversity might be mapped using planning features such as ecosystem connectivity and integrity, threatened species distribution, species richness, and Key Biodiversity Areas. In addition to using existing layers 'as is', the ELSA science team might recommend two approaches to create data layers that better reflect each of the ten priority policy targets: (1) extracting specific attributes or categories of a given dataset; (2) creating composite layers that bring together several different layers. Each planning feature is also classified based on whether the target it represents is most relevant for biodiversity, climate change, or sustainable development. The analysis will ultimately seek to optimize outcomes across all planning features.

BOX 18 |

Data used to map the 10 priority targets for the Dominican Republic



This figure shows the complete list of planning features for the Dominican Republic and how each data layer is associated with each of the priority targets. As an example, see the uppermost target in the graphic which is taken from the Action Plan on the National Strategy for the Conservation and Sustainable Use of Biodiversity: “By 2020, at least 17 percent of terrestrial and inland water surfaces and 10 percent of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem services, are safeguarded through comprehensive and well-connected systems of ecologically representative, effectively managed protected areas and other means, and integrated into the wider land- and seascapes.” To map this target, the science team used five different data layers:

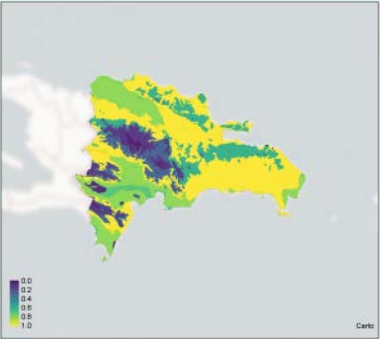
- **Mangroves:** a single national data layer of mangrove distribution in the year 2012. Mangroves are considered to be very important for biodiversity and ecosystem services, and therefore it made sense to include this layer when representing the target.<sup>11</sup>



Regions in yellow contain mangroves, according to this national dataset.

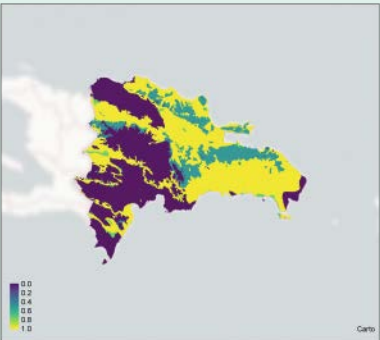


■ **Threatened ecosystems:** a composite layer derived from a national ecosystem layer<sup>12</sup> and global human footprint index layer.<sup>13</sup> For each ecosystem, areas are designated as intact where human footprint is less than or equal to 13 (45 percent of the country’s terrestrial land). The threat status of an area is determined by the proportion of the area not intact in an ecosystem.



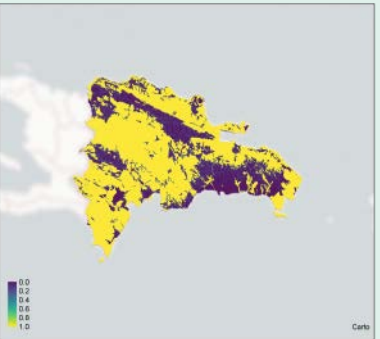
*In this map, regions in yellow have a high ecosystem threat status and regions in purple have a low ecosystem threat status.*

■ **Underrepresented ecosystems:** a composite layer derived from the national ecosystem layer<sup>14</sup> and the national protected areas layer.<sup>15</sup> If the coverage of protected areas within a certain ecosystem is under 30 percent, this ecosystem is considered underrepresented in this layer. The value assigned to a given planning unit is the percentage of unprotected areas within the underrepresented ecosystems.



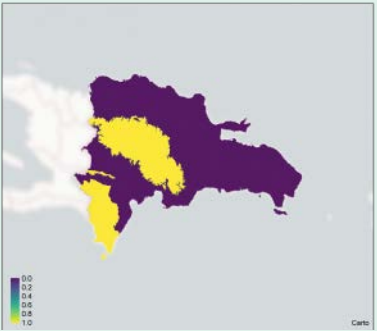
*Ecosystems in yellow areas have low protected area coverage while ecosystems in purple have high protected area coverage.*

■ **Forest conservation:** a layer of areas under protection extracted from the original national layer of forest use purpose,<sup>16</sup> which includes areas under protection and production.



*Areas in yellow represent forests classified for protection.*

■ **Connectivity areas:** a single layer of nationally defined connectivity areas.<sup>17</sup>



*Areas in yellow are considered important for ecosystem connectivity.*

This example shows how the ELSA science team uses available individual layers, specific attributes of a given dataset, and composite data layers to create a data stack that specifically reflects each of the priority targets selected by a country.

3. Data to constrain nature-based action zones. Nature-based action zones determine where each nature-based action can be implemented according to the land capacity and political zoning of the country. These zones are created based on rules, or constraints, that help the algorithm identify viable locations for each action. For example, zoning con-

straints might tell the algorithm that protection can only take place in areas where ecosystem quality is high, human pressure is low, and government zoning allows the allocation of protected areas. Table 6 provides an example for the nature-based action zones and how data can help to spatially constrain them to certain areas.





TABLE 6 |  
Data used to map zones for the Dominican Republic

Action	National definition of nature-based action	Area-based target	Origin of target	Spatial definition of each nature-based action zone	Spatial constraints for zone
Protection	Effective area-based conservation measures, such as private protected areas and co-managed areas. These areas may allow some forms of human use (e.g., tourism, harvesting of trees, and non-timber forest products).	30 percent of the national territory.	Action Plan 2011-2020 of the National Strategy for the Conservation and Sustainable Use of Biodiversity: by 2020, at least 17 percent of terrestrial and inland water surfaces and 10 percent of marine and coastal areas. Currently, the Dominican Republic's protected area coverage has already exceeded this target. Considering that the Dominican Republic is one of the member countries of the High Ambition Coalition, a new target of 30 percent was used for terrestrial and inland water surfaces.	This zone includes protected areas and areas with a low human footprint index value to identify areas that maintain intact natural ecosystems and wildlife habitats.	<ul style="list-style-type: none"><li>■ In protected areas (all)</li><li>■ Human footprint less than 16</li></ul>
Management	Sustainable management techniques used in agricultural areas, including crops and pastures, that increase soil organic matter, reduce erosion, reduce agricultural inputs, including fertilizers and pesticides, and increase habitat structure (shrubs or trees).	4.87 percent of the national territory.	Area-based objectives related to 3 existing policies were combined: <ul style="list-style-type: none"><li>■ Coffee Nationally Appropriate Mitigation Actions: low carbon coffee in the Dominican Republic. By 2035, 75,102 hectares of coffee area are under sustainable management, low carbon, and climate resilient coffee production.</li><li>■ Cacao Nationally Appropriate Mitigation Actions (climate-smart agriculture): Development of low carbon and resilient small cocoa producers in 146,648 hectares.</li><li>■ NDC: By 2030, 20 percent (14,000 hectares) of hillside crops have been intervened on land with high erosion potential (soils with slopes greater than or equal to 15 percent).</li></ul> The total number of hectares specified in these documents is equivalent to 4.87 percent of the national territory.	This zone includes areas of agriculture and grazing, and areas with a low or medium-high human footprint index value.	<ul style="list-style-type: none"><li>■ Agriculture and pasture greater than 0.3 and human footprint less than 19.</li></ul>

Action	National definition of nature-based action	Area-based target	Origin of target	Spatial definition of each nature-based action zone	Spatial constraints for zone
Restoration	Passive or active restoration of forest cover. Increases habitat structure and vegetation biomass, especially in currently degraded areas.	3.2 percent of the national territory.	Target 1 of the National Action Plan to Combat Desertification and the Effects of Drought 2018-2030: By 2030, the country's forest cover has increased by 8.5 percent. According to the latest forest cover map, made to be published in the 2021 national forest inventory, the forest area as of 2019 was 37.65 percent.	The restoration zone is created within the forest life zone, but excludes existing forests, urban areas, and areas with a high human footprint. Areas within the restoration zone are suitable for reforestation.	<ul style="list-style-type: none"><li>■ Forest life zone greater than 0</li><li>■ No current forest</li><li>■ No urban areas</li><li>■ No human footprint greater than 19</li></ul>

4. Data to map lock-in constraints: Lock-in constraints ensure that specific areas are always assigned to a specific nature-based action within the ELSA map. Typically, lock-ins are used to make sure that a country's existing protected areas are included within the 'protect' zone in the final ELSA map. Some countries also request other areas be locked in, such as areas where restoration is currently occurring.

Because lock-ins force the optimization process to include these areas, it can reduce the overall representation of planning features in the final map. The ELSA science team, therefore, recommends that lock-ins are used only where required to reflect current conservation actions within a country, ensuring that national stakeholders can effectively use the resulting map (Box 19).



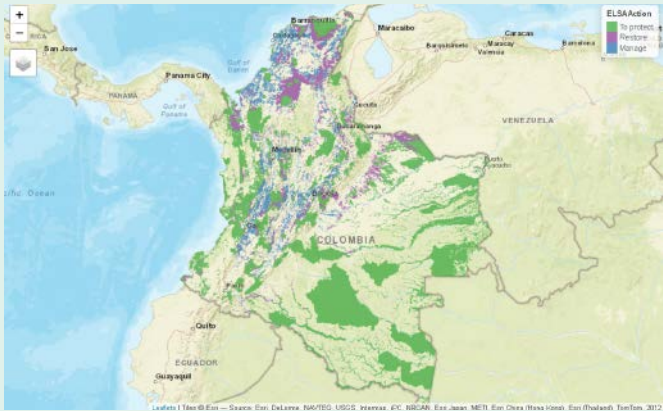


Lock-in constraints

In SCP, spatial constraints can be added to ensure that all solutions exhibit a specific property.<sup>18</sup> For example, constraints can be used to delineate areas that must be included in the final map (lock-in constraints) or they can be used to exclude certain areas from the final map (lock-out constraints).

There are multiple types of constraints available in SCP. In ELSA, the most frequently used constraints are lock-in constraints and zoning constraints that delineate where nature-based actions are ‘feasible’. The ELSA science team uses lock-in constraints to ensure that certain planning units are selected in the solution. For example, it may be desirable to lock in planning units that are inside existing protected areas so that the final map includes all existing protected areas and fills in the gaps in the existing reserve network. Areas that are locked in will be fully included in the map. The ELSA team uses zoning constraints to exclude areas of the country where data indicates that an action is simply not feasible, such as establishing a protected area across a major city.

Colombia’s ELSA map with and without protected areas locked in (shown on the UNBL webtool)



a. ELSA map with protected areas locked in



b. ELSA map without protected areas locked in

| TABLE 7 |

Data used in the Dominican Republic’s ELSA map

Feature layers

Layer name	Descriptions	Data source
Mangroves	Mangrove distribution in Dominican Republic	Dominican Republic, Ministry of Environment and Natural Resources (2012). Mangroves. Atlas of biodiversity and natural resources of the Dominican Republic. Santo Domingo. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>
Threatened ecosystems	Derived layer: ecosystems are considered intact when the Human Footprint is less than or equal to 13 (45 percent of land area). The threat status is the proportion of area that is not intact.	Organization of American States (1967). Holdridge life zones map. “Project for the Recognition and Evaluation of the Natural Resources of the Dominican Republic”. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>  Williams, B.A., and others (2020). Change in Terrestrial Human Footprint Drives Continued Loss of Intact Ecosystems. One Earth 3, 371–382. <a href="https://doi.org/10.1016/j.oneear.2020.08.009">https://doi.org/10.1016/j.oneear.2020.08.009</a>
Underrepresented ecosystems	Derived layer: ecosystems with a protection coverage of less than 30 percent	Organization of American States (1967). Holdridge life zones map. Project for the Recognition and Evaluation of the Natural Resources of the Dominican Republic. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>  Dominican Republic, Ministry of Environment and Natural Resources (2012). National System of Protected Areas. Atlas of biodiversity and natural resources of the Dominican Republic. Santo Domingo. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>
Forest conservation	Extracted from a national layer classifying forests according to their purpose (protection, conservation, production)	Vice Ministry of Forest Resources, Forest Monitoring area and Environmental Information and Natural Resources Direction (2020). Classification of forests according to purpose (not published).
Coastal and marine conservation objects	National coastal and marine conservation objects as defined in the Sixth National Report	MARENA (2018). Conservation targets. Sixth National Report for the Convention on Biological Diversity - Latin America and the Caribbean. Dominican Republic. Project 00106014



Layer name	Descriptions	Data source
Connectivity areas	Nationally-defined connectivity areas	MARENA (2018). Important areas for connectivity. Sixth National Report for the Convention on Biological Diversity - Latin America and the Caribbean. Dominican Republic. Project 00106014.
Important areas for bird conservation and Key Biodiversity Areas	Composite layer: combined important areas for bird conservation and key biodiversity areas	Grupo Jaragua (2010). Important Bird Conservation Areas. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>  Grupo Jaragua: Anadón-Irizarry, V., and others (2017). KBA Source of Vulnerability Criteria: Sites for priority biodiversity conservation in the Caribbean Islands Biodiversity Hotspot. Journal of Threatened Taxa, vol. 4, No. 8. <a href="https://www.threatenedtaxa.org/index.php/JoTT/article/view/786/1406">https://www.threatenedtaxa.org/index.php/JoTT/article/view/786/1406</a>
Threatened reptile richness	Species richness of endemic and threatened native reptiles	Dominican Republic, Ministry of Environment and Natural Resources (2012). Threatened endemic and native reptiles. Atlas of biodiversity and natural resources of the Dominican Republic. Santo Domingo. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>
High endemism areas	Areas with high endemism	Dominican Republic, Ministry of Environment and Natural Resources (2012). High endemism zones. Atlas of biodiversity and natural resources of the Dominican Republic. Santo Domingo. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>
Total biomass carbon	Composite layer of global data	Spawn, S.A., Sullivan, C.C., Lark, T.J., et al. (2020). Harmonized global maps of above and belowground biomass carbon density in the year 2010. Sci Data 7(112). <a href="https://doi.org/10.1038/s41597-020-0444-4">https://doi.org/10.1038/s41597-020-0444-4</a>
Carbon dioxide sequestered	Carbon dioxide sequestered (average and sum) if deforestation stops, at the basin level.	DIARENA (2018). CO2 sequestered if deforestation in forests is stopped, at the watershed level. Sixth National Report to the Convention on Biological Diversity. Dominican Republic.
Soil carbon stock	National soil carbon stock data	Poggio, L., de Sousa, L. M., Batjes, N. H., Heuvelink, G. B. M., Kempen, B., Ribeiro, E., and Rossiter, D. (2021). SoilGrids 2.0: producing soil information for the globe with quantified spatial uncertainty, SOIL. 7, 217–240.

Layer name	Descriptions	Data source
Environmental sensitive areas index	Environmental sensitive areas index map	M. Izzo, N. Araujo, P. P. C. Aucelli, A. Maratea, A. Sánchez (2013). Map of environmentally sensitive areas. Land sensitivity to desertification in the Dominican Republic: an adaptation of the ESA Methodology. <a href="https://onlinelibrary-wiley-com.ezproxy.library.uwa.edu.au/doi/full/10.1002/ldr.2241">https://onlinelibrary-wiley-com.ezproxy.library.uwa.edu.au/doi/full/10.1002/ldr.2241</a>
Land Productivity Dynamics	Value from 0-1: declining productivity, early signs of deterioration, stable but stressed, stable not stressed, increasing productivity (highlighted)	UNCCD (2017). Land Productivity Dynamics. Land Degradation Neutrality Target Setting Programme. National Consultant’s Report. <a href="https://knowledge.unccd.int/sites/default/files/Idn_targets/Dominican%20Republic%20LDN%20TSP%20Country%20Report.pdf">https://knowledge.unccd.int/sites/default/files/Idn_targets/Dominican%20Republic%20LDN%20TSP%20Country%20Report.pdf</a>
Management quality index	Management quality index map	M. Izzo, N. Araujo, P. P. C. Aucelli, A. Maratea, A. Sánchez (2013). Management quality index. Land sensitivity to desertification in the Dominican Republic: an adaptation of the ESA Methodology. <a href="https://onlinelibrary-wiley-com.ezproxy.library.uwa.edu.au/doi/full/10.1002/ldr.2241">https://onlinelibrary-wiley-com.ezproxy.library.uwa.edu.au/doi/full/10.1002/ldr.2241</a>
Flood risk	Flood risk map	DIARENA (2021). Flood map (unpublished).
Surface water producing areas	Surface water producing areas	DIARENA (2012). Surface water producing areas. Atlas of biodiversity and natural resources of the Dominican Republic. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>
Critical areas of human pressure	Critical areas of human pressure according to population and percentage of poor households, defined by the Sixth National Report (pressures and threats on biodiversity and forests)	MARENA (2018). Human pressure hotspots. Sixth National Report for the Convention on Biological Diversity - Latin America and the Caribbean. Dominican Republic. Project 00106014.
<b>Lock-in constraints</b>		
Protected areas	National system of protected areas	DIARENA (2012). National System of Protected Areas. Atlas of biodiversity and natural resources of the Dominican Republic. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>
<b>Layers used to create zones restrictions</b>		
Holdridge life zones forest	Nationally-defined Holdridge life zones	OEA (1967). Holdridge life zones map. “ Project for the Recognition and Evaluation of the Natural Resources of the Dominican Republic. <a href="http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf">http://ambiente.gob.do/wp-content/uploads/2016/10/ATLAS-2012.pdf</a>
Forests (2012)	Forest cover in Dominican Republic	DIARENA (2012). Land Use and Land Cover Map.



Layer name	Descriptions	Data source
Human footprint index (HFP)	Global terrestrial human footprint map 2013, human pressure scores ranging from 0 (no pressure) - 50 (very high pressure)	Williams, B.A., et al. (2020). Change in Terrestrial Human Footprint Drives Continued Loss of Intact Ecosystems. One Earth 3, 371–382. <a href="https://doi.org/10.1016/j.oneear.2020.08.009">https://doi.org/10.1016/j.oneear.2020.08.009</a>
Agriculture and pasture land	Agriculture and pasture	DIARENA (2012). Land Use and Land Cover Map.
<b>Zones</b>		
Manage	Agriculture greater than 0.3 and human footprint less than 19	DIARENA (2012). Land Use and Land Cover Map. Williams, B.A., et al. (2020). Change in Terrestrial Human Footprint Drives Continued Loss of Intact Ecosystems. One Earth 3, 371–382. <a href="https://doi.org/10.1016/j.oneear.2020.08.009">https://doi.org/10.1016/j.oneear.2020.08.009</a>
Restore	Areas where life zone forest is greater than 0, current forest (2012) is greater than 0.3, urban is not greater than 0, and human footprint is not greater than 19	OEA (1967). Holdridge life zones map. Project for the Recognition and Evaluation of the Natural Resources of the Dominican Republic. <a href="http://ambiente.gob.do/wp-content/uploads">http://ambiente.gob.do/wp-content/uploads</a> DIARENA (2020). Classification of forests according to purpose (unpublished). Williams, B.A., et al. (2020). Change in Terrestrial Human Footprint Drives Continued Loss of Intact Ecosystems. One Earth 3, 371–382. <a href="https://doi.org/10.1016/j.oneear.2020.08.009">https://doi.org/10.1016/j.oneear.2020.08.009</a>
Protect	Human footprint index less than 16.	Williams, B.A., et al. (2020). Change in Terrestrial Human Footprint Drives Continued Loss of Intact Ecosystems. One Earth 3, 371–382. <a href="https://doi.org/10.1016/j.oneear.2020.08.009">https://doi.org/10.1016/j.oneear.2020.08.009</a>

6.2.c Create the ELSA analysis based on national context and priorities

When the data stack is finalized (Table 7), the science team will design the other parameters needed to create ELSA analysis and integrate all data and parameters into the country’s ELSA webtool. In Systematic Conservation Planning (SCP), the design of an integrated spatial planning analysis is often called the ‘problem formulation’. This is because it creates a ‘problem’ for which the optimization then works to find an optimal ‘solution’. In the case of ELSA, the problem is how to achieve the best outcomes for the 10 priority policy targets when

allocating specific amounts (percentages) of the national territory to nature-based actions, including protection, management, restoration. The solution is the resulting ELSA map.

Some elements of the ELSA problem are directly set by the ELSA science team. The remainder of the elements are set by the national experts during the second round of stakeholder consultations (covered in section 6.3 below). This section introduces the basic design

principles of the ELSA problem formulation and structure of the ELSA problem, focusing on the parameters that are pre-set by the science team.

ELSA design criteria

To design a customized ELSA analysis for each country, the ELSA science team works from a central set of design criteria. These specify that the analysis must:

- Use the tools and concepts of SCP;
- Harness national expert opinion and stakeholder values;
- Create spatially explicit maps;
- Use national datasets where available and global datasets to fill in gaps;
- Directly support national policy targets for biodiversity, climate change, and sustainable development;
- Include actions to protect, manage, and restore ecosystems;
- Identify indicative ELSAs, not precise locations to deploy specific programs; and
- Be flexible, allowing exploration of how results change under different scenarios before producing final ELSA maps.

Maximum utility objective function

In SCP, there are various approaches that can be used to structure the analysis, known as ‘objectives’. The objective determines what input parameters are needed as part of the problem formulation, as well as how the problem is solved.

The ELSA analysis uses what is called a ‘maximum utility objective function’ to align with the ELSA design criteria (Box 20). In simple terms, this approach starts from a specific amount of land area available for each of the nature-based actions, referred to as the area-based targets. The maximum utility objective function identifies where each nature-based action should be taken, based on these area-based targets, the input data stack, and several additional parameters developed by the science team in partnership with national stakeholders. In addition to the data stack, the key elements of the maximum utility problem include:

- Area-based targets for each nature-based action;
- Impact scores of each action on each planning feature;
- Calibrated planning feature weights;
- The boundary penalty factor; and
- Lock-in constraints.

| BOX 20 |

Focus on the science: The maximum utility objective function

The ELSA analysis uses what is called in SCP a ‘maximum utility objective function’. This objective function maximizes the overall expected amount of the planning features represented by the zones, weighted by their relative importance and the impacts that each zone has on each feature.

The maximum utility objective function is used for two related reasons. The first is that most countries have clear area-based targets for nature-based actions (e.g., protect 30 percent of land). The second reason is there is a general lack of clear targets for planning features, which is needed to use the more typical ‘minimum set objective function’. While clear targets do exist for some biodiversity features, there is almost no basis to derive through policy or science clear targets for planning features related to human well-being used by ELSA (e.g., clean water provision and inclusion of Indigenous lands).



Area-based targets for each nature-based action

As explored in section 5.4.b, an area-based target is the maximum land area (expressed as a percentage of total country land area) that can be allocated to a nature-based action zone, such as protection, management, and restoration. During the ELSA process, countries must define their area-based targets related to each of the nature-based actions that they include in their map. If stakeholders determine that the ELSA map should allocate five percent of the land to sustainable agriculture, the analysis will produce a map that meets but does not exceed that percentage.

During the problem formulation stage of the process, the ELSA science team reviews the area-based targets suggested during the first consultation and selects the most appropriate for further review by national stakeholders.

Impact scores

Impact scores refer to numerical values that indicate the degree to which each nature-based action contributes to achieving the representation of each planning feature, and by proxy, the country’s priority policy target related to that planning feature. For instance, the nature-based action of sustainable management contributes strongly to achieving planning features related to agricultural production but would not contribute as strongly to planning features related to ecosystem integrity. Impact scores typically range from ‘0’ (does not contribute to maintaining a planning feature), ‘1’ (able to fully maintain a planning feature) to ‘1.5’ (an increase of 50 percent from the current condition).

After the ELSA science team determines the impact scores, they input them into the ELSA webtool so that the relationship between planning features and nature-based actions is taken into consideration in the analysis (Table 8).

TABLE 8 | Example of the impact score values for ELSA Costa Rica from the ELSA webtool

Data	Theme	Protect	Restore	Manage	Urban_greening
90th percentile precipitation history	Reduce Human Vulnerability to Climate Events	1.00	1.50	0.50	1.00
Extreme aridity	Reduce Human Vulnerability to Climate Events	1.00	1.50	0.50	1.50
Urban greening opportunities	Reduce Human Vulnerability to Climate Events	0.00	1.00	0.00	1.00
Opportunities to reduce the risk of marine flooding	Reduce Human Vulnerability to Climate Events	1.00	1.50	0.50	0.20
Potential soil erosion	Reduce Human Vulnerability to Climate Events	1.00	1.50	0.50	0.20
Biological corridors	Reduce Human Vulnerability to Climate Events	1.00	1.50	0.50	0.50
Carbon stocks (invest)	Promote the Adaptation of Ecosystems to Climate Change	1.00	1.50	0.75	0.75
Carbon in terrestrial soil	Promote the Adaptation of Ecosystems to Climate Change	1.00	1.50	0.50	0.00
Potential soil sequestration	Promote the Adaptation of Ecosystems to Climate Change	1.00	0.00	0.50	0.00
Forest structural integrity index	Promote the Adaptation of Ecosystems to Climate Change	0.00	0.00	1.00	0.00
Mangroves	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.00	0.00
Wetlands and Ramsar sites	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.00	0.00
Unprotected ecosystems	Ensuring Ecosystem Services for the Human Population	1.00	0.00	0.00	0.00
Threatened ecosystems	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.00	0.00
Threatened ecosystems	Ensuring Ecosystem Services for the Human Population	1.00	0.00	0.50	0.00
Suitability of protection	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.00	0.00
Key Biodiversity Areas	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.50	0.00
Restricted range species	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.50	0.00
Indigenous peoples and communities	Ensuring Ecosystem Services for the Human Population	1.00	1.00	1.00	1.00

Data	Theme	Protect	Restore	Manage	Urban_greening
Agricultural suitability	Ensuring Ecosystem Services for the Human Population	0.00	0.00	1.00	0.00
Abundance of pollinators	Ensuring Ecosystem Services for the Human Population	0.00	0.00	1.00	0.00
Poverty	Ensuring Ecosystem Services for the Human Population	0.50	0.50	1.00	1.00
Forest water yield	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.50	0.00
Potential supply of clean water	Ensuring Ecosystem Services for the Human Population	1.00	1.50	0.50	0.00
Opportunities to reduce water pollution	Ensuring Ecosystem Services for the Human Population	0.50	1.00	1.50	0.50

Calibrated planning feature weights

The ‘maximum utility objective function’ used in the ELSA problem formulation works to try to achieve the best outcomes possible for all planning features used to map the 10 priority targets for a country. In SCP, the degree to which each feature is captured in the resulting ELSA map is referred to as the ‘representation’ of a planning feature. The maximum utility approach means that it is possible for the majority of features to be well represented in the final map and some features to be represented poorly. This can happen if a given planning feature’s distribution is very different from the other planning features, it can lead to the planning feature not being well represented in the resulting ELSA map.

To minimize this uneven representation, the ELSA science team tunes the input parameters using a calibration analysis.<sup>19</sup> This calibration typically begins with establishing a maximum theoretical representation for each planning feature by running a scenario that only weights that feature. Next, the science team runs an ELSA optimization with all planning features given equal weights. This is then followed by a series of scenarios that increase the weights of poorly represented features, measured as the shortfall between representation in ELSA divided by theoretical maximum representation. This is done iteratively until the evenness of representation across features cannot be further improved.<sup>2021</sup> The resulting calibrated weights are added to the back end of the ELSA webtool, effectively normalizing the representation of all planning features when users select equal weights on the front end of the tool.

For the final creation of a ‘Map of Hope’, national stakeholders engage in a participatory weighting process to assess the comparative importance of each planning feature based on national priorities, explored in the next lesson.

Boundary penalty factor

The boundary penalty factor is used to promote spatial cohesion when identifying ELSAs. The boundary penalty can be zero or higher. A higher boundary penalty factor value results in larger and more contiguous ELSAs in the final map. These larger and more contiguous areas closely resemble typical protected area networks. This is because protected areas are often created with logistical and management considerations (costs) in mind; costs are often reduced when protected areas are implemented across a smaller number of larger areas. Furthermore, large, more contiguous areas can often safeguard important landscape connectivity and processes. However, increasing the boundary penalty factor can decrease the representation of each planning feature in the final map, leading to suboptimal outcomes for a country’s priority targets.

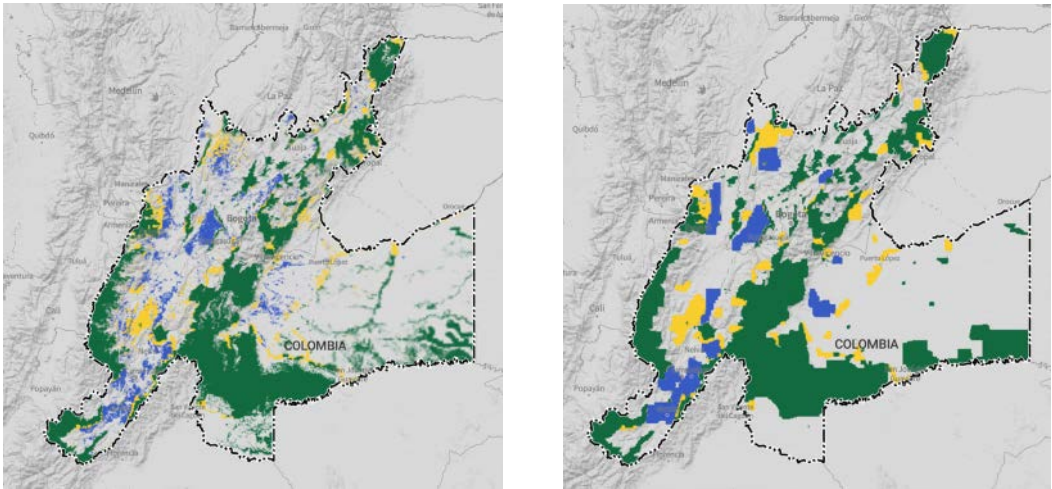
After the co-creation of the ELSA map, explored in the next lesson, the ELSA science team works to identify a boundary penalty factor that addresses these trade-offs. They also provide an ELSA map with a boundary penalty factor set to zero so that countries can select the option they prefer (Figure 8).



I FIGURE 8 I

Example of ELSA map with a boundary penalty factor of 0 (left) and 500 (right)

On this map, green represents areas for protection, blue represents areas for restoration, and yellow represents areas for sustainable management.



Lock-in constraints

Lock-ins constraints ensure that specific areas are always assigned to a specific nature-based action within the ELSA map. Typically, lock-in constraints are used to make sure that a country’s existing protected areas are included within the ‘protect’ zone in the final ELSA map. Some countries also request other areas be locked in, such as areas where restoration is currently occurring. Because lock-in constraints force the optimization process to include

these areas, it can reduce the overall representation of planning features in the final map. The ELSA science team therefore recommends that lock-in constraints are used only where required to ensure national stakeholders can effectively use the resulting map.

Based on requests received during the first stakeholder consultation (5.2.b), the ELSA science team creates the needed lock-in constraints as part of the ELSA problem formulation for a given country.

6.2.d Create the ELSA Webtool

The six elements discussed in the previous chapter, plus the ELSA data stack, together comprise the ELSA problem for a country. Once available, they can be used to create the customized ELSA webtool used to run and iterate the analysis. Developed by the ELSA science team within the R-shiny web interface, the webtool is an interactive online webpage that generates ELSA maps based on the country’s priority policy targets, supporting steps 5 (see section 6.3), 6 (see section 6.4), and 7 (see section 6.5) in the ELSA process. The webtool is easy to

use for people who are not spatial data experts, with no coding or modeling skills required.

The webtool runs optimizations quickly (typically in three to five minutes). It can therefore be used to generate and refine ELSA maps in real-time during stakeholder meetings, and contribute to a more transparent, inclusive, and defensible decision-making process. For details on the science and code behind the ELSA webtool, explore Box 21.





Focus on the science: The ELSA webtool

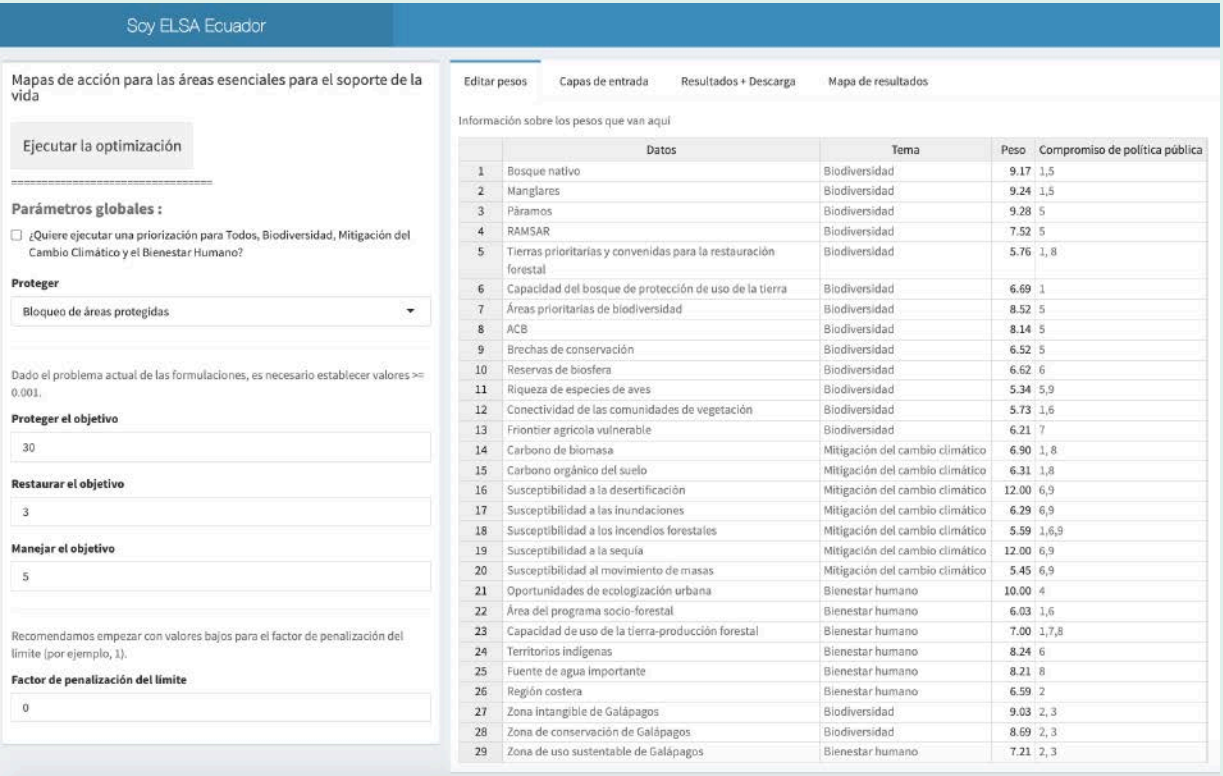
The ELSA analysis uses the prioritizr software package, in the R programming language, as a spatial optimization tool to run spatial optimization analyses.<sup>22</sup> The prioritizr package implements integer linear programming techniques to provide a flexible interface for building and solving conservation planning problems.<sup>23</sup> It supports a broad range of objectives, constraints, and penalties to create a tailored analysis.

There are also other decision support systems like Marxan and Zonation that can be used to run spatial optimization analyses. The ELSA project uses prioritizr because it can solve large problems (1 million cells) faster than other approaches, allowing real-time analysis with stakeholders, and guarantees that the optimal solution can be found, given the data and parameters entered. The table below compares prioritizr with Zonation and Marxan.

Remember, decision support systems are designed to help you make decisions—they can’t make decisions for you.

Comparison of different decision support tools for SCP

	Zonation	Marxan	prioritizr
Aim of the tool	Continuous ranking of the planning area’s conservation value	Target-based planning	
Algorithm	Priority ranking (maximal retention of weighted range-size normalized richness)	Simulated annealing	Integer linear programming
Support multi-zones?	No	Yes (Marxan with Zones)	Yes
Outputs	The priority rank map produced by iteratively removing the planning unit that leads to the smallest aggregate loss of conservation value	Develops solution maps, creating portfolios of planning units that minimize the cost of the solution while ensuring that all targets are met	Develops solution maps. In ELSA, it creates portfolios of planning units that cover as many features as possible within a given budget (the area-based targets)
Pros	Can be used even for very large datasets	The most frequently used conservation planning software	Higher quality solutions in less processing time. Support a broad range of objectives, constraints, and penalties.
Cons	Primarily operates on binary conservation planning problems	Simulated annealing provides no guarantee of solution quality. Can be relatively slow in solving large problems.	Not suitable for solving very large problems (>1 million planning units) that include nonlinear constraints.



ELSA Webtool for Ecuador

Stakeholders can use the ELSA webtool to:

- Choose to lock-in or lock-out protected areas;
- Change the percentage of land that can be allocated to each nature-based action zone (usually protect, restore, and manage);
- Edit weights of each planning feature;
- Edit the boundary penalty factor;
- Run the optimization; and
- View and download the ELSA map and summary results.

All of these parameters can be adjusted in real-time to enable a group of stakeholders to co-create an ELSA map.

Stakeholders cannot use the ELSA webtool to:

- Customize zoning constraints used to define where actions to protect, manage, and restore nature can occur in the country;
- Upload additional data layers for inclusion in the model as planning features or as zoning constraints; and
- Add additional lock-in constraints.

All of these parameters are hard-coded into the backend of the ELSA webtool by the science team based on input from the core project team. At this time, they cannot be modified by individual users. A comprehensive user guide for the ELSA webtool can be found in the annex.



6.3 Step 5: Set remaining ELSA analysis parameters in consultation with national stakeholders

Once the science team has created the ELSA analysis and ELSA webtool, national experts provide additional information to set the parameters to run the analysis. During a second stakeholder consultation that takes place during Step 5 of the ELSA process, national experts work with the science team to:

- Confirm data to map nature-based action zones;
- Confirm area-based targets;
- Select lock-in constraints; and
- Assign weights to the planning features.

Based on these inputs, national stakeholders work with the ELSA science team to create the ELSA map (6.4) and review, iterate, and validate the results (6.5).

Confirm data to map nature-based action zones

A critical part of the ELSA analysis is the data used to map the zones for each of the nature-based actions. The ELSA science team selects and integrates the data to map the maximum extent of each zone (6.2.b) based on the national definitions for each nature-based action (5.4.a). The second stakeholder consultation provides a critical forum for national experts to assess the accuracy of the resulting nature-based action zone maps and provide feedback before they are integrated into the analysis. At this point, stakeholders also have an additional chance to confirm that the area-based targets selected for each nature-based action in the first stakeholder consultation are still accurate. Based on the outcomes of this session, the ELSA science team makes the final revisions to the nature-based action zones before integrating them into the ELSA webtool.

Confirm area-based targets

The second stakeholder consultation also provides an opportunity for participants to confirm the percentage of land that they would like the ELSA webtool to assign for protection, management, and restoration. These area-based targets are then plugged into the ELSA webtool as a key input parameter for the analysis.

Select lock-in constraints

As explored in 6.2.c, lock-in constraints enable stakeholders to ensure that certain areas are included within a particular nature-based action zone in the final ELSA map. Countries most commonly include a lock-in for their existing protected areas, ensuring that official protected areas fall under the nature-based action of protection on their ELSA map. During the second stakeholder consultation, the ELSA science team works with national experts to explore if they would like to create versions of the ELSA map with protected areas locked in, protected areas unlocked, or both.

Stakeholders should choose to lock-in protected areas if they want to force the analysis to include existing protected areas within the ‘protect’ zone. In addition to showing existing protected areas, the resulting map will also show where new protected areas should be placed.

If stakeholders want the analysis to allocate areas for each nature-based action without considering the locations of existing protected areas, they should choose to leave protected areas unlocked. This means that the final map may not include all existing protected areas within the zone for protection. Depending on ecosystem degradation within existing protected areas, places may even be identified as suggested areas for restoration or management in the resulting ELSA map. Running the analysis in this way can also potentially provide independent evidence to support the placement of national protected areas.

Assign weights to planning features

As explored in 6.2.b, the ELSA data stack includes a number of planning features or spatial datasets to map the 10 priority policy targets. Weights provide a way to prioritize some planning features over others. For example, if a country assigns greater weight to carbon sequestration than food security, its ‘Map of Hope’ will reflect both, but will prioritize the areas most important for carbon sequestration over those for food security.

During the second stakeholder consultation, the ELSA science team asks national experts to consider two criteria to select a weight for each planning feature:

- The importance of the planning feature and the priority targets it maps compared to other planning features/priority targets; and
- Their confidence in the data.

To do this, national stakeholders assign a score between 0 and 5 (in the case of South Africa and Chile, between 0 and 10) based on the importance and confidence of the planning feature, where:

0 = Planning feature should be excluded from the analysis  
3 = Average importance  
5 = Highest importance

In South Africa and Chile, national stakeholders separated out confidence from importance, assigning two unique scores to each criterion. For the confidence score, the following rubric was used:

0 = No confidence  
0.5 = Uncertain or partial confidence  
1 = Reasonable confidence

It is impossible to assign a high confidence to the data because experts can never be completely confident in its quality.

Where both importance and confidence are scored, the ELSA science team then calculates the weight for each planning feature, where the total weight =  $\frac{\sum_{i=1}^N I_i * C_i}{N}$ , where **I** is the importance score, **C** is the confidence score, and **N** is the number of stakeholders participating in the exercise. In simple terms, the weight is the confidence score multiplied by the importance score averaged across all participating national stakeholders. This exercise provides the last critical input needed to run the ELSA analysis. Table 9 and 10 provide examples of what the final weights could look like.

TABLE 9 | Final average stakeholder weights for all planning features included in the Cambodia analysis separated by theme.

Outcome/Feature	Theme	Weight
Natural Forest	Biodiversity	4.58
Mangrove	Biodiversity	4.06
Intact ecosystems	Biodiversity	3.76
Threatened ecosystems	Biodiversity	4.17
Biodiversity corridors	Biodiversity	4.00
BPAMP priority areas - all taxa	Biodiversity	3.11
KBAs	Biodiversity	3.18
Community protection area	Biodiversity	3.06
Biomass Carbon	Climate Change	3.85
Vulnerability of deforestation	Climate Change	3.82
Areas with high potential emissions	Climate Change	4.47
Climate adaptive capacity 2012	Climate Change	3.50
Population Affected by Flood 2011	Climate Change	2.94
Upland watershed	Climate Change	3.71
Important areas for food security	Human Well-being	3.62
Community - fishery	Human Well-being	3.41
Fisheries dependence	Human Well-being	2.53
Community - forestry	Human Well-being	3.47
Watershed - agroforestry	Human Well-being	3.12
Main river and buffer	Human Well-being	3.24
Urban buffer	Human Well-being	3.35
Tourism Hotspot	Human Well-being	3.68



Above are the results of the weighting exercise in Cambodia. The weights show that participants highly value biodiversity and climate change features but put less importance on human well-being features in this exercise.

I TABLE 10 I

Final average stakeholder weights for all planning features included in the Kazakhstan analysis separated by theme

Outcome/Feature	Theme	Weight
Forest Cover	Biodiversity	3.80
Key Biodiversity Areas	Biodiversity	4.25
Rare Ecosystems	Biodiversity	4.40
Redbook Winged Insects	Biodiversity	2.80
Threatened Species Richness (Nature) Map	Biodiversity	4.20
Carbon Sequestration	Climate Change	2.50
Carbon (Biomass)	Climate Change	3.00
Carbon (Soil)	Climate Change	3.20
Wetlands	Human Well-being	3.20
Crop Suitability	Human Well-being	3.40
Future Crop Suitability	Human Well-being	3.00
Dust Storms	Human Well-being	3.00
Groundwater Reserves	Human Well-being	7.00
Potential Clean Water	Human Well-being	4.00
Realised Water Provision	Human Well-being	3.20
Soil Fertility	Human Well-being	4.20

During the weighting exercise in Kazakhstan, participants gave groundwater reserves an average score of 7. This is higher than the 1 to 5 scale weighing scale because it reflects how water security is especially important to the country.

With these weights, the webtool now has all of the information that is needed to run the ELSA analysis. Box 22 below shows the final elements in the problem, including: the data, which refers to the data stack; the objective, which in the case of the ELSA problem is the maximum utility objective function (see section 6.2.c); feature weights, which are assigned to each planning

feature; constraints such as lock-ins and area-based targets; penalties, which is the boundary length modifier in this analysis; the decision type, which is a binary decision where either a planning unit is selected or is not selected for a nature-based action; and the solver, which is Gurobi, a type of integer linear programming software. The solution to this problem is the ELSA map.



I BOX 22 I

Input elements of the ELSA analysis with prioritiz<sup>24</sup>

```
problem <- data +
            objective +
            feature weights +
            constraints +
            penalties +
            decision type +
            solver

solution <- solve (problem)
```

6.4 Step 6: Create ELSA maps to locate where protection, management, and restoration can support the achievement of national policy priorities

To identify areas that will best contribute to all priority policy targets, the ELSA webtool starts from national area-based targets for each nature-based action, and then runs an optimization to determine where these actions can produce the most impact across all planning features. The optimization run by the ELSA webtool operates based on four rules:

- It must not exceed the area-based targets for each nature-based action, meaning that the percentage of land allocated to each action cannot be higher than the limit that was previously determined based on national policies and stakeholder feedback (5.3.b);
- It may only consider areas where each action is feasible, or the ‘zones’ for each action (6.2.c; 6.3);
- If the lock-in constraint is selected, it must include these areas (usually protected areas) in the final analysis (6.2.c; 6.3); and
- Its final output must maximize benefits across all planning features used to map the priority policy targets based on the parameters specified (impact scores and weights, 6.2.c and 6.3).

The ELSA analysis generates two products: (1) heat maps that show areas of importance of each planning unit for biodiversity, climate change, human well-being, or all together in the country; and (2) an ELSA action map that shows the places in the country where action to protect,

manage, and restore nature will provide the greatest benefits in achieving their 10 priority policy targets.

Heat maps

The first ELSA products for the country are heat maps of ecological values across the country. Heat maps identify the distribution of ecological values that support the country’s priority targets. Heat maps are the result of the intersection of the planning features and their respective weights. The higher the value on a range from zero to one, the more features of high weight overlap. Heat maps can show overall areas of importance for biodiversity, climate change, or human well-being in the country, or all three values in a singular map (Figure 9).

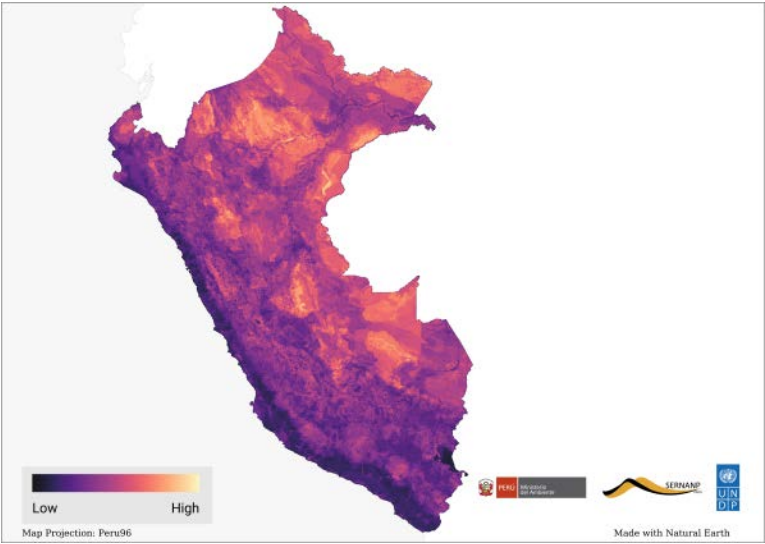
During the second stakeholder consultation, the ELSA science team reviews the ELSA heat map with national experts to determine if they are aligned with their expectations and personal knowledge of the region. If they are not, the science team works with national stakeholders to identify what input layers (or lack thereof) could be causing this disconnect, and to revise the data stack accordingly.

Heat maps offer a valuable opportunity to review and validate the ELSA input data as well as to visually demonstrate areas of importance in each country. However, these maps don’t yet indicate the best places to take action to contribute to the achievement of the ten priority policy targets.



| FIGURE 9 |

Example of an ELSA heat map for Peru. Darker areas are regions where many of the most important, or higher weighted, planning features overlap.



ELSA maps

The second ELSA product for countries is the ELSA map (also called a ‘Map of Hope’). Resulting from the ELSA analysis, the ELSA map shows areas that should be prioritized for protection, management, and restoration in order to most efficiently deliver across the ten priority policy targets associated with biodiversity, climate change, and human well-being.

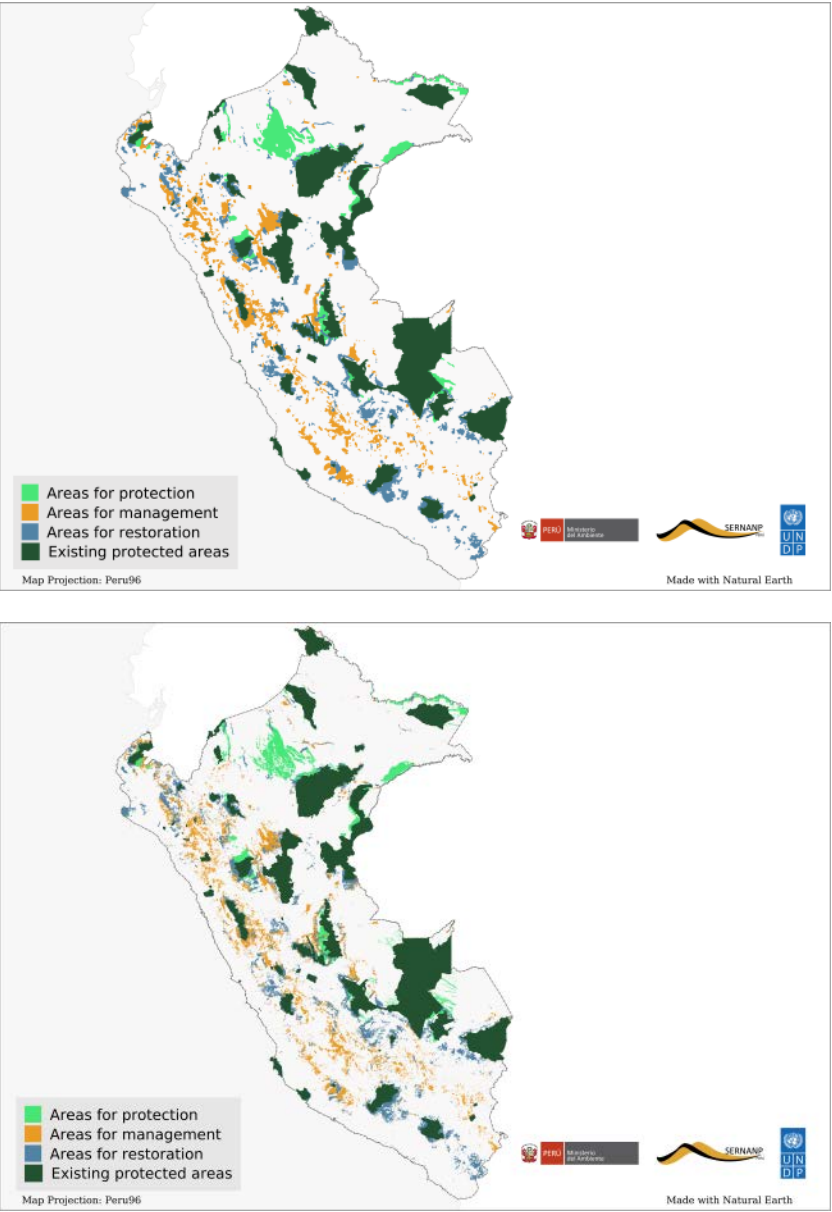
The ELSA map, developed and validated by stakeholders in the country, demonstrates where nature-based actions can achieve the greatest impact across all plan-

ning features. Two versions of the map are available: a filtered version and an unfiltered version. A filtered ELSA map is produced using a higher boundary penalty factor, which results in ELSAs that are both larger and more contiguous. An unfiltered ELSA map uses a smaller boundary penalty factor and therefore captures the most optimal outputs (at the pixel level) of the ELSA analysis, showing small areas where nature-based actions would produce optimal outcomes for the ten priority targets. Figure 10 demonstrates how these two maps can look different.



| FIGURE 10 |

Example of ELSA maps of Peru (filtered on the top and unfiltered on the bottom)



6.5 Step 7: Review and revise maps with national experts

Following the creation of the first iteration of a country’s ELSA map, in the second stakeholder consultation, the ELSA science team works with stakeholders to review the outputs and make changes based on trade-offs among planning features. This includes two elements, both of which are accomplished in the second stakeholder consultation:

- Discussion of synergies and trade-offs.
- Revision of weighting and iteration of the ELSA map.

After stakeholders are satisfied with the map, they share it with relevant parties and work to have it validated for use following the second stakeholder consultation.



6.5.a Discuss synergies and trade-offs

The goal of the ELSA analysis is to identify synergies across actions for biodiversity, climate change, and sustainable development. The optimization conducted by the ELSA webtool shows a country where strides could be made in achieving a wide range of goals by protecting, managing, and restoring nature. However, if a given planning feature’s distribution is very different from the other planning features, it can lead to that planning feature not being well represented in the resulting ELSA map.

The ELSA analysis measures the outcome for each planning feature with a representation score to show where planning for all three themes (biodiversity, climate change, and human well-being) creates trade-offs. Because each planning feature is associated with both its relevant policy target(s), and one of the three overall themes, stakeholders can assess the difference

in planning only for a particular theme compared to integrated planning across all three themes in the ELSA map. To do this, the algorithm will identify a trade-off score by calculating the degree to which each planning feature is represented in the overall ELSA map, compared to how well it is represented under the targeted planning scenario for its particular theme.

At this point in the ELSA process, the national stakeholders can review the results and determine if the ELSA map effectively capitalizes on synergies and minimizes trade-offs across planning features used to map priority policy targets. In cases where the ELSA map represents substantially less of a given feature than the more targeted scenario (typically identified as 80 percent or less), the ELSA science team works with national stakeholders to determine if they should increase the weight of a given planning feature.

6.5.b Revise weighting and iterate

With input from national stakeholders on which trade-offs are acceptable or not, the ELSA science team works to revise the weighting to increase the representation score of key planning features. This is often an iterative process to ensure that representation of these planning features improves, while the representation of other planning features does not decrease. See examples in Boxes 23 and 24. The result of this process is a second iteration of the ELSA map that can be shared for national validation with key stakeholders.

The ability to change weighting for each planning feature in the ELSA webtool enables an iterative approach to developing the ELSA map, where stakeholders can revise weighting to better deliver across all planning features and measure the results using the downloaded table. The weighting can also be revised over time as the relative importance of the ten priority targets shift in the country.

| BOX 23 |

Iterating the ELSA map in South Africa to reduce trade-offs

In the first iteration of the ELSA map of South Africa, five features were showing more than a 20 percent decline in representation in the ELSA scenario compared to their highest possible value. Through the trade-off exercise, participants voted to increase the weights for water ecosystems to maintain and invasive alien plant invasions in riparian areas, but not the other planning features (see voting sheet below). When the second iteration of the ELSA map was created based on the new weights, the new representation showed an improved coverage of aquatic ecosystems without compromising the representation of other feature layers.

Which planning features should have a higher weight?

Results	Yes	No
Wildlife sector current extent 66.2%, 4.94	✓✓✓✓✓	✗✗✗✗✗✗✗✗✗ ✗✗
High priority agriculture areas 73.5%, 7.1	✓✓✓✓✓	✗✗✗✗✗✗✗✗
Invasive alien plant invasions - landscape 74.1%, 4.17	✓✓✓	✗✗✗✗✗✗
Invasive alien plant invasions - riparian 77.3%, 4.92	✓✓✓✓✓✓✓✓	✗✗✗
Soil organic carbon 77.6%, 5.19	✓✓	✗✗✗✗✗
Water ecosystems to maintain 78.6%, 7.8	✓✓✓✓✓✓✓✓ ✓✓✓✓✓	✗✗





Iterating the ELSA map in the Dominican Republic to reduce trade-offs

During the second stakeholder consultation in the Dominican Republic, participants reviewed the trade-offs in the analysis. They found that the data layers on connectivity areas, flood risk areas, and sequestered carbon were all under-represented in the ELSA map due to the current weights. The participants felt that these layers needed more representation, and so they increased their weights through the ELSA webtool (see image below). The final weight for connectivity areas was 3.9, flood risk was 6.3, and sequestered carbon was 8.0. The new weights improved the coverage of these features in the ELSA map.

Soy ELSA Dominican Republic

Mapas de acción para las áreas esenciales para el soporte de la vida

Ejecutar la optimización

Parámetros globales :  
¿Quiere ejecutar una priorización para Todos, Biodiversidad, Mitigación del Cambio Climático y el Bienestar Humano?

Proteger  
Bloqueo de áreas protegidas

¿Cada vez que el problema actual de las formulaciones, es necesario establecer valores >= 0.001.

Proteger el objetivo  
30

Restaurar el objetivo  
3.20025

Mejorar el objetivo  
4.867676809

Editar pesosCapas de entradaResultados + DescargaMapa de resultados

Información sobre los pesos que van aquí

	Datos	Tema	Peso	Compromiso de política pública
1	Manglares	Biodiversidad	4.79	5,7
2	Ecosistemas teatizados	Biodiversidad	4.64	7,0
3	Ecosistemas subrepresentados	Biodiversidad	3.86	7,0
4	Conservación forestal	Biodiversidad	4.43	4,7,8
5	Objetos de conservación costeros y marinos	Biodiversidad	3.71	5,0
6	Áreas de conectividad	Biodiversidad	3.90	7,9
7	KBA y AICAS	Biodiversidad	3.64	6,0
8	Riqueza de reptiles amenazados	Biodiversidad	3.43	6,0
9	Áreas de alto endemismo	Biodiversidad	4.57	6,0
10	Carbono de biomasa	Mitigación del cambio climático	3.00	4,0
11	Co2 secuestrado	Mitigación del cambio climático	8.00	4,0
12	Stock de carbono del suelo	Mitigación del cambio climático	2.79	2,3,4
13	Índice de áreas ambientales sensibles	Mitigación del cambio climático	3.64	1,2,3,10
14	Dinámica de la productividad de la tierra (LPD)	Bienestar humano	4.36	1,2,3,8,10
15	Índice de calidad de la gestión	Bienestar humano	3.07	1,2,3,10
16	Riesgo de inundación	Bienestar humano	6.30	10,0
17	Zonas de producción de agua superficial	Bienestar humano	4.21	8,0
18	Áreas críticas de presión humana	Bienestar humano	4.14	8,0

6.5.c Validate ELSA map for national use

Once the final ELSA map is created during the second stakeholder consultation, it is important to give relevant decision makers an opportunity to review the results and validate the map for official use. This process starts with a validation meeting that brings together representatives from leading organizations and ministries to view the ELSA map and learn about the process leading up to its

creation. After the validation meeting, relevant ministries, the UNDP Country Office, and other groups may have internal discussions to either suggest final changes to the map or confirm its approval. Often, many of these organizations have been involved from the beginning of the ELSA process, which greatly facilitates national validation of the map.





Endnotes

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# Chapter 7

## Mainstreaming project results

### 7.1 Introduction

The increased coordination and capacity that arise through the process of co-creating the Essential Life Support Areas (ELSA) map are highly valuable, in and of themselves. And yet, no ELSA project is complete without

developing policy recommendations, communicating results, and mainstreaming these results into relevant policy. This chapter explains these critical steps and relevant support tools.

### 7.2 Step 8: Develop policy recommendations to implement discoveries

Essential Life Support Areas (ELSA) maps show areas that should be prioritized for protection, management, and restoration to most effectively deliver across the 10 priority policy targets associated with biodiversity, carbon sequestration, and human well-being. These

maps provide governments with insights that can be translated into policy actions for achieving the country’s 10 policy priorities, with the aim to achieve multiple co-benefits for climate mitigation and adaptation, nature, and sustainable development.

#### 7.2.a Review results and draft policy recommendations

To ensure that the ELSA map has the greatest impact, it is essential to develop tailored policy recommendations that inform how to act on the results of the ELSA analysis. This step of the ELSA process consists of: reviewing the ELSA map and taking note of insights and surprises; examining opportunities for integrating priority actions into national policies and plans; and meeting with decision makers during the national results-sharing meeting to disseminate and mainstream the results of the project.

##### Review the results and take note of surprises

First, stakeholders and the ELSA core team should critically review the results of the analysis. During this step, national stakeholders should take note of any surprises in the results or discrepancies between the ELSA map and current nature-related activities.

Examples of guiding questions for this step include:

- Are there areas that the map recommends for protection that are not currently under formal protection? If so, why are these areas not under protection? Are they not suitable for protection because of factors not included in the analysis, such as intersecting infrastructure (like railroads) or formal or informal land tenure by Indigenous people and local communities?
- Who/which groups will be most impacted and/or benefit the most by ELSA actions? If they haven’t been involved in the ELSA process yet, how could they be involved in decision-making?
- What are the top three most expected (or unexpected) outcomes of the map? Why?



- Are there areas that national policymakers are already considering for nature-based action that don’t fall under those categories in the ELSA map? Is this due to the limitations of this ELSA analysis or because those areas are not suitable for the intended use? Could there be another reason for this discrepancy?
- How does the ELSA map compare to other integrated planning maps that have been created in the country in the past? What are the similarities and differences?
- How does the ELSA map align with current or planned projects around nature? Are there any conflicts or synergies?

##### Develop policy recommendations

Next, stakeholders and the ELSA core team should delve into specific opportunities for integrating the insights from the analysis into current and upcoming national policies and plans. Countries can begin by establishing high, medium, and low ambition versions of the map to reflect different percentages of protection, management, and restoration targets, which can be assigned in the

ELSA webtool. As needed, they can also review and modify weights to reflect the relative importance of the different planning features used in the analysis to spatially represent the country’s priority targets. The resulting high, medium, and low ambition maps can help countries to identify where nature-based actions have the greatest potential for synergizing positive outcomes for climate, biodiversity, and human well-being based on existing policy priorities. These different maps can be assessed by stakeholders to determine which of the recommended nature-based actions are the most realistic within existing national policies and plans and/or are the most feasible to implement, depending on financial needs, timelines, and implementing actors.

Each implementation strategy will vary by country depending on national priorities and the map that is derived from these priorities. All countries can benefit from implementing the ELSA results as part of a process of engagement with multiple ministries and sectors, including representatives from ministries related to climate change, environmental management, forests, economics, and/or inter-ministerial coordination committees, if existing. Examples of policy recommendations are featured in Boxes 25 and 26.



Potential policy applications for the Dominican Republic’s ELSA map

The national ELSA team in the Dominican Republic identified potential applications for their ELSA map related to specific national strategies and plans. These applications are broken into the three nature-based actions below:

Applications related to protection

- Boost the implementation of payment for ecosystem services (to support the Food and Nutrition Sovereignty and Security Plan<sup>1</sup> and National Development Strategy 2030).<sup>2</sup>
- Increase the connectivity of habitats and ecological processes (to support the National Climate Change Adaptation Plan 2030)<sup>3</sup> through the establishment of new non-state protected areas.
- Applications related to sustainable management
- Avoid land use change, deforestation, and degradation (to support the National Climate Change Adaptation Plan 2030).<sup>4</sup>
- Promote sustainable development practices (to support the Sectoral Strategic Plan for Agricultural Development).<sup>5</sup>
- Implement family farming projects led by women (to support the Gender and Climate Change Plan).<sup>6</sup>
- Implement programs that encourage good agricultural practices including soil and water conservation (to support the Gender and Climate Change Plan).<sup>7</sup>
- Establish low-carbon and climate-resilient coffee or cocoa areas (to support the Coffee Nationally Appropriate Mitigation Actions,<sup>8</sup> the Cocoa Nationally Appropriate Mitigation Actions,<sup>9</sup> and Nationally Determined Contribution (NDC) 2020).<sup>10</sup>

Applications related to restoration

- Promote reforestation and increase the rate of reforestation with native endemic forest and fruit species (to support the NDC 2020,<sup>11</sup> National Development Strategy 2030,<sup>12</sup> and Gender and Climate Change Plan).<sup>13</sup>
- Implement REDD+ projects (to support NDC 2020).<sup>14</sup>
- Increase connectivity of habitats and ecological processes (to support the National Climate Change Adaptation Plan 2030)<sup>15</sup> through areas where restoration activities are implemented.
- Restore ecosystem services, with emphasis on river basins, and design and implement mechanisms for the payment of environmental services to communities and productive units that protect them (to support the National Development Strategy 2030).<sup>16</sup>
- Develop agroforestry projects linked to rural landscape restoration (to support the Food and Nutritional Sovereignty and Security Plan).<sup>17</sup>

Recommendations for Ecuador’s ELSA map

The national ELSA team in Ecuador developed the following recommendations to strengthen the analysis and apply the results:

Technical recommendations to strengthen the ELSA analysis

- Update the ELSA map periodically as spatial data are modified, especially data on marine protection areas.
- Implement the ELSA methodology on a smaller scale in the Galapagos Islands.
- Design an ELSA methodology for marine zones, specifically in the Galapagos National Park and the new “Hermandad” Marine Area.
- Perform the ELSA methodology periodically and modify the country’s 10 priority policy targets as new environmental, social, and political approaches are established.
- Establish alliances with the National Council of Geoinformatics and the National Information System to support opportunities to frequently update data in the official geoportals and seek new sources of spatial data.
- Generate methodologies to gather data on the availability and use of water that can be integrated into the ELSA map.

Recommendations to support implementation

- Present the results of the ELSA map to key stakeholders and representatives with decision-making power in territorial planning, with the possibility to support public policy.
- Promote training for local governments, seeking a mechanism that does not generate more workload and that helps local authorities make more strategic decisions through the use of ELSA maps at the local scale.
- Develop a mechanism to align the nature-based actions (protect, restore, and manage) with the concepts of the UNCCD (avoid, reduce, and recover) and seek specific synergies.
- Identify areas of protection in Indigenous territories, especially in the Ecuadorian Amazon, that are vulnerable due to the extraction of natural resources.
- Determine unprotected areas that are adjacent to protected areas in order to create ecological corridors that can conserve species in danger of extinction due to fragmentation.
- Conduct an exhaustive analysis of conservation gaps that Ecuador needs to address to achieve the goals set out in its policies and strategic plans.





7.2.b National results-sharing meeting

Finally, the ELSA core team meets with decision makers in a results-sharing meeting to disseminate and mainstream the results of the project. Traditionally, this meeting is organized by the Ministry of Environment with support from the United Nations Development Programme (UNDP) Country Office and UNDP Global Programme on Nature for Development. The goal of the meeting is to ensure that stakeholders have access to the ELSA map via the ELSA webtool and the UNBL workspace and understand how these tools can be used to support decision-making. The meeting should also strengthen collaboration among relevant ministries and institutions and build a pathway toward integrating project results into national planning for nature and

sustainable development. Typically, the results-sharing meeting includes the following:

- Review of project process and presentation of final ELSA map;
- Presentation of the country's ELSA webtool and UNBL secure workspace (7.3.c), two tools that stakeholders can use to view the ELSA map and create insights to drive decision-making; and
- Discussion on potential policy applications for the ELSA map and next steps.

7.3 Step 9: Take action and monitor results

After the ELSA map is created and the webtool has been handed over to the country, action must be taken to apply the policy recommendations, monitor indicators, and iterate maps based on new data and policies. Success in the step is dependent on the quality of stakeholder engagement across the project.

Two central tools are provided by the ELSA project to support the monitoring of the policy targets: the UNBL workspace and the ELSA webtool. Together, these platforms provide a suite of resources to: (1) access the national data used in the creation of the ELSA map (UNBL); (2) change parameters and run the ELSA analysis (ELSA webtool); and (3) monitor the impact of interventions using dynamic indicators (UNBL).

7.3.a Engage in cross-sectoral coordination to apply policy recommendations

Applying policy recommendations requires the participation and buy-in of cross-sectoral stakeholders. The parties involved in the decision-making process for policy application should create space for dialogue with relevant stakeholders across ministries, non-governmental organizations, the private sector, and more. Inter-sectoral dialogue can aid in brainstorming and defining potential applications for the ELSA map. This cross-cutting coordination also increases the feasibility of creating practical long-term strategies and securing a robust framework for the implementation of

ELSA insights by building high-level political will and a joint mandate for the different sectors to align and maximize synergies among plans and strategies. Enhancing communication and engagement across the three Rio conventions on biodiversity, climate change, and desertification can also support alignment across each convention's commitments and targets to streamline reporting and enhance awareness of the linkages across biodiversity, climate change, and desertification.

7.3.b Explore potential Biodiversity Finance Initiative connections

The Biodiversity Finance Initiative (BIOFIN) is a UNDP-led initiative that supports governments and the private sector to use financial solutions as a mechanism for biodiversity. These financial instruments can use market-related levers to support biodiversity or new government regulation. Examples include: green investments; solutions that incentivize the conservation of nature, like payment for environmental services and green subsidies; and solutions that de-incentivize its destruction, like taxes on harmful pesticides and fees. The initiative aims to bridge the gap between the US\$143 billion that is spent on biodiversity a year, versus the US\$824 billion that is needed to shore up our planetary safety net.<sup>18</sup>

The initiative follows four steps:

- **Step 1:** Finance Policy and Institutional Review: Assess the policy, institutional, and economic context for biodiversity finance and map existing finance solutions.
- **Step 2:** Biodiversity Expenditure Review: Measure and analyze current biodiversity expenditures from

the public and private sectors, donors, and non-governmental organizations.

- **Step 3:** Biodiversity Financial Review Assessment: Make a reliable estimate of the finances needed to achieve a country's biodiversity goals, and compare this to current biodiversity expenditures and other resources available.
- **Step 4:** Biodiversity Finance Plans: Develop a Biodiversity finance plan that identifies and mobilizes the resources and policies required to implement the most suitable finance solutions.<sup>19</sup>

Hand in hand, BIOFIN and ELSA together can lead to better results for nature. BIOFIN can support countries to determine how to finance the nature-based actions identified in the ELSA project. Similarly, ELSA can support countries to integrate spatial data insights into their decision-making process to determine where to apply BIOFIN solutions, as demonstrated in Box 27.

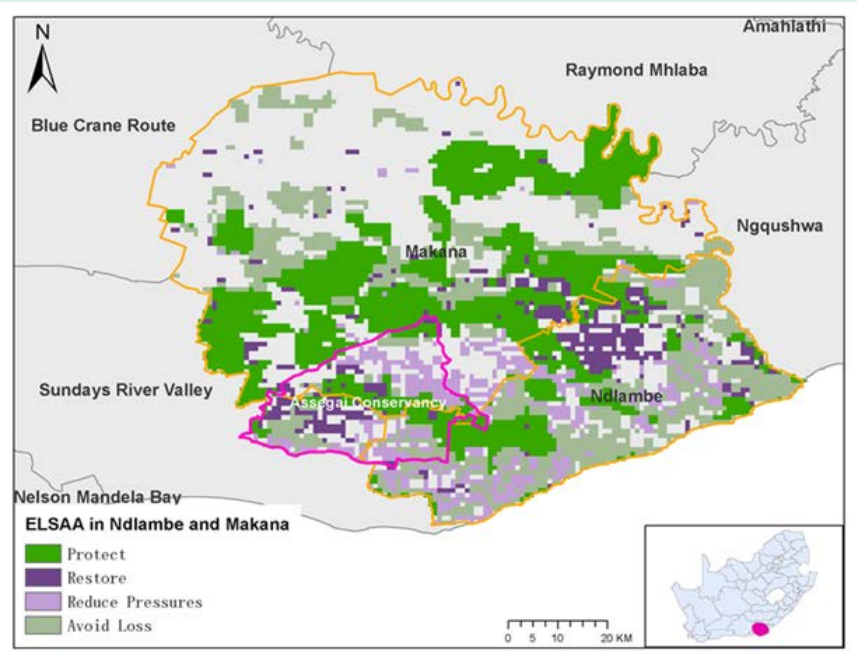




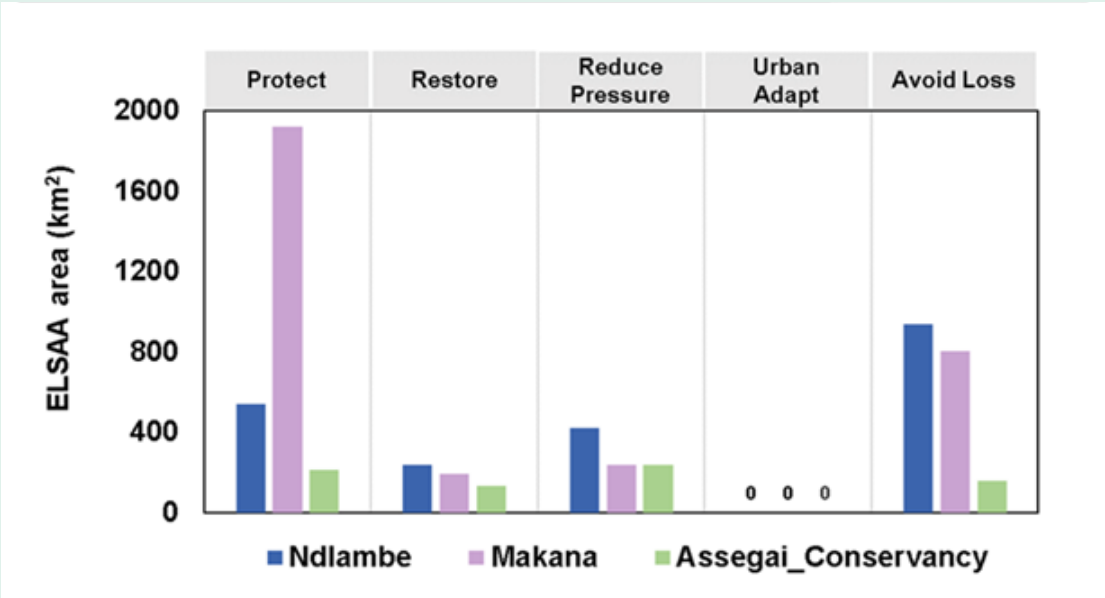
**ELSA’s role in implementing a voluntary, market-based wildlife economy certification scheme**

The United Nations Country Office in South Africa plans to use the county’s Essential Life Support Action Areas (ELSAA) map to support the impact monitoring of a market-driven wildlife certification scheme once it has been established. Through the ELSAA map, a further case for funding the certification scheme may be made if it can be shown that the scheme incentivizes environmentally and socially sustainable practices that contribute to biodiversity conservation in the country. The UNDP BIOFIN project team overlaid the country’s ELSAA map with the local municipalities of Ndlambe and Makana and their Assegai Conservancy to see where these ELSAAs are located in the municipalities and then ran an analysis based on the resulting map. The Department of Forests, Fisheries, and the Environment then conducted a field visit in the Eastern Cape to study the feasibility of applying nature-based actions in the indicated areas to support the wildlife economy certification scheme.

Note that South Africa decided to relabel ELSA as “Essential Life Support Action Areas (ELSAA)” to emphasize the nature-based actions (protect, restore, reduce pressure, urban adapt, and avoid loss) that are recommended as a result of the analysis.



ELSAA’s shown within the local municipalities of Ndlambe and Makana and the Assegai Conservancy.



Analysis to see where ELSAAs overlapped with local municipalities of Ndlambe, Makana, and the Assegai Conservancy.



Ground-truthing of the ELSAA map in the Ubukhulu Game Farm, Eastern Cape



BIOFIN provides an excellent mechanism to support resource mobilization for ELSA maps, however, the initiative is just one pathway toward funding the application of ELSA project results. Countries have also found that they are

able to fund the application of their map through linkages within ongoing projects, policies, and strategies. Chapter 8 provides examples of many of these applications across ELSA pilot countries.

7.3.c Monitor targets through UNBL workspaces

UNBL ([www.unbiodiversitylab.org](http://www.unbiodiversitylab.org)) can play a core support role in the implementation and long-term monitoring of the ELSA project. UNBL offers free workspaces to participating ELSA countries who need a secure area to access and use the ELSA map, in addition to other national and global maps. The workspaces can serve as a common data repository, offer a collaborative work environment, and enable countries to calculate dynamic indicators for a subnational or transboundary area of interest. They offer a secure area to visualize and explore data regardless of GIS experience. In this platform countries can:

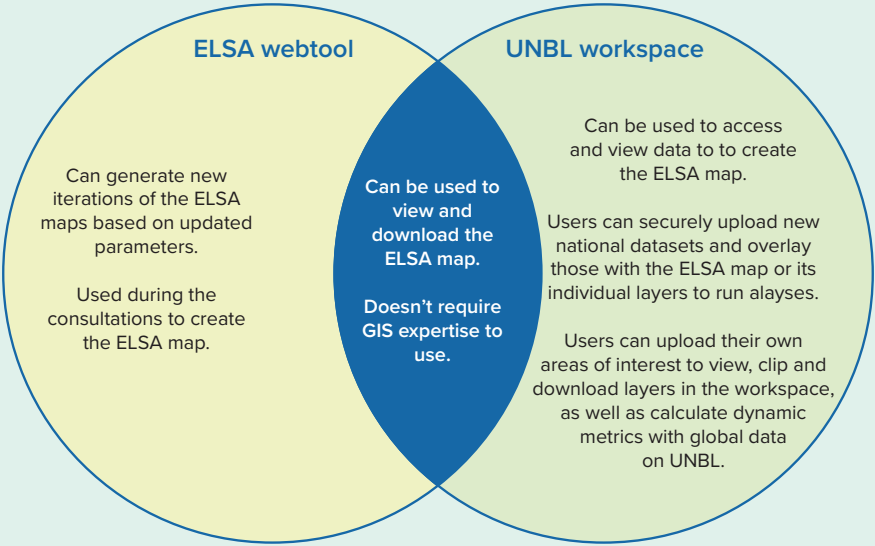
- Visualize the country’s ELSA map, in addition to all input layers used in the map;
- Upload additional national layers and create ‘collections’ to organize by project or theme;
- Access and visualize other global data available on UNBL;
- Upload shapes for any area of interest such as the official national boundary, a transboundary area, or a sub-national area;
- View dynamic indicators for any area of interest, and download the data metrics for further analysis or reference in the national reports;
- Download maps, screenshots, and use the raw data for inclusion in official reports and communication products; and
- Manage membership and privileges of a discrete set of users.



Some of these functionalities are also available in the UNBL webtool. See Box 28 for an explanation of the overlaps and differences between the two tools.

I BOX 28 I  
Difference between the ELSA webtool and the UNBL workspace

At the end of the project, countries will have two main tools to access their ELSA map and use it to support decision-making: the ELSA webtool and the UNBL workspace. These tools do have some similar functions, but overall serve different purposes and could have different users.



For more information on the ELSA webtool, please see section 6.2.d. A full webtool manual is also available Annex 1. To learn more about the UNBL workspace, please see section 7.3.c.

When setting up the UNBL workspaces, countries can assign roles to individuals or user groups to determine their level of access. These roles include:

- Owners: Nominated by the country to take control of the workspace. The owners will be responsible for inviting and granting access to other users, as well as adding other administrators.
- Admins: Can add and manage users, assign roles to users as editors and viewers, manage workspace

assets via the admin tool, and view all workspace assets on the map view.

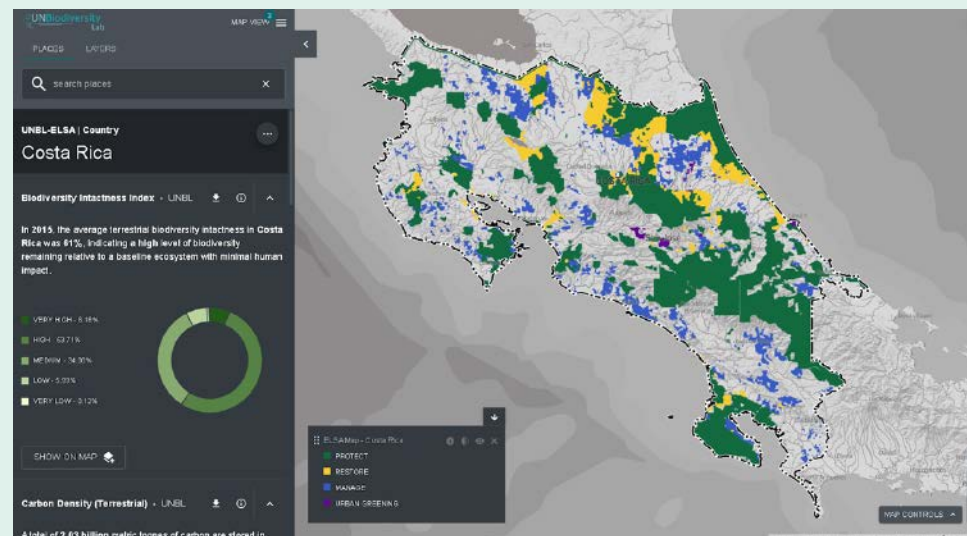
- Editors: Can manage workspace assets via the admin tool, and view all workspace assets on the map view. Editors should have experience working with GIS software to enable them to upload and edit data layers.
- Viewers: Can view all workspace assets on the map view. Viewers cannot access the admin tool.



Boxes 29 and 30 demonstrate how the UNBL workspaces look like to viewers in two countries.

| BOX 29 |

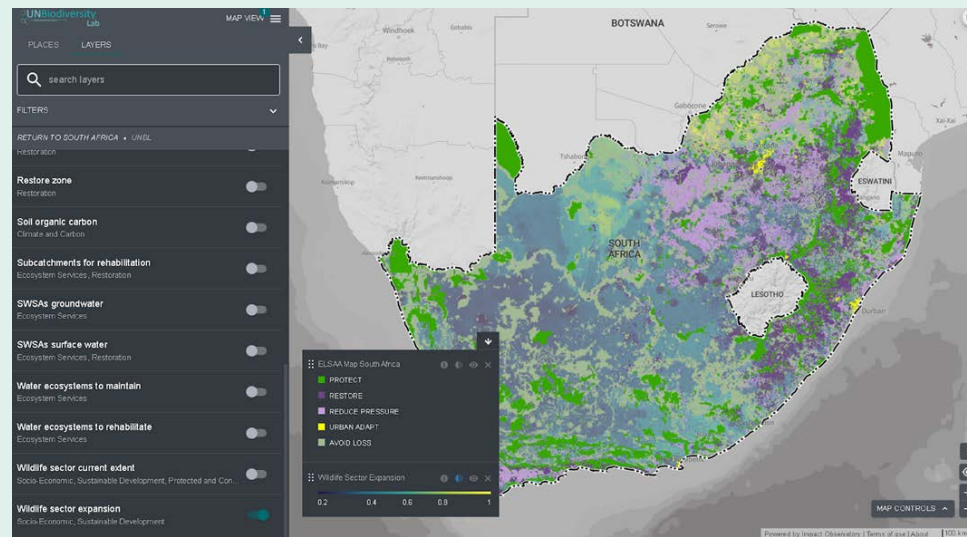
Capture of the UNBL workspace for Costa Rica.



On the left panel, users can scroll through dynamic indicators on biodiversity intactness, terrestrial carbon density, vegetation, global land cover, monthly fire activity, protected areas, terrestrial human footprint, and tree cover loss.

| BOX 30 |

Capture of South Africa’s UNBL workspace, showing the country’s ELSA map overlaid with a Wildlife Sector Expansion map



The UNBL workspace is shared with stakeholders as part of a package of final products. This complete package of handover products includes:

- **ELSA map:** A summary map that indicates where the country can take a series of nature-based actions to achieve the targets identified during a stakeholder engagement process.
- **UNBL workspace:** Countries can use this secure space to view the ELSA map and its layers on an easy-to-use platform.
- **ELSA webtool:** In this platform, countries can adjust the weights of each planning feature, adjust the area

allocated to each nature-based action, download the map, and more.

- **Webtool manual:** Produced by the science team, this manual explains how countries can use the webtool to produce new iterations of their ELSA map. See section A.1 for an amended version of this document.
- **ELSA science brief:** This short document explains the main scientific methodology used in creating the ELSA map.
- **Policy applications document:** This document outlines potential applications of the ELSA map, often listing specific policies that the map could support.

7.3.d Iterate upon ELSA maps and related policies based on results

The ELSA webtool (also see section 6.2.d) is designed specifically to run the ELSA analysis developed for countries and offers complementary services to UNBL. The ELSA webtool can be used to create and iterate the ELSA map based on changing national priorities and needs. It enables users to change a variety of parameters - including the weights of feature layers, area-based

targets, and lock-in options, run the optimization analysis, and download and review the resulting ELSA map.

With the ELSA map validated by the national government and stakeholders, further analysis and actions can be taken to embed the spatial planning outputs into the achievement of the country’s sustainable development.

7.4 Step 10: Communicate achievements

The final step of the ELSA process is to communicate project achievements, although this step can and should ideally take place across the duration of the project. Communications can take many forms, from events such as the Nature for Life Hub or a Convention on Biological Diversity (CBD) Conference of Parties (COP), to press releases and features in national news programs.

These communications products and events can serve to: inform decision makers about project progress and results; increase interest in the project and spatial data as a tool for development planning; increase the uptake of the results within the country; and demonstrate the power of spatial planning and the ELSA process to other countries and international organizations.

7.4.a Good practices for effective communication of ELSA maps

If ELSA maps are embedded into specific communication products, special attention needs to be taken to make sure that the map is well understood. The following recommendations are from a video series on the ELSA process, created by the Pacific Marine Analysis and Research Association (PacMARA) and UNDP.<sup>20</sup>

1. Provide adequate background information when communicating results

On their own, results displayed on ELSA maps can be misleading and easily misinterpreted by the viewer. To avoid this, adequate background information should be included when communicating results. The audience should be given enough information to



ensure they have a basic understanding of the ELSA analysis, the map products, and the key terminology.

There are different ways to disseminate background information. Some information can be included on the maps themselves, but supplemental materials can also accompany the map to help in interpreting the results. In some cases, basic training may also be required to make sure the audience understands what the map is, how the ELSA webtool and UNBL workspace function, and what the different outputs and maps mean.

2. Communication should be audience-driven

It is important to tailor communication to the audience. Audience members may consist of technical reviewers, scientific experts, decision makers, stakeholder representatives, or a mix of some or all of these groups. These groups differ based on their needs, interests, and background knowledge. For instance, scientific experts might want to know technical and data-related details relating to their area of expertise, while other stakeholder groups might not want to know any technical details, but will likely want to know how their specific interests and concerns were accounted for in the planning process, and how the proposed plan may impact them. Hence, the audience will play a key role in determining the type of information and level of detail that should be included when communicating results.

3. Present results in a useful and user-friendly manner

Results should be presented in a user-friendly manner. Spatial prioritization outputs should be shown as ELSA maps or other planning products that are easy to interpret and meaningful to the audience. When maps are presented to a specific stakeholder group, it is important to include how concerns that are specific to the specific stakeholders were incorporated into the analysis and how this impacted the results.

4. Be prepared to answer questions and receive feedback

It is important to be prepared to answer questions and receive feedback from the audience. Consider

what questions need to be covered when presenting results, such as:

- What does the map mean?
- Why are certain areas selected and others not?
- How will the map inform decisions?

Preparing responses in advance to potential questions can help make any feedback sessions run more smoothly.

5. Be clear and transparent about analysis limitations

It is important to be clear and transparent about the limitations of the analyses that led to the ELSA map, and to explain the assumptions that were made in the planning process. This will help build relationships and trust with stakeholders, providing a solid foundation for effective communication.

6. Highlight maps as drafts or ‘works in progress’

Maps should be presented as drafts or ‘works in progress’, rather than a final plan. The audience should understand that spatial optimization tools, like the ELSA webtool, are designed to help people make decisions based on the best available data. That data changes over time and the map will therefore evolve. Moreover, a map is a tool for decision-making, and decision parameters, such as policy priorities, can change over time.

7. Choose the right person to communicate results

Finally, it is important to choose the right person to communicate results. It should be someone who has a good knowledge of maps and what went into developing them. They must have strong communication skills, including an ability to explain results in non-technical terminology. The right person for the job may change based on the audience. If the audience includes a particular stakeholder group, for example, it may be advantageous to choose someone who already has a good working relationship with these stakeholders, and a good understanding of their shared needs, interests, and values.

7.4.b Types of communication products

Countries should use two or more types of communication products about their ‘Map of Hope’ to engage diverse audiences. The following types of communication products have been successful in ELSA pilot countries:

- **Press releases:** Press releases are often published by the national ministry, the UNDP Country Office, or a partner organization in tandem with or after key meetings and consultations to share progress. The press releases are usually brief and formal, containing quotes from representatives who spoke during the associated event. Press releases can also be published to build excitement around engagement in high-level events. As with other communication products, press releases can be shared via social media channels.
- **Blogs and photo essays:** Blogs and photo essays usually have a more conversational tone than press releases and can dig deeper into why the project matters. They can also use case studies to illustrate the impact of the work. Because blogs and photo essays are associated with an author’s name (or multiple names), partners also might see them as an important professional opportunity. As the name suggests, photo essays differ in content from blogs because the story is often told, in part, through imagery.

- **Videos:** Videos are a great way to quickly communicate about the project to diverse audiences. Short videos (under two minutes) can be effective tools for social media, especially when paired with a link to a blog or press release. Longer videos can be effective tools as content during virtual events. Either type of video can be used repeatedly, in different settings.
- **Engagement in high-level events:** High-level events, especially those related to the Sustainable Development Goals (SDGs) or the Rio Conventions, can be great opportunities for countries to share their project results, engage with other leaders in spatial data, and advocate for the use of integrated spatial data for biodiversity, climate change mitigation and adaptation, and sustainable development.

Box 31 shows examples of these types of communication products in Costa Rica. Note that each of the communication forms above can be paired with social media campaigns in order to reach a wider audience. Both Twitter and Facebook posts are recommended platforms, although some countries prefer using just one over the other. The most successful social media campaigns are ones that enlist many partners to share and re-share posts via their platforms. Therefore, it is recommended to send template posts for both Twitter and Facebook with the communication leads at partner organizations before any launch.





Communications around the ELSA project in Costa Rica

Costa Rica has developed a portfolio of communications pieces around the project, each using different methods to engage audiences around the work. Select pieces are featured below.



Costa Rica’s photo essay, ‘Mapping hope: nature for climate’,<sup>21</sup> uses photos and quotes to tell the story of the ELSA project in Costa Rica. UNDP Costa Rica published this photo essay on Exposure, a platform that lends itself well to illustrative imagery and evocative storytelling.



Costa Rica has two short videos about their work in the country (Nature for climate video<sup>22</sup> and Costa Rica solution video).<sup>23</sup> These videos intertwine beautiful shots of the country’s ecosystems with statements from high-level representatives from both UNDP and the Ministry of Environment and Energy to convey the importance of mapping nature in Costa Rica. While the videos first premiered at the Nature for Life Hub, they have also been featured in additional events and consultations to succinctly catch people up to speed on the work that has been taken in the country and spark excitement around the project.

HOME / BLOG / MAPPING NATURE TO CREATE A GLOBAL BIODIVERSITY FRAMEWORK

# Mapping nature to create a global biodiversity framework

POSTED AUGUST 28, 2020

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Executive Director, National Environment Management Authority, Uganda

**CARLOS MANUEL RODRIGUEZ**  
Minister of Environment and Energy, Costa Rica

Three champions of the project, Carlos Manuel Rodriguez, former Minister of Environment and Energy of Costa Rica and CEO and Chairperson of the Global Environment Facility (GEF), Francis Ogwal, Co-Chair of the UN Biodiversity Convention post-2020 working group, and Tom Okurut, former Executive Director of the National Environment Management Authority in Uganda, co-wrote a think piece entitled ‘Mapping nature to create the GBF.’<sup>24</sup> This think piece combines the powerful voices of these three leaders to create a compelling argument for why integrated spatial planning must play an important role in the GBF.



UNDP Costa Rica and the Ministry of the Environment and Energy co-created a press release<sup>25</sup> on their work using the ELSA methodology to support climate change adaptation. This press release, entitled ‘Creating maps of ecosystems to reduce the impact of climate change on the country,’<sup>26</sup> was then picked up by Delfino, a digital newspaper in Costa Rica. It additionally attracted the interest of Noticias Repretel, a national news program that interviewed a project lead<sup>27</sup> from the Ministry of Environment and Energy on air.



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Chapter 8

Use cases - how countries have mainstreamed results

8.1 Introduction

The Essential Life Support Areas (ELSA) methodology provides a versatile approach to spatial planning. Its flexibility empowers decision makers to create customized maps that deliver insights where they are needed the most. Over the pilot phase of the Mapping Nature for People and Planet project, countries have applied the ELSA methodology in new and innovative ways. Originally conceived as a tool for national planning,

countries have proven that the ELSA methodology can also be used for targeted decision-making around specific regions or needs, such as adaptation to climate change, building a green economy, regional water security, and disaster risk reduction. This section includes 10 illustrative case studies to help countries consider how they too can apply this methodology.

8.2 ELSA for coordinated data management in Cambodia

Although the nation of Cambodia has successfully halved extreme poverty since 1990,<sup>1</sup> there are still millions of Cambodians living in rural areas who critically depend on nature for their livelihoods.<sup>2</sup> A changing climate and degrading landscapes increasingly put their livelihoods, food security, and water accessibility at severe risk. The country recognizes that more integrated action is needed to ensure that the ecosystems supporting ecotourism, food production, water provision, and other services are maintained. However, it can be challenging for decision-makers to access reliable spatial data to conduct needed analyses on the environment. In response to this gap, United Nations Development Programme (UNDP) Cambodia and the Cambodian Ministry of Environment are creating a new digital platform - the Cambodian Environmental Management Information System (CEMIS)

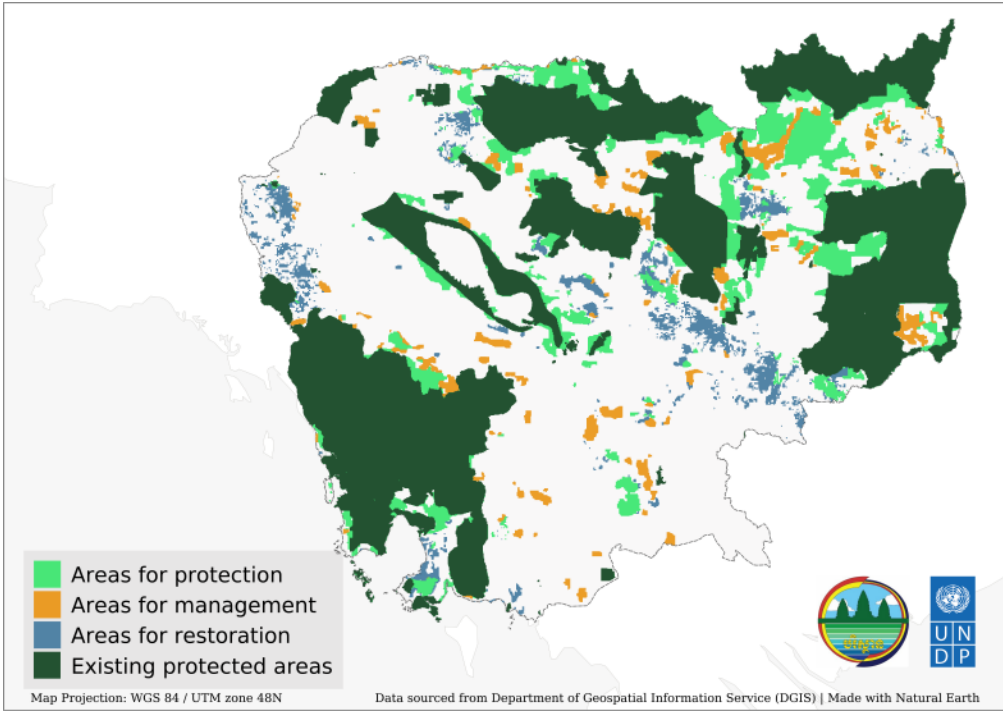
- with support from ELSA, United Nations Biodiversity Lab (UNBL), and other partners. Through a special connector, users of CEMIS will have direct access to the entire spatial database and spatial tools available in the UNBL. This data management system is an important national mechanism for facilitating collaboration across government ministries and development partners to collect and disseminate information and monitor and analyze environment-related targets. The ELSA project is providing data and analytic capacity to support this system in solving problems and in gaining new insights, in addition to building a community of practice around the common objective of better environmental decision-making. Together, CEMIS, UNBL, and ELSA will help Cambodia to make a digital transformation and monitor areas under protection, restoration, and management.

With our map of hope, we can now collectively make better decisions about how to protect and sustainably manage nature - the backbone of the region’s economic development opportunities.

His Excellency, Choup Paris  
Under Secretary, Ministry of Environment, Cambodia

I FIGURE 11 I

ELSA map of Cambodia



Cambodia will also use the ELSA map (Figure 11) in support of moving toward increasing economic prosperity. As the country continues its transition to a higher level of development, it faces a historic opportunity to manage its natural resources for the benefit of both people and

the environment. The ELSA map is being used to identify regions where ecotourism and the sustainable use of nature may strengthen the local economy and reduce pressures on natural resources.





It is essential to break the spiral of degradation of our natural and social heritage, with all the burden of despair and suffering it entails, and move toward a virtuous cycle of sustainability and resilience in territories and communities. This cannot be done without the protection, restoration, and sustainable management of our ecosystems. No society has been able to and will be able to sustain itself over time without taking into account the limits of nature. No development model can prosper if it neglects this aspect.

Daniela Manuschevich

the Head of the Natural Resources and Biodiversity Division of the Ministry of the Environment, Chile

8.3 ELSA for a just socio-ecological transition in Chile

The ELSA project in Chile coincides with a period of profound transformation and political reflection in the country, including reflection on the biodiversity, climate, and pollution crises, the impacts and degradation of natural and social systems, and the recognition of the rights of nature. As a result, the country has initiated several activities to promote a just socio-ecological transition to transform its development model and achieve carbon neutrality and bioclimatic resilience while improving the quality of life of people and protecting natural systems. The development of Chile’s ELSA map has the potential to provide valuable technical support to these processes of reflection and transformation.

Chile sees clear opportunities associated with mapping its ELSAs. These include: the use of a robust methodology to support decision-making in various sectors of concern; the possibility of constructing and evaluating different development scenarios through a rapid and accessible methodology with easily understandable results; the option to extend the use of the methodology at the sub-national scale; and the possibility of the effective communication of public policy concerns and objectives regarding the protection, sustainable management, and restoration of the country’s natural heritage.

Likewise, the process of creating Chile’s ELSA map has sparked technical insights that will serve the country in future mapping work. Among these:

- The importance of a detailed methodological explanation of the process and the results;
- The recognition of the country’s previous and on-going efforts in the protection, sustainable management, and restoration of nature, and their implications for the identification of ELSAs;
- The requirement of broad participation of national experts in the consideration of the use of human footprint as a unique cost estimation base layer and its intersection with other national layers;
- The importance of an analysis of the differences in surface areas produced by the use of different cartographic projections;
- The need to consider a detailed and participatory review of the results in order to strengthen their legitimacy and promote their use;
- The importance of a periodic review of the spatial information used; and
- The relevance of transferring capacities from the ELSA science team to the country to make the ELSA tool a dynamic resource to support decision-making and public policy objectives.

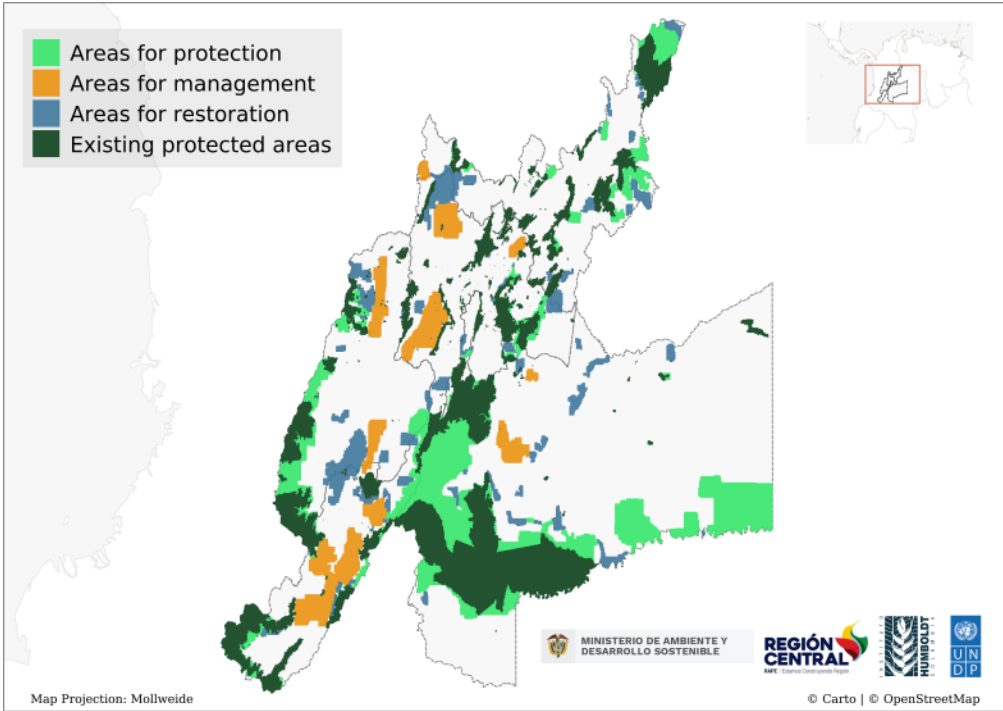
8.4 ELSA for water security in Colombia

In Colombia, 70 percent of drinking water comes from the páramos, a fragile ecosystem high in the Andes. They occur in only two and a half percent of Colombia’s territory but regulate water provision for over a third of its population.<sup>3</sup> Climate change is predicted to reduce the extent of the páramos ecosystem by up to 75 percent. Colombia has created a regional ELSA map as a key tool for building consensus on how and where to safeguard a sustainable urban water supply from this ecosystem. For example, this map shows that creating new protected areas in the departments of Meta, Boyacá, and Tolima could have ripple effects for water security across the region. Conversely, sustainable land management in Cundinamarca, Huila, and Tolima, three departments

with an agricultural-based economy, could enable better ecosystem functions.

The ELSA map is helping national and regional policymakers visualize the critical role of these páramos areas for water provision to densely populated cities. A critical part of the Water Security Plan for the Central Region,<sup>4</sup> the map shows decision makers where they can take action to maintain this rich ecosystem to sustain access to clean water for nearly 15 million people (Figure 12). The policymakers in the central region believe that this plan will ensure water access for human well-being and livelihoods, prevent waterborne pollution, and build resilience against water-related disasters.

FIGURE 12 | Water security ELSA map for Colombia



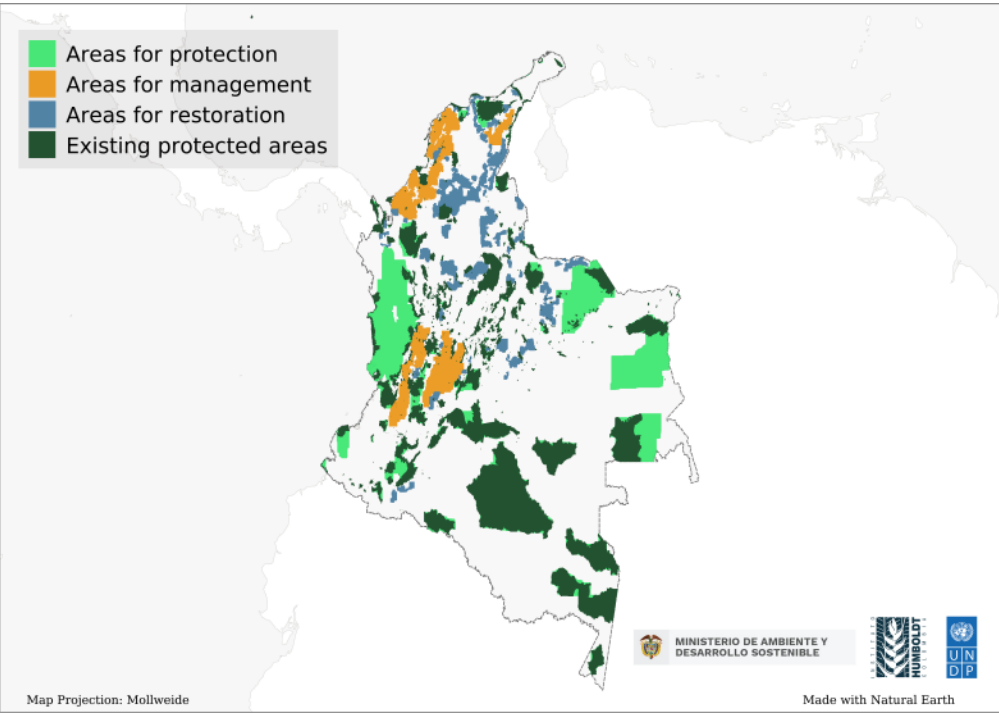
In parallel, Colombia’s national ELSA map is also supporting decision-making by providing a big-picture lens for understanding the nation’s critical ecosystems and the services they provide (Figure 13). The national ‘Map of Hope’ is designed to support the development of the country’s strategies for nature and integrated development. For example, Colombia is evaluating its priority areas for new conservation measures by comparing its na-

tional ELSA map with other conservation planning maps that only take into account nature and climate change criteria, excluding criteria around sustainable development. This will help the country determine where to create new conservation areas that protect nature while also sustaining critical ecosystem services that improve human well-being, such as disaster risk reduction and water provision. In addition, the Humboldt Institute has used



its ELSA map to assess the feasibility of complementary conservation strategies, including land management strategies that favor conservation outside national parks.

FIGURE 13 |  
ELSA map of Colombia



These applications demonstrate how ELSA is proving to be an adaptive tool in Colombia that can support decision-making at all stages of policy development.

In Colombia, ELSA facilitates the identification of biological corridors, key conservation areas, watersheds, and agricultural use areas, among others, that should be considered for water security planning, ensuring that the ecosystem service of water provision is protected for current and future generations.

**Jose Manuel Ochoa**  
Lead of Biodiversity Assessment and Monitoring Program, Humboldt Institute, Colombia

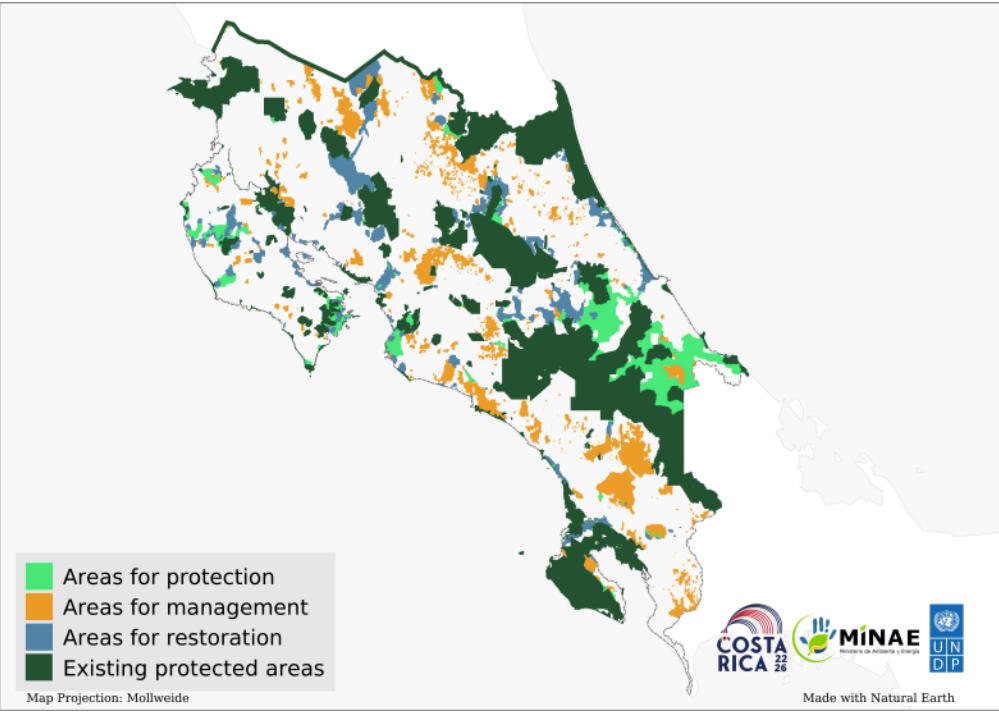


8.5 ELSA for reduced climate change threats in Costa Rica

Flanked by two oceans, Costa Rica is gravely aware of its vulnerability to climate change. Healthy ecosystems are central to the country’s resilience against the many threats of climate change, including natural disasters, food shortages, and water scarcity. For example, the nation’s forests and urban treed landscapes are helping to prevent urban heat islands. Coral reefs and mangroves

are buffering against sea-level rise and flooding in coastal areas. In addition, the country’s intact forests and pristine coastlines draw tourism, which directly and indirectly accounts for over eight percent of the country’s economy.<sup>5</sup> The degradation of these valuable ecosystems could spell catastrophe for the country.

FIGURE 14 |  
ELSA climate change adaptation map of Costa Rica



Costa Rica has leveraged the flexibility of the ELSA approach to help develop its National Climate Adaptation Plan.<sup>6</sup> Created by UNDP Costa Rica and the Ministry of Environment through a collaborative process with key climate adaptation stakeholders, the ELSA Adaptation map indicates where the country can use ecosystem protection, management, and restoration, in addition to urban greening, to achieve its ecosystem-based climate adaptation policy priorities (Figure 14).

This map supported stakeholders to visually represent climate adaptation targets for the country, and identify actions to reduce climate vulnerabilities. These targets and actions are now an integral part of the plan (Box 32). The country is confident that the National Adaptation Plan, supported by ELSA, will reduce vulnerability to climate-related hazards, secure ecosystem services for human populations, and promote ecosystem adaptation to climate change.



BOX 32

Examples of National Adaptation sub-actions that reference the ELSA adaptation map

Axis 1 (Knowledge management on the effects of climate change, climate services and local and institutional capacity building), sub-action 1.2.39: “1 analysis to identify wetland ecosystems that require ecological rehabilitation processes to formulate and implement rehabilitation plans, prioritizing those that contribute to adaptation to climate change according to the ELSA adaptation analysis.”

Axis 3 (Biodiversity management, ecosystems, watersheds, and marine and coastal areas for adaptation), sub-action 1.3.12: “At least 10 restoration and reforestation projects on degraded lands, taking into account the ELSA adaptation map.”

Axis 3 (Biodiversity management, ecosystems, watersheds, and marine and coastal areas for adaptation): sub-action 3.1.12: “10 restored rural landscapes on degraded soils with secondary forest management potential, through the implementation of forestry management plans and taking into account the ELSA adaptation map, which allow the development of sustainable forestry production processes, aimed at improving resilience and well-being of communities and the livelihoods of their inhabitants.”

UNDP Costa Rica and the Ministry of Environment of Costa Rica have also led the creation of an additional national ‘Map of Hope’ with a more general focus on human well-being, nature, and climate change. National authorities like the National System of Conservation Areas and the Ministry of Agriculture will be using the resulting map to inform how and where to implement

national strategies that support nature-positive development, such as the 2021 State of the Environment Report, Agro-Environment Agenda, Urban-Environment Agenda, National Wetlands Programme, Payment for Environmental Services Programme, and National Landscape Restoration Strategy.

The [National Decarbonization Plan and the National Climate Adaptation Plan] represent an opportunity to have an impact on the territories by transforming the national economy, generating sources of employment, and improving people’s quality of life... The decisions we make in this regard are vital to generate welfare and modernize our country by improving air quality, reducing travel times, saving resources, and improving our ecosystems, indispensable actions in the fight against climate change.

The Former First Lady of Costa Rica, Claudia Dobles

The Dominican Republic has an impressive biological wealth from both a global and regional perspective. Biodiversity is fundamental for our economy and the productive sectors. We are part of the solution and put nature at the heart of development. We are honored to be at the forefront of the ELSA initiative. The Dominican Republic is committed to leading the revolution toward more sustainable business models, putting our resources and our people at the center of development.

Orlando Jorge Mera,  
Former Minister of Environment and Natural Resources of the Dominican Republic

8.6 ELSA for economic prosperity in the Dominican Republic

In the mountainous regions of the Dominican Republic, cocoa and coffee provide an economic backbone for many families. The Caribbean country is one of the world’s largest exporters of organic cocoa and is expanding its organic coffee market. The local production of these goods is central in the country’s agricultural sector, and can have a triple positive impact – social, economic, and environmental – on society.

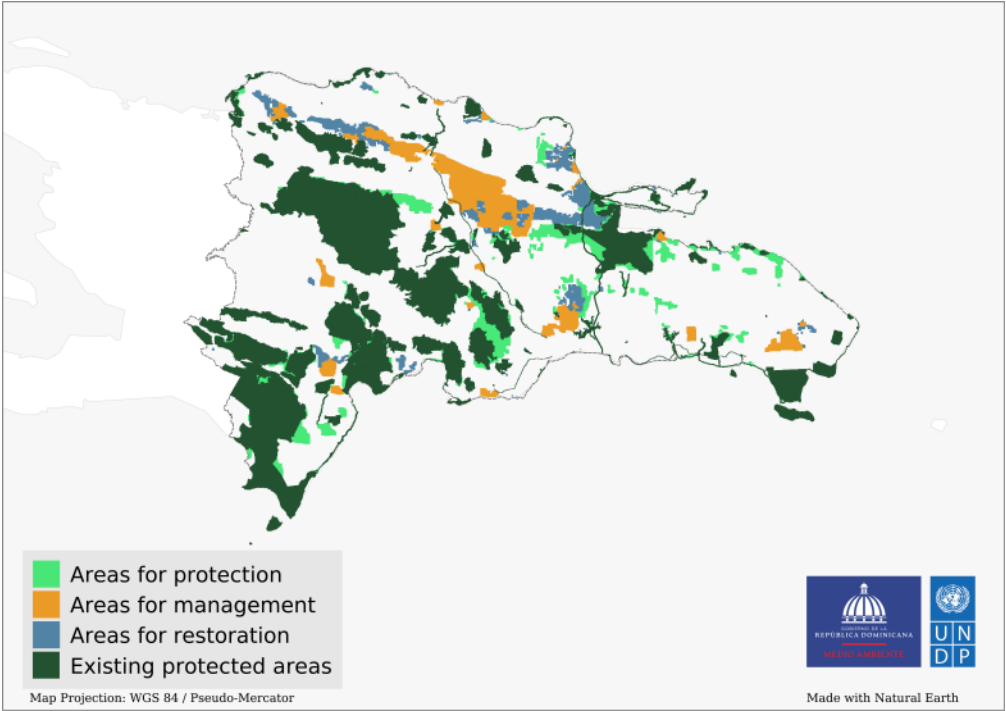
The ELSA project presents an opportunity to mainstream the protection of ecosystem services in mountainous regions into public policies. Through ELSA, the country is looking at the intertwined relationships between nature, production, and human development to help ensure that the most vulnerable communities can benefit from innovation and have access to sustainable livelihoods. The ELSA map has helped to reveal opportunities to increase community resilience to climate change impacts, restore forests and ecosystem services, and increase vegetation cover (Figure 15). For example, the map indicates how the country can sustainably manage 4.9 percent of its land area to simultaneously make progress toward its nature, climate, and sustainable development goals. This includes the country’s goals to: apply soil conservation practices in 75 percent of farms (Sectoral Strategic Plan for Agricultural Development

2010 to 2020);<sup>7</sup> establish climate-resilient, low-carbon, small-scale cocoa production in 146,648 hectares of land (a little less than double the size of New York City) over a period of 10 years (Nationally Determined Contribution of the Dominican Republic 2020);<sup>8</sup> and prevent the extinction and decline of threatened species (National Biodiversity Strategy and Action Plan (NBSAP) 2011-2020).<sup>9</sup>

The Dominican Republic intends to use the ELSA map to take action to implement the Kunming-Montreal Global Biodiversity Framework (GBF) in the country and its Nationally Determined Contribution (NDC) to the Paris Climate Agreement. The analysis is also supporting policymakers to plan and implement a suite of public policies and projects that require high-quality and easily accessible geospatial data. These potential applications include identifying areas for climate-resilient coffee and cocoa production, implementing women-led agriculture projects to support the country’s Gender and Climate Change Plan, and promoting reforestation of native endemic forest and fruit species. The Dominican Republic is committed to leading the revolution toward more sustainable business models, and the ELSA project is helping guide decision-makers to harmonize its national resources and its people at the center of development.



| FIGURE 15 |  
ELSA map of the Dominican Republic



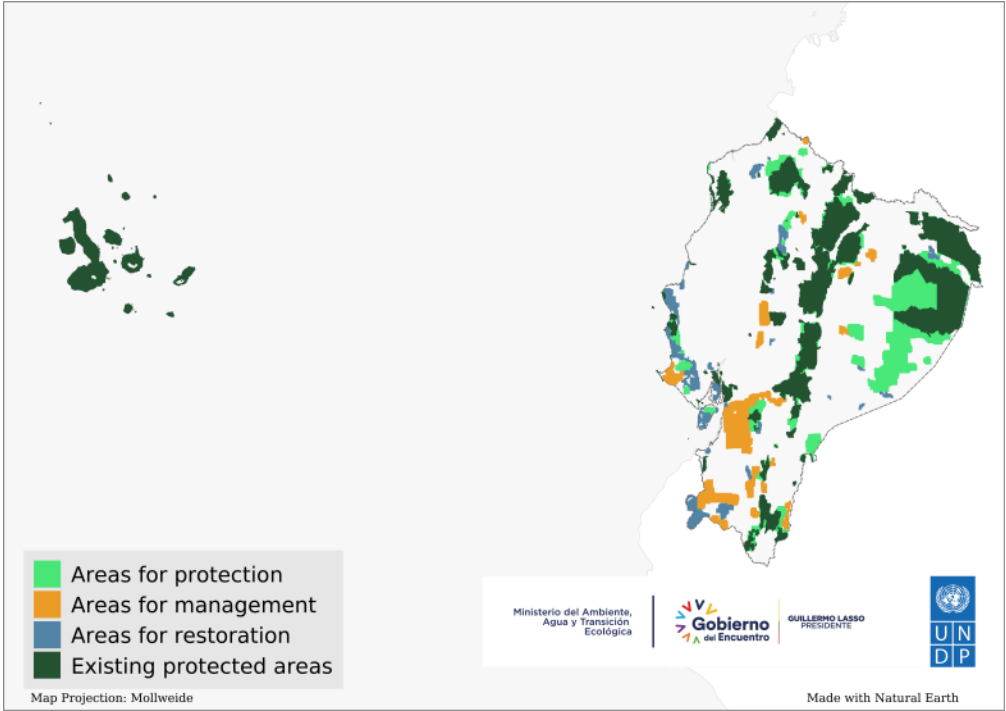
8.7 ELSA for forests and forest-based livelihoods in Ecuador

From the Amazon to the Galapagos Islands, Ecuador has more than 90 unique ecosystems that sustain both wildlife and human populations. However, ecosystem degradation, biodiversity loss, and climate change are increasing the country’s exposure to disasters such as floods and droughts. These threats are exacerbating inequalities and making it harder for marginalized groups to support themselves. In recent years, Ecuador has prioritized development that emphasizes the well-being of its inhabitants, biodiversity conservation, and the mitigation of the effects of climate change. This is demonstrated in part through the country’s ratification of the Escazú Regional Agreement, which promotes a rights-based approach to sustainable development and guarantees access to environmental information and opportunities to participate in related decision-making processes.<sup>10</sup>

To support better decision-making to implement the Escazú Regional Agreement and achieve its national nature-related goals, the country developed an ELSA map through fostering collaboration across diverse groups,

including governmental ministries, research institutes, non-governmental organizations, and the Confederation of Indigenous Nationalities of the Ecuadorian Amazon (Figure 16). This ‘Map of Hope’ is supporting national reporting efforts around Sustainable Development Goal (SDG) 15 - Life on Land, which aims to protect, restore, and promote the sustainable use of land, combat desertification, reverse land degradation, and halt biodiversity loss. The country also sees many other opportunities to use its ELSA map, including: the development and monitoring of sustainable development and land management plans related to the conservation of native forests and the reduction of deforestation; the identification of protected Indigenous lands that are vulnerable to illegal mining and other extractive activities; the establishment of new protected areas to reverse ecosystem fragmentation and conserve vulnerable species. In addition, the country is recommending a complementary ELSA analysis on the Galapagos Islands and their surrounding marine areas, with the purpose of the ELSA map to help protect nature, ensure human well-being, and promote development opportunities in this unique island chain.

| FIGURE 16 |  
ELSA map of Ecuador



It is a priority for our office to provide assistance to countries to achieve their national goals that also contribute to the Sustainable Development Goals. (...) The results of this collaborative work serve as an example for the application of data for informed and strategic decision-making for the sustainable development of the country.

**Matilde Mordt**  
UNDP Resident Representative in Ecuador





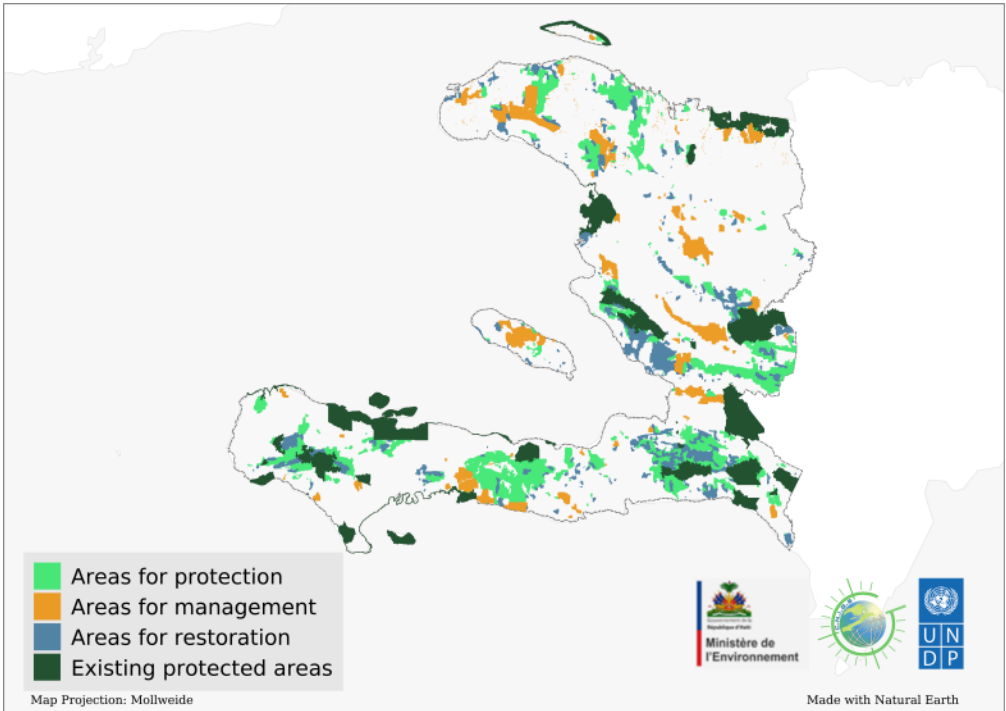
8.8 ELSA for protection and reforestation in Haiti

Ecosystems in Haiti are highly degraded by human pressures, which is leading to diminished climate resilience, decreased water security, and increased exposure to natural disasters. At the same time, food security and poverty reduction are among the most central concerns across the nation. The ELSA project is helping to identify nature-based solutions that secure a better future within this reality. For example, the nation's ELSA map shows where protecting mangroves will reduce the impact of disasters on the coast; where restoring forests can limit soil erosion and landslides; and where agroforestry can conserve important biodiversity while improving food security, livelihoods, nutrition, and sequestering carbon (Figure 17). These insights

are helping Haiti fortify ongoing action for nature and explore new paths forward.

Haiti is using its ELSA map to guide NBSAP implementation by helping policymakers, natural resource managers, and scientists understand where actions for nature can align with immediate and long-term national goals around threatened species, invasive species, and agricultural biodiversity. The map is also guiding the identification of funding opportunities around these actions, such as creating communal nurseries in cities to increase food security, monitoring the national system of protected areas, and identifying locations for environmental management, biodiversity conservation, reforestation, watershed management, and more.

I FIGURE 17 I  
ELSA map of Haiti



According to available data, Haiti is among the most vulnerable countries to the effects of climate change. We will not achieve better situations or develop our resilience to the effects of climate change, without the coordination and convergence of our actions.

**Boby Emmanuel Piard**  
Director of the National Center for Geo-Spatial Information of Haiti

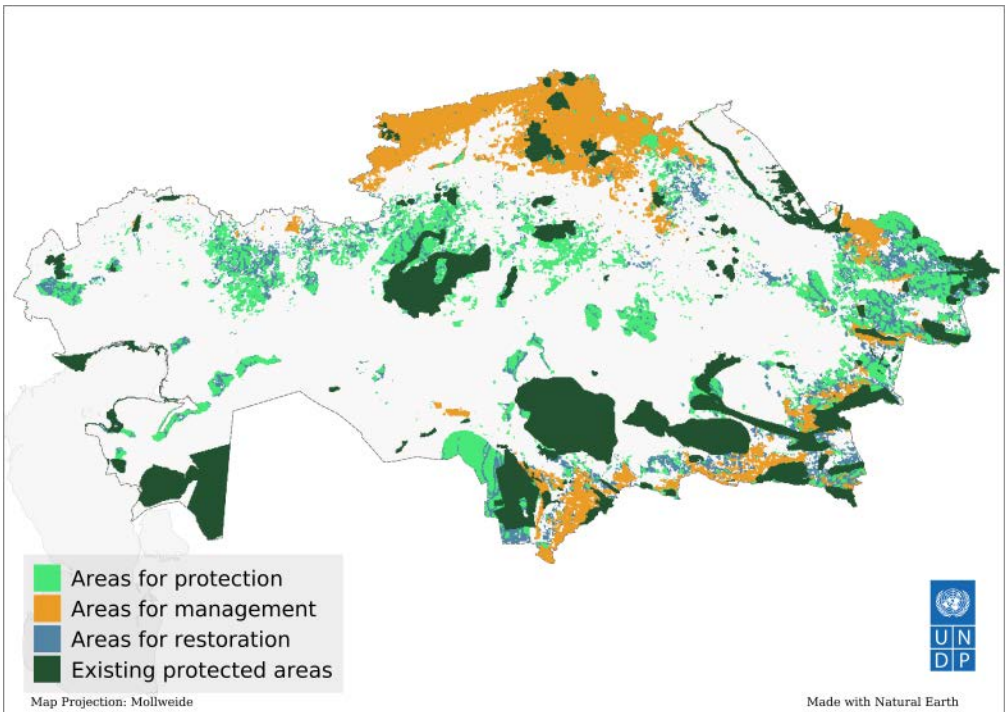
8.9 ELSA for conservation planning in Kazakhstan

Desertification and environmental degradation are compromising Kazakhstan's ecosystems and biodiversity, which is threatening the livelihoods, health, and well-being of the country's 18.7 million people. Kazakhstan's 'Map of Hope' reveals opportunities to protect, manage, and restore the country's ecosystems, landscapes, and natural resources with maximum benefit and at minimum cost.

Kazakhstan has identified many pathways to enhance decision-making through its ELSA map (Figure 18). For example, leaders in Kazakhstan are using ELSA to monitor the implementation of the country's NBSAP until 2030 to help ensure that the country is on track to achieve its targets. The ELSA map is providing data to achieve NBSAP goals around species conservation, protected area

management, and agrobiodiversity. Kazakhstan's ELSA map will also be used to support a Global Environment Facility (GEF) funded project that is strengthening the conservation and sustainable use of valuable arid, riparian, forest, and grassland areas. With the ELSA map as a key input, UNDP and the Forest and Wildlife Committee of the Ministry of Agriculture will identify regions for new protected areas and sustainable land management. Additionally, Kazakhstan also considers its ELSA map to be a key tool to guide funding opportunities for ecotourism projects in the country. Due to its vast natural areas and diverse wildlife, Kazakhstan has untapped potential for ecotourism. ELSA will be used to develop ecotourism management plans based on an ecosystem approach and determine norms in ecotourism practices.

I FIGURE 18 I  
ELSA map of Kazakhstan





Our food systems cannot be restored through a single solution; the forces behind land degradation are vast and varied. But, spatial data can cut through the noise. Kazakhstan is creating a Map of Hope to reveal where we can take action to combat environmental degradation and attain food security.

Yakup Beris

Resident Representative, UNDP Kazakhstan

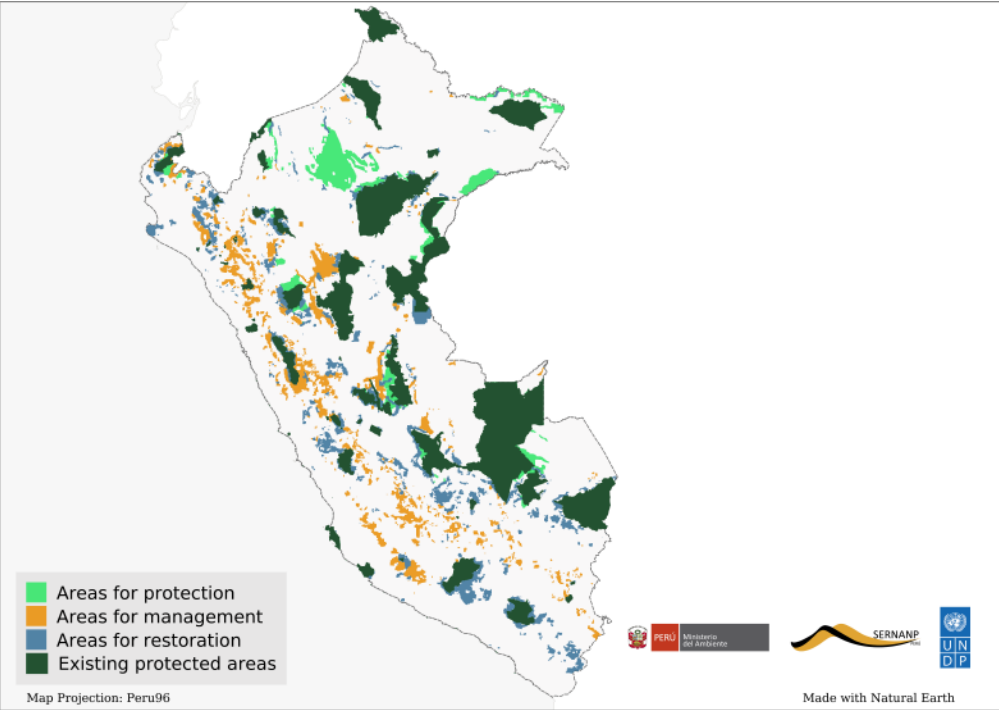
8.10 ELSA for green recovery in Peru

Peru is utilizing the ELSA methodology to envision an inclusive green recovery from the COVID-19 pandemic, one of Peru’s worst socio-economic crises. As the virus is exacerbating inequalities, diverse groups, such as the Ministry of Environment, the Regional Governments of Ucayali and Huanuco, the Ministry of Culture, as well as civil society and nongovernmental organizations including Helvetas Perú, Instituto del Bien Común, Paz y Esperanza – Perú, Periferia, Practical Action, ProNaturaleza, and Sociedad Peruana de Derecho Ambiental are collaborating to develop a ‘Map of Hope’ to shape action (Figure 19). Driven by leaders from the Ucayali region and members of Peru’s Ministry of the Environment, the project has enabled the country to pinpoint the precise locations where nature-based solutions can have the greatest impact on economic recovery. This has increased access to official spatial data across the themes of biodiversity, climate change, and sustainable development and strengthened national capacity to use this data. Through the project, technical capacities were also enhanced in the development of the ELSA tool programming code as well as in the use of

the ELSA platform for decision makers from the different participating institutions.

Peru intends for its ELSA map to serve as an adaptive tool to support decision-making across the country. The government aims to maintain a technical working group to continue updating the ELSA map as new and better data becomes available, to continue to increase spatial data capacity, and to embed results into new national planning efforts. Peru aims to use its national ELSA map as input for national and regional planning processes, including national conservation plans, and economic and ecological zoning plans. The country also aims to use its ELSA map as a support tool for citizen engagement in decision-making, including through participatory budgets and the role of civil society in environmental monitoring and oversight. Civil society organizations that participated actively in the construction of the ELSA map are now equipped with a tool to engage decision makers in discussions about potential trade-offs among multiple development objectives.

FIGURE 19 |  
ELSA map of Peru



One of our priorities is precisely to make this scientific information available and not only accessible, but also understandable to decision makers. Nature is an asset for development, and this has to be clear to all decision makers. Nature allows us to develop, to reduce risks, and to ensure the livelihoods of the population, so it has to be visualized.

Tatiana Pequeño

Director of Monitoring and Evaluation of Natural Resources of the Territory, The Ministry of Environment, Peru





8.11 ELSA for resource mobilization in South Africa

South Africa is embracing the notion that nature and socio-economic growth are not mutually exclusive. The country’s rich biodiversity is considered an important foundation for economic growth and human development, as it facilitates national access to clean water, food, shelter, and nature-driven livelihoods such as ecotourism and sustainable agriculture.

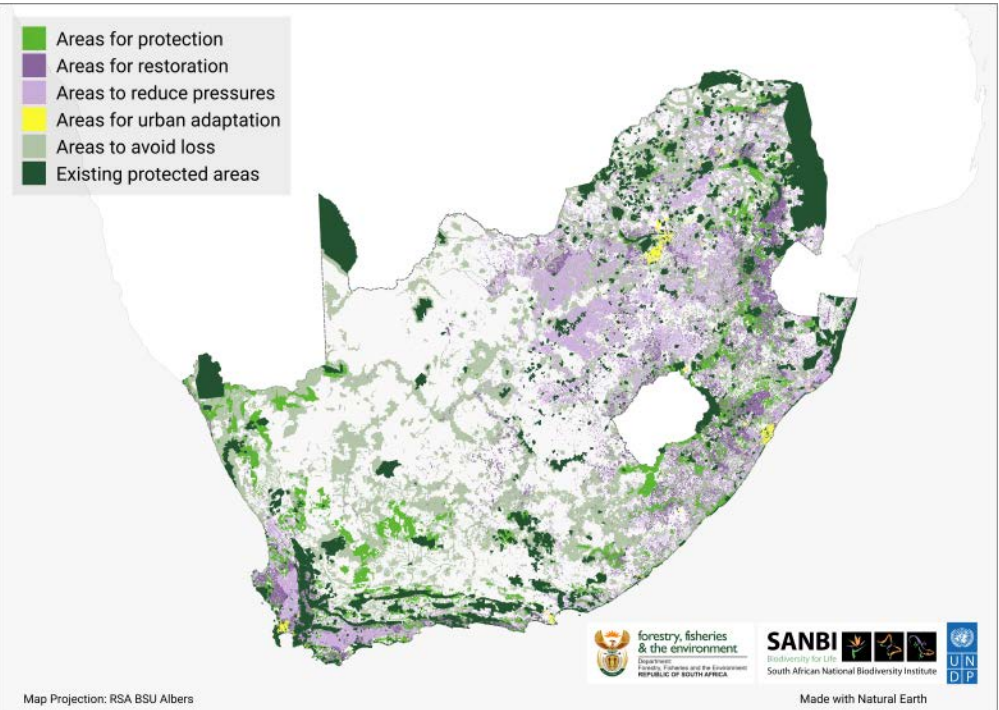
UNDP South Africa, the South African National Biodiversity Institute, and the South African Department of Forestry, Fisheries, and Environment are leading efforts to harness the positive opportunities provided by biodiversity and ecosystems as a catalyst for sustainable development and economic growth. Through a rich stakeholder engagement process, expert planners in the environment and agricultural sectors, as well as key national institutions around land-use planning and the application of spatial technologies for decision-making guided the creation of a map that translates the nation’s top 10 nature-based policy targets into clear actions to be taken across the country

(Figure 20). These actions relate to: protecting, restoring, and reducing pressures on nature, avoiding ecosystem loss, and adapting to the threat of natural climate disasters in urban areas.

South Africa’s ‘Map of Hope’ is seen as a critical tool for resource mobilization by UNDP. The map identifies synergies across multiple policies, and prioritizes them spatially, which provides a guide to unlocking financial investment. The country is considering leveraging this tool to support projects around ecotourism, sustainable land use, wetland restoration, nature stewardship incentives, and more. Furthermore, the map provides insights that could drive investment into the wildlife sector to contribute to the National Development Plan of 2030’s goal of creating 100,000 new jobs and increasing the national Gross Domestic Product (GDP) by 10 percent.” The country’s ‘Map of Hope’ contributes to further tools that can help South Africa collectively make better decisions about how to safeguard nature for a thriving economy.

FIGURE 20 | Essential Life Support Action Areas (ELSAA) map of South Africa.

Note that South Africa decided to relabel ELSA as “Essential Life Support Action Areas (ELSAA)” to emphasize the nature-based actions that are recommended as a result of the analysis.



In partnership with the Department of Forestry, Fisheries and Environment, and provincial conservation agencies, we have developed high-quality, reliable spatial data on nature for decision makers. These maps of critical biodiversity areas and ecological infrastructure are helping stakeholders to manage land, rivers, and catchment for sustainable development.

Deshni Pillay  
Chief Director of Biodiversity Information and Policy Advice at the South African National Biodiversity Institute

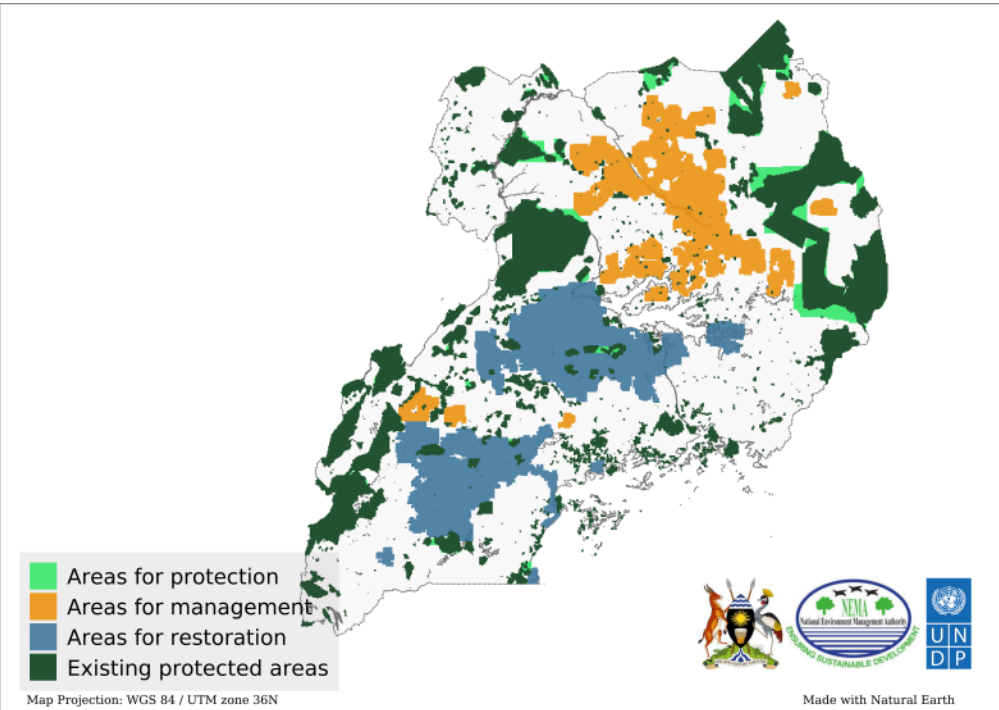
8.12 ELSA for disaster risk reduction in Uganda

Uganda faces a high degree of land degradation, including the loss of valuable wetlands and forests, the conversion of grasslands, and the degradation of agricultural soils. As a result, many areas in Uganda suffer from natural disasters, including flooding, droughts, and landslides. To reduce these risks, national policymakers are calling for a paradigm shift to place nature-based solutions at the center of the country’s development framework.

Uganda’s National Environment Management Authority is using its ‘Map of Hope’ to fast-track the implementation and review of the country’s Third National Development

Plan, showing how safeguarding and restoring nature can have ripple effects for human safety and well-being (Figure 21). The plan will support afforestation and wetland restoration, among other activities that strengthen nature’s capacity to mitigate the risk of disasters. The country’s ELSA map is also seen as a critical tool to support the economic evaluation of nature, national capital accounting, biodiversity offsets, and other techniques to conserve biodiversity. In addition, Uganda is considering how its secure workspace on UNBL can be used to assess the capacity of soils for carbon capture to mitigate climate change.

FIGURE 21 | ELSA map of Uganda





Uganda sees ELSA as a tool to cohesively support the development and implementation of the GBF, which is intended to orient humanity to a new era of living in harmony with nature. The framework will contribute to the cultivation and preservation of ecosystems, species, and

genetic diversity while simultaneously meeting human needs. As countries such as Uganda work to address the planetary emergency, the use of spatial data to map ELSAs and platforms such as UNBL will become continually more useful to support action on an international scale.

The ELSA process provides Uganda with an opportunity to generate integrated landscape analyses to support policy development for environmental, agricultural, and land management challenges.

**Monique Akullo**

Senior Internal Monitoring and Evaluation Officer, National Environment Management Authority, Uganda



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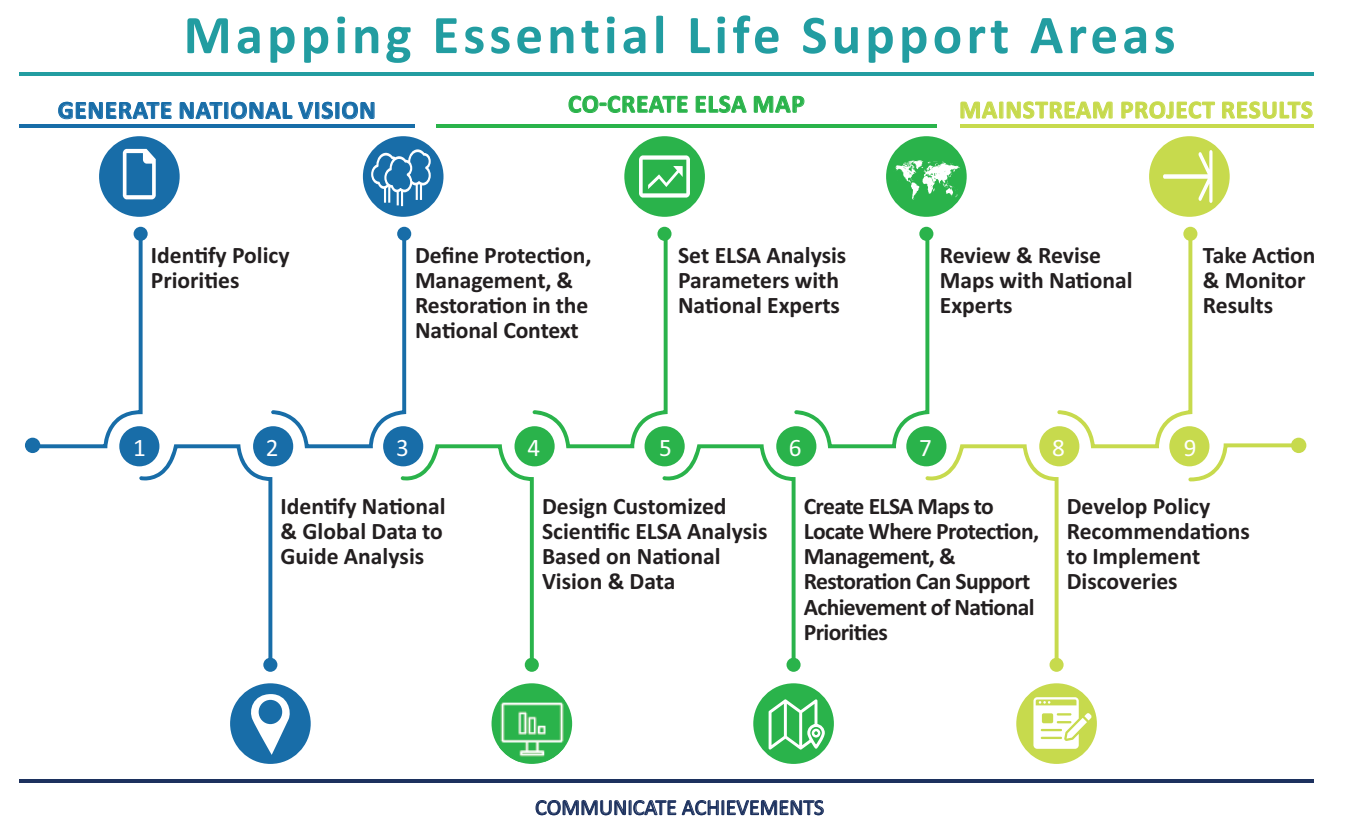
Annex

A.1 Webtool manual

A.1.1 What purpose does the ELSA webtool serve?

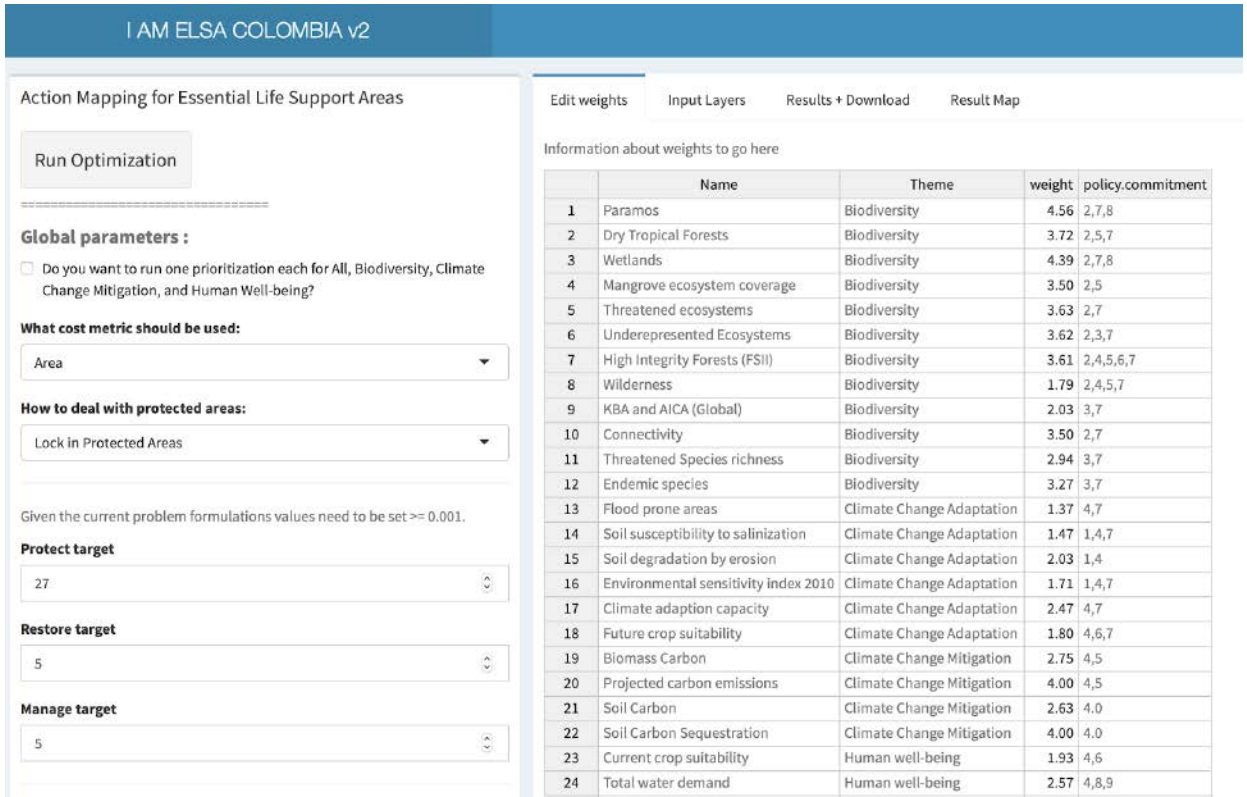
The Essential Life Support Areas (ELSA) webtool is an interactive online webpage<sup>1</sup> that generates ELSA maps based on the country’s targets for nature, climate change, and sustainable development. This webtool supports steps 5, 6, and 7 in the ELSA process (Figure 1). The webtool is easy to use for people who are not spatial data experts, and requires no coding or modeling skills.

I FIGURE 1 I  
The ELSA process



The webtool runs optimizations quickly (typically in less than one minute). It can therefore be used to generate and refine conservation plans in real-time during stakeholder meetings, and contribute to a more transparent, inclusive, and defensible decision-making process.

I FIGURE 2 I  
The interface of the ELSA webtool-Colombia



A.1.2 Functions of the online webtool

The ELSA webtool is created specifically for each country and can be used for several key functions. It is important to note that the webtool can be used to change any of the parameters of the analysis selected by national stakeholders during the second consultation, but it cannot be used to change or update data layers.

What stakeholders can use the ELSA webtool to accomplish:

- Choose to lock-in or lock-out protected areas.
- Change the percentage of national territory that can be allocated to each nature-based action zone (protect, restore, and manage).
- Edit weights of each planning feature.
- Run the optimization.
- View and download the ELSA map and summary results.

All of these parameters can be adjusted in real-time to enable a group of stakeholders to co-create an ELSA map.







I TABLE 1 |  
Example of nature-based actions and area-based targets used in the ELSA analysis in Colombia

Action	National definition of action	Area-based Target	Origin of target	Spatial definition of zone for each action	Spatial constraints for zone
Protection	The introduction of land use restrictions equivalent to those on protected areas or other effective area-based measures for conservation that support the processes of the natural ecosystem and limit the exploitation of land resources by humans. These areas can facilitate some human use: tourism, harvesting of trees and non-timber forest products, and agroforestry.	20 percent of national territory	NBSAP: “By 2025, a National System of Land Protected Areas is functional and up to 20 percent of the territory’s cover is completed.”	This zone includes existing protected areas and areas where agroforestry is practiced. It excludes urban areas or areas with dense agriculture.	In all protected areas  For areas outside of protected areas: not in urban areas or areas with dense agriculture.
Management	Sustainable management methods used in agricultural areas, in particular agroforestry. Agroforestry is an agricultural system where various types of trees such as fruit, coffee, cocoa, and forestry trees are grown in the same plots together with other crops and/or pasture. In addition to improving soil quality, agroforestry landscapes can strengthen ecosystem services such as flood and erosion control, wind shelter, biodiversity protection, and carbon sequestration.	5.43 percent of national territory	NBSAP: “By 2030, ... agroforestry coverage will have increased .. by 30 percent .”  *This is equivalent to a 5.43 percent increase in national territory devoted to agriculture	This zone excludes dense agroforestry, dense agriculture, urban areas, or areas that receive less than 600 millimeters of rainfall a year which are not suitable for agriculture.	Not in dense agriculture.  Not in dense agroforestry.  Not in urban areas.  Not in areas with less than 600mm rainfall.

Action	National definition of action	Area-based Target	Origin of target	Spatial definition of zone for each action	Spatial constraints for zone
Restoration	Passive or active restoration of forest cover and/or increases habitat structure and vegetation biomass, especially in areas that are currently degraded. This can include agroforestry.	5.66 percent of national territory	First NDC: “Plant 137,500 ha of forest by 2030, giving priority to local species, and expand existing mangrove forests (19,500 hectares) by 2030”.  *This. Is equivalent to a 5.66 percent increase in national territory devoted to agriculture	This zone excludes all urban areas and agricultural areas.	Not in urban areas.  In non-agricultural zones.





A.1.5 Boundary penalty factor

The boundary penalty is used to promote spatial cohesion when prioritizing land use areas. It helps to avoid a map with actions assigned to very small areas scattered across the landscape. The boundary penalty can be 0 or higher. The higher the value, the more likely to create an ELSA map that has larger contiguous areas for each action, making it more implementable.

Steps

- 1. To set the boundary penalty, start with a very small number e.g., 0.00001.
- 2. Iteratively increase the number by an order of magnitude (e.g., 0.00001 -> 0.0001 -> 0.001), reducing the rate of increase as you near solutions that lead to your desired level of clumping (Figure 4).

I FIGURE 4 I  
Boundary penalty factor setting

Given the current problem formulations values need to be set >= 0.001.

Protect target

27

Restore target

5

Manage target

5

We recommended starting with low values for Boundary penalty factor (e.g. 1).

Boundary penalty factor

0

A.1.6 Edit weights of features

To run the optimization analysis, stakeholders need to decide the comparative importance of each of the planning features that map the priority policy targets for the country. This is accomplished through weighting. For example, if Key Biodiversity Areas are considered as highly important, higher weight should be given to this feature (greater than 3).

The default weights in the tool weights are based on inputs from a diverse group of policymakers, experts, and other stakeholders in your country. The default weights visible in the webtool are developed through the second consultation for the ‘Mapping Nature for People and Planet’ project.

Steps

- 1. Enter a weight for each planning feature (Figure 5). It is recommended to use a scale from 0-5 based on the priority level of each conservation feature:
  - 0 – not important / do not consider
  - 1.0 – low importance
  - 3.0 – average importance
  - 5.0 – highest importance

I FIGURE 5 I  
Weight setting within the Colombia webtool

I AM ELSA COLOMBIA v2

Action Mapping for Essential Life Support Areas

Run Optimization

Global parameters :

☒ Do you want to run one prioritization each for All, Biodiversity, Climate Change Mitigation, and Human Well-being?

What cost metric should be used:

Area

How to deal with protected areas:

Lock in Protected Areas

Given the current problem formulations values need to be set >= 0.001.

Protect target

27

Restore target

5

Manage target

5

Edit weights

Input Layers

Results + Download

Result Map

Information about weights to go here

	Name	Theme	weight	policy.commitment
1	Paramos	Biodiversity	4.56	2,7,8
2	Dry Tropical Forests	Biodiversity	3.72	2,5,7
3	Wetlands	Biodiversity	4.39	2,7,8
4	Mangrove ecosystem coverage	Biodiversity	3.50	2,5
5	Threatened ecosystems	Biodiversity	3.63	2,7
6	Underepresented Ecosystems	Biodiversity	3.62	2,3,7
7	High Integrity Forests (FSII)	Biodiversity	3.61	2,4,5,6,7
8	Wilderness	Biodiversity	1.79	2,4,5,7
9	KBA and AICA (Global)	Biodiversity	2.03	3,7
10	Connectivity	Biodiversity	3.50	2,7
11	Threatened Species richness	Biodiversity	2.94	3,7
12	Endemic species	Biodiversity	3.27	3,7
13	Flood prone areas	Climate Change Adaptation	1.37	4,7
14	Soil susceptibility to salinization	Climate Change Adaptation	1.47	1,4,7
15	Soil degradation by erosion	Climate Change Adaptation	2.03	1,4
16	Environmental sensitivity index 2010	Climate Change Adaptation	1.71	1,4,7
17	Climate adaption capacity	Climate Change Adaptation	2.47	4,7
18	Future crop suitability	Climate Change Adaptation	1.80	4,6,7
19	Biomass Carbon	Climate Change Mitigation	2.75	4,5
20	Projected carbon emissions	Climate Change Mitigation	4.00	4,5
21	Soil Carbon	Climate Change Mitigation	2.63	4,0
22	Soil Carbon Sequestration	Climate Change Mitigation	4.00	4,0
23	Current crop suitability	Human well-being	1.93	4,6
24	Total water demand	Human well-being	2.57	4,8,9





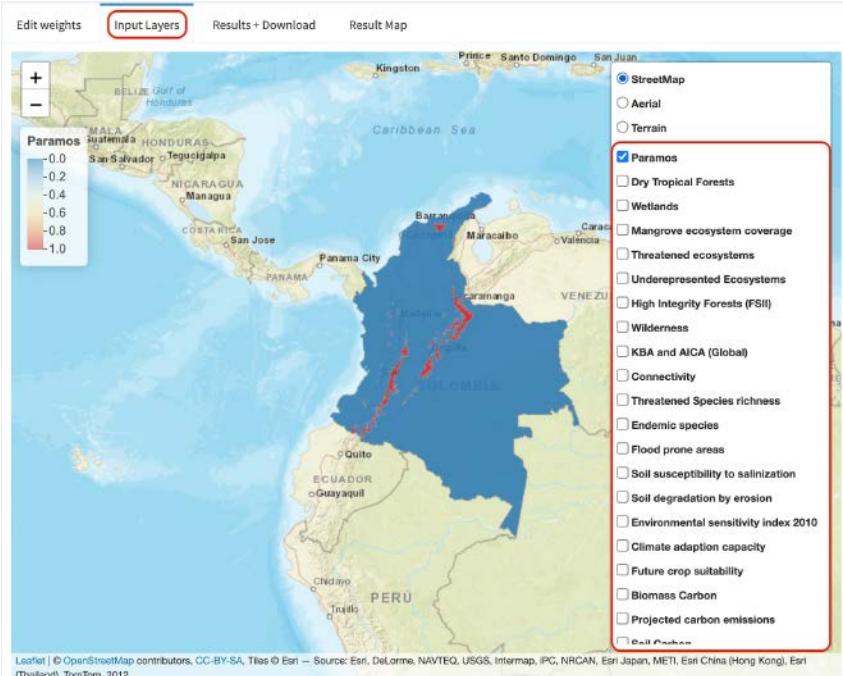
A.1.7 View the input layers

By clicking the ‘input layers’, users can view the maps for the planning features included in the ELSA analysis.

Steps

- 1. Check the box for each input layer you would like to visualize (Figure 6).
- 2. Uncheck the box to remove the input layer from the view.

I FIGURE 6 I  
View the input layers



A.1.8 View the heat maps

Prior to running an optimization, clicking the ‘result map’ on the right panel will result in the creation of four heat map (HM) layers. The heat maps identify important locations for the country’s priority targets. They are the result of the intersection of the planning features and their respective weights. The higher the value on a range from 0 to 1, the more features of high weight overlap. They thus can be identified as hotspots for biodiversity, climate change mitigation, human well-being, or all combined.

The heat maps can be toggled on and off, to either view the ELSA heat map (all features), which displays all planning features together, or heat maps showing only planning features within specific themes (biodiversity, climate change mitigation, human well-being). Important areas are shown in warm colors, with red indicating the most important.

By looking at the heat maps before the action maps, data experts can view the combined planning feature data, and determine if the patterns are aligned with their expectations and personal knowledge of the region. To aid in this process, users can toggle between the heat maps and underlying satellite images and road maps, which helps orient the heat maps in the landscape. There are four types of heat maps on the webtool, as explained in Table 2.

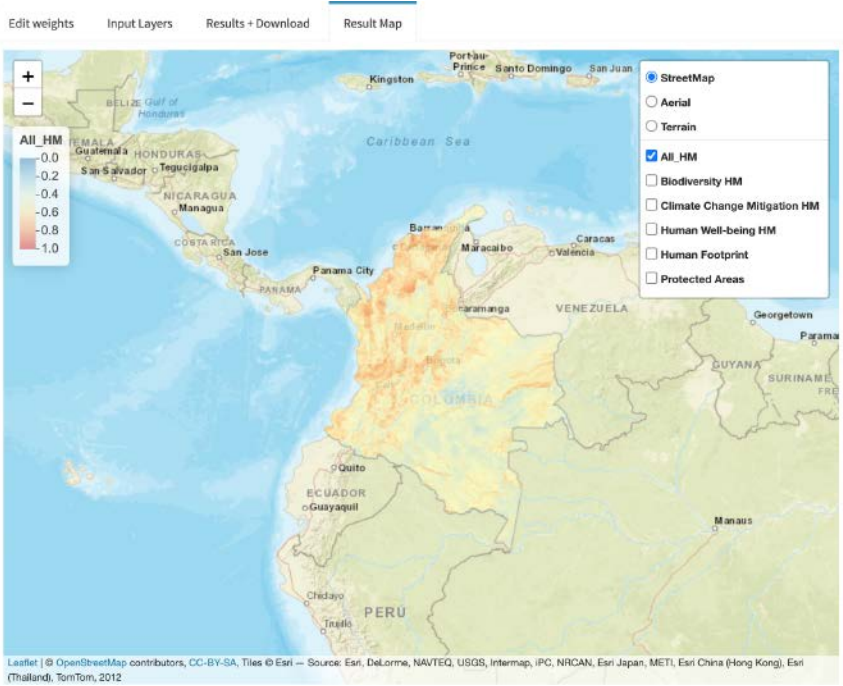
I TABLE 2 I  
Types of heat maps on the webtool

Name	Description
All_HM	The ELSA heat map. This heat map shows the intersection of all planning features to indicatively show areas of importance based on ALL national priority policy targets.
Biodiversity_HM	The biodiversity heat map. This heat map shows the intersection of planning features for biodiversity to indicatively show areas of importance for biodiversity based on national priority policy targets.
Climate Change Mitigation_HM	The climate change mitigation heat map. This heat map shows the intersection of planning features for climate change mitigation to indicatively show areas of importance for climate change mitigation based on national priority policy targets.
Human_well-being_HM	The human well-being heat map. This heat map shows the intersection of planning features for human well-being to indicatively show areas of importance for human well-being based on national priority policy targets.

Steps

- 1. Click on the ‘results’ tab in the right panel.
- 2. Toggle between the four heat maps to review the information before you run the optimization (Figure 7).
- 3. Experiment with switching between ‘aerial’ and ‘terrain’ views.

I FIGURE 7 I  
ELSA Heat map of all features (All\_HM)





A.1.9 Run optimization

After you have customized the parameters listed above and reviewed the heat maps, you are ready to run the ELSA optimization analysis!

Steps

1. Prior to running the optimization, you can choose to check the box under “Global parameters”. By checking this box, and after the optimization has occurred, you will be able to display four maps: the final ELSA map, in which nature-based actions are optimized for benefits in all planning features; another map optimized for biodiversity planning features; another optimized for climate change mitigation; and another optimized for human well-being. Conversely, if you only want to display the final ELSA map, you should leave this box unchecked.
2. Click the ‘run optimization’ button (Figure 8). It may typically take up to 2-5 minutes to run the analysis. However, if the country is large (resulting in more planning units), there are large numbers of planning features being used, or a high boundary penalty factor is applied, it may take significantly longer. You should see a progress bar that documents the analysis status. Do not re-click on ‘run optimization’ while the analysis is already running.
3. Every time you change any parameters, click ‘run optimization’ again to run the model to refresh your result report and map.

I FIGURE 8 | Optimization

Action Mapping for Essential Life Support Areas

Run Optimization

Global parameters :

☒ Do you want to run one prioritization each for All, Biodiversity, Climate Change Mitigation, and Human Well-being?

What cost metric should be used:

Area

How to deal with protected areas:

Lock in Protected Areas

Calculation in progress

Calculation in progress 1/4

A.1.10 Analyze synergies and trade-offs

After running an iteration of the analysis, you can view the results and assess whether the parameters you selected led to an acceptable representation for each of the planning features.

Steps

1. Go to the ‘Results + Download’ tab, scroll down, and click ‘download summary table’ (Figure 9). This will download an excel file of the results.
2. Review the results.
  - Column 1 provides the name of the planning feature.
  - Column 2 documents the theme it is associated with.
  - Columns 3 to 6 indicate a planning features’ representation across the three independent planning scenarios and the combined ELSA scenario, e.g.:
    - ELSA: includes all planning features;
    - Biodiversity: planning features only;
    - Climate change mitigation: planning features only, and
    - Human well-being: planning features only.
  - Column 7 shows the representation of the ELSA scenario (as a percentage) compared to the highest representation amongst the independent planning scenarios.
3. For features where the feature representation under the ELSA scenario (column 7) shows a substantial decline (~20 percent) relative to the highest representation possible (columns 4-6), e.g., the value in column 7, it is advised to consider returning to the weights in the tool and increasing the weight for that feature so it is better represented within ELSA areas.

I FIGURE 9 | Download summary table

Edit weightsInput LayersResults + DownloadResult Map

Result Summary Table

Numeric values are in percent.

	Name	Theme	All_action	CDB_action	UNFCCC_action	SDG_action
1	Paramos	Biodiversity	80	93	63	73
2	Dry Tropical Forests	Biodiversity	75	73	46	51
3	Wetlands	Biodiversity	65	82	31	35
4	Mangrove ecosystem coverage	Biodiversity	81	75	56	60
5	Threatened ecosystems	Biodiversity	54	63	38	35
6	Underepresented Ecosystems	Biodiversity	32	33	29	33
7	High Integrity Forests (FSII)	Biodiversity	38	38	32	31
8	Wilderness	Biodiversity	39	39	32	32
9	KBA and AICA (Global)	Biodiversity	83	84	85	82

Showing 1 to 9 of 31 entries

Previous1234Next

Results download (output layers):

Download

Results download (summary table):

Download



A.1.11 View and download maps

After running the optimization, you will be able to view and download eight maps (including four heat maps and four action maps) for your country based on the results of the ELSA analysis (Table 3). These can be used for communication and implementation purposes.

TABLE 3 | ELSA maps available for download from the ELSA webtool

Name	Description
ELSA.tif	The ELSA map. This shows the optimal spatial locations where action should be taken to protect, manage, and restore nature to best achieve all planning features.
Biodiversity.tif	The biodiversity action map. This shows the optimal spatial locations where action should be taken to protect, manage, and restore nature to best achieve the planning features for biodiversity.
Climate_change_mitigation.tif	The climate change mitigation action map. This shows the optimal spatial locations where action should be taken to protect, manage, and restore nature to best achieve the planning features for climate change mitigation.
Human_well-being.tif	The human well-being action map. This shows the optimal spatial locations where action should be taken to protect, manage, and restore nature to best achieve the planning features for human well-being.

Steps

1. Click “Result Map” to view the action maps in the webtool (Figure 10).
2. Zoom into particular areas by clicking the “+” icon.
3. Switch to an aerial / terrain view by clicking “Aerial” / “Terrain” on the bar at the right of the map.
4. Click “Results + Download”, then click “Results download (output layers)” to download the maps as GeoTIFFs (Figure 10). This can be viewed and analyzed in GIS software.



FIGURE 10 | Action map

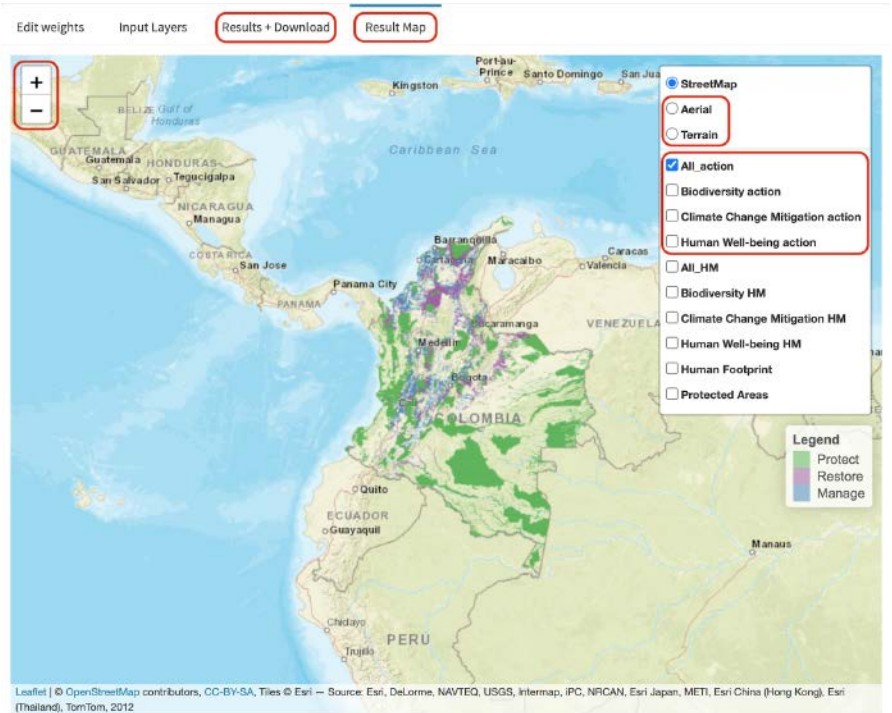
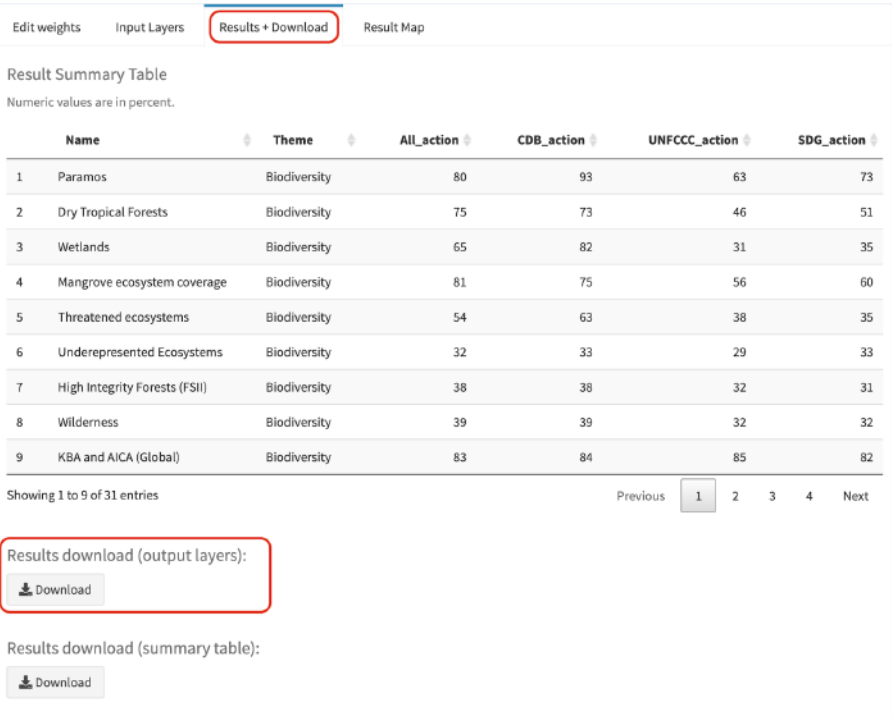


FIGURE 11 | Download output layers





A.2 Glossary

Action Map

In the ELSA process, action maps show the optimal locations where action should be taken to best contribute to achieving a country’s priority policy targets. An action map that integrates all planning features across a country’s 10 priority policy targets can also be called an ELSA map. However, it is also possible to create action maps that focus on specific themes, such as biodiversity, climate change action and human-well being.

Area-based target

An area-based target is the maximum land area (expressed as percentage of total country land area) that can be allocated to a zone and its nature-based action, such as protection, management, and restoration. During the ELSA process, countries must define their area-based targets related to each of the nature-based actions that they include in their map. If stakeholders determine that the ELSA map should allocate five percent of land to sustainable agriculture, the analysis will produce a map that meets but does not exceed that percentage.

Boundary penalty factor

Used in spatial optimization analyses, the boundary penalty factor is one of the criteria used to select the optimal ELSA map, also known as the optimal solution to the Systematic Conservation Planning (SCP) problem. This penalty is applied to each of the areas selected for protection, management, restoration, or urban greening within each potential ELSA map, based on the total length of the exterior boundary of the area. By penalizing solutions with longer boundaries, the boundary penalty factor can be used to promote spatial cohesion or clumping of areas selected for protection, restoration, and management in the resulting optimal ELSA map. This may be preferred by national stakeholders as contiguous areas can be easier and less expensive to maintain than a series of small areas spread across a landscape. Furthermore, large, more contiguous areas can often safeguard important natural processes and habitats better than small areas.

Coordinate reference system

This spatial reference system uses coordinates to define how a two-dimensional, projected map is related to real locations on the surface of the Earth. All data layers used in the ELSA analysis must use the same coordinate reference system in order to be able to be used together.

Calibration analysis

When building the ELSA problem formulation, a calibration analysis is used to ensure that the data layers representing the country’s priority policy targets have similar ‘representation’ when used together to create the ELSA map. The calibration analysis will show the science team which of these data layers, also known as planning features, will need to have more or less weight so that one doesn’t overshadow another in the final map. This initial calibration sets the stage for the second stakeholder consultation, where national experts will have the opportunity to further adjust these weights if they deem that one planning feature should have more representation or impact on the final ELSA map.

Constraints

In spatial optimization analyses, constraints can be used to ensure that the optimization results exhibit specific characteristics. When running the ELSA analysis, the most common constraints include spatial constraints for zones and lock-in constraints. These constraints define where ELSAs can and cannot occur. See these entries for more information.

ELSAs

ELSAs (Essential Life Support Areas) are places where nature-based actions can sustain critical benefits important to a country, including food and water security, sustainable livelihoods, disaster risk reduction, and carbon sequestration. By protecting, managing, and restoring ELSAs, countries deliver across multiple policy goals at once for people and for the planet.

ELSA analysis

The ELSA analysis refers to the spatial optimization process that occurs in the preparation and application of the ELSA webtool to create ELSA maps. The backbone of the ELSA project, this analysis uses an SCP approach to identify where nature-based actions to protect, manage, and restore nature can lead to the best outcomes across the country’s 10 priority policy targets.

ELSA core team

In this workbook, the term ‘ELSA core team’ is used to describe the group that oversees the implementation of the project in a country. This group usually includes representatives from the Ministry of Environment and the UNDP Country Office, in addition to a knowledge management and capacity building specialist and a spatial data specialist. The ELSA core team also includes members from UNDP Global Programme on Nature for Development who provide project guidance based on their experience with previous ELSA countries. The ELSA core team meets on a regular basis, usually weekly or bi-monthly, especially in the weeks before project consultations to procure permissions, prepare materials, and communicate with stakeholders.

ELSA maps

Also called ‘Maps of Hope’, these maps show areas that should be prioritized in order to most efficiently deliver across countries’ top policy targets on biodiversity, climate change adaptation, and human well-being. Co-created through a comprehensive stakeholder consultation process that brings together experts across sectors, ELSA maps reflect the national policy context and nature-related goals. Countries are using these maps to harmonize nature and development policies and prioritize areas for protection, management, and restoration.

ELSA science team

In this workbook, the term ‘ELSA science team’ is used to describe the group of global experts that have developed the methodology behind the ELSA analysis and support countries to use this methodology to create their ELSA maps. During consultations, the ELSA science team will lead national experts through a series of exercises

to develop the parameters for their ELSA analysis and develop the final map.

ELSA webtool

The ELSA webtool is an interactive online webpage that generates ELSA maps based on the country’s targets for nature, climate change, and sustainable development. The webtool is easy to use for people who are not spatial data experts, with no coding or modeling skills required. As the webtool runs optimizations quickly (typically in three to five minutes), it can be used to generate and refine ELSA maps in real-time during stakeholder meetings, and contribute to a more transparent, inclusive, and defensible decision-making process.

Data hackathon

After stakeholders select the 10 priority policy targets related to nature, climate, and sustainable development during the policy hackathon, they work together during a data hackathon to begin to identify spatial datasets that can be used to represent each of these targets. For example, a goal to expand protected areas could be represented through a combination of data layers, including Key Biodiversity Areas, threatened species habitat, species richness, threatened ecosystems, and internationally important wetlands, among others depending on the national context. During the hackathon, the stakeholders will also discuss useful data that could be used to map zones for nature-based action (usually protection, management, and restoration). After the consultation, the ELSA core team then uses this information to begin collecting data.

Data stack

A country’s data stack is the compilation of data that they use to create their ELSA map. Every country’s data stack is different, composed of a unique mix of national and global data based on the policy priorities and national context. However, data stacks must always include data that can: (1) serve as a proxy for the country’s priority policy targets; (2) constrain the zones where each nature-based action can take place; and (3) create lock-in constraints for areas that must be included in the final map, such as protected areas.



Decision support system

Decision support systems are computer-based programs that assess large amounts of information and identify the best possible solutions given the constraints of the analysis. Decision support systems are only as accurate as the data presented to them and so therefore should be used in tandem with expert consultation and research in order to come to final decisions. Spatial optimization tools like the ELSA webtool are a type of decision support system.

GIS

GIS (Geographic Information Systems) are computer-based systems that support the capture, storage, management, analysis, and presentation of spatial data.

Global UNDP team: In this workbook, this term refers to members from the United Development programme (UNDP) Global Programme on Nature for Development who support the ELSA project. It includes members of the ELSA science team and project other experts.

Heat maps

The heat maps identify the distribution of ecological values that support the country’s 10 priority targets. They are the result of the intersection of the planning features and their respective weights. The higher the value on a range from zero to one, the more features of high weight overlap. The resulting map shows a gradient across the country from areas that contain the highest number of planning features by weight to areas that have no planning features, or planning features weighted as zero. Heat maps can show overall areas of importance for biodiversity, climate change, or human well-being in the country, or all three values in a singular map.

Impact scores

Impact scores refer to numerical values that indicate the degree to which each nature-based action contributes to achieving representation of each planning feature, and by proxy, the country’s priority policy target related to that planning feature. For instance, the nature-based action of sustainable management contributes strongly to achieving planning features related to agricultural production but would not contribute as strongly to

planning features related to ecosystem integrity. The ELSA science team determines the most appropriate impact scores for the customized ELSA analysis based on the country’s policy targets, planning features, and definitions of each nature-based action. The impact score is the key parameter in the optimization that links the nature-based actions to the planning features, and by proxy to the policy targets, in the optimization.

Integer linear programming

Integer linear programming is a mode of data analysis implemented by prioritizr that expresses the optimization of a linear function (i.e., achieving the best representation for the planning features used to map the national priority targets) subject to a set of linear constraints over integer variables, or, in this case, the unit and area constraints to define the optimal areas for protection, restoration, and management.<sup>2</sup>

Integrated spatial planning

Integrated spatial planning applies a whole-of-government approach to create land use maps that show pathways to achieving multiple diverse outcomes at once, including goals around nature, climate, and sustainable development. These maps can help to solve complex development issues by revealing where nature-based actions, like the protection, management, and restoration of land, could propel a country toward its national development targets. The project Mapping Nature for People and Planet supports countries to create ‘Maps of Hope’ based on the principles of integrated spatial planning.

Lock-in constraints

Lock-in constraints ensure that specific areas are always assigned to a specific nature-based action within the ELSA map. Typically, lock-in constraints are used to make sure that a country’s existing protected areas are included within the ‘protect’ zone in the final ELSA map. Some countries also request other areas be locked in, such as areas where restoration is currently occurring. Because lock-in constraints force the optimization process to include these areas, it can reduce the overall representation of planning features in the final map. The ELSA science team therefore recommends that lock-in constraints are used only where required to reflect

current conservation actions within a country, ensuring that national stakeholders can effectively use the resulting map.

Management

This nature-based action is typically understood as the adoption of sustainable practices to minimize land degradation in agricultural areas, including sustainable livestock management and the integration of trees into farmlands. However, countries may choose to use a different definition when setting up their ELSA analysis. ELSA maps show areas where sustainable land management, along with protection and restoration, can help the country achieve its goals related to nature, climate, and sustainable development.

Map of Hope

See ELSA map.

Maximum utility objective function

The maximum utility objective function is a type of problem formulation for SCP that maximizes the overall expected amount of the planning features represented in each of the zones, weighted by their relative importance and the impacts that each zone has on each feature. In simpler terms, this approach identifies where each nature-based action (protection, management, or restoration) should be taken based on the area-based targets, the data stack, and several additional parameters developed by the ELSA science team in partnership with national stakeholders. The maximum utility objective function is used in the ELSA analysis because most countries have clear area-based targets for nature-based actions (e.g., protect 30 percent of land areas) but lack clear targets for planning features, which would be needed to use the more typical SCP ‘minimum set objective function’. While clear targets do exist for some biodiversity planning features, there is almost no basis to derive through policy or science clear targets for planning features related to human well-being used by ELSA (e.g., clean water provision, inclusion of Indigenous lands).

Minimum set objective function

The minimum set objective function is a problem formulation that minimizes resources expended, subject to

the constraint that all features meet their conservation target. The maximum utility objective function is used in the ELSA analysis rather than the minimum set because countries tend to have clearer targets for nature-based actions rather than planning features.

Nature-based actions

ELSA maps usually indicate areas where three distinct types of nature-based actions could occur: environmental protection, management, and restoration. These nature-based actions are defined by the countries during stakeholder consultations as protection, management and restoration have disparate meanings in different countries. Countries can also include additional nature-based actions in their ELSA analysis, including actions such as urban greening and urban adaptation to climate change. ELSA maps identify areas where each of these nature-based actions could be taken to achieve the country’s policy targets.

Nature-based action zones

Nature-based action zones are spatially defined areas where each nature-based action (often protection, management, and restoration) can be implemented according to the land capacity and political zoning of the country. These zones are created based on “rules”, or constraints, that help the algorithm to identify viable locations for each action. The ELSA analysis optimizes across these zones, along with the planning features, lock-in constraints, and additional parameters, to identify ELSAs.

Optimization

Optimization is the calculation run on the ELSA webtool that determines the optimal solution to the ELSA problem based on the input parameters and data stack. The resulting ELSA map identifies areas where protection, management, or restoration can best contribute to achieving a country’s 10 priority policy targets.

Planning area

The planning area is the geographic area analyzed in the ELSA analysis. Usually, the planning area is the entire country, although some countries chose to focus on smaller planning areas, such as a State or region.



Planning areas can be divided into discrete areas called planning units.

**Planning features**

Planning features are datasets that are used alone or together to serve as proxies for the country’s priority policy targets on the ELSA map. For example, a policy target for biodiversity might be mapped using planning features such as ecosystem connectivity and integrity, threatened species distribution, species richness, and Key Biodiversity Areas.

**Planning units**

Planning units are the building blocks of an ELSA map. The planning area is divided into planning units, which are smaller geographic parcels of regular or irregular shapes, including squares, hexagons, cadastral parcels and hydrological units.

**Projections**

Used in spatial planning, projections portray the surface of the Earth on a two-dimensional, flat piece of paper or computer screen.

**Policy hackathon**

During the first stakeholder consultation, the project team brings together diverse stakeholders to review the results of the rapid policy analysis and identify targets to be the foundation of the ELSA map. After being briefed on the goals of the project and the results of the rapid policy analysis, the stakeholders must select around 10 priority policy targets that together can summarize the country’s policy priorities related to nature, climate, and sustainable development.

**prioritizr**

Spelled with a lower-case p, the prioritizr software package is a spatial optimization tool used by the ELSA methodology to run spatial optimization analyses. The prioritizr package implements integer linear programming techniques to provide a flexible interface for building and solving conservation planning problems. It supports a broad range of objectives, constraints, and penalties to create a tailored ELSA analysis.

**Priority policy targets**

Priority policy targets are a country’s 10 most important targets related to nature, climate, and sustainable development. During the policy hackathon, national experts select these targets for their ability to summarize the country’s nature-based ambitions. The identification of priority policy targets is an important step in the ELSA process as the final map will display areas where nature can be protected, managed, and restored to achieve these specific targets.

**Protection**

This nature-based action often is defined as the introduction of land use restrictions to limit the exploitation of land resources by humans. The most common form of restriction is protected areas, although other effective area-based conservation measures also fall under the protection category in this analysis. However, countries may choose to use a different definition when setting up the parameters for their ELSA analysis. ELSA maps show areas where protection, in addition to management and restoration, can help the country achieve its goals related to nature, climate, and sustainable development.

**Rapid policy analysis**

Conducted by the ELSA core team, the rapid policy analysis identifies mappable policy targets related to nature, climate, and sustainable development across the country’s leading policy documents. This rapid policy analysis will provide the basis for the policy hackathon where national experts prioritize 10 of these targets for use in the ELSA analysis.

**Raster data**

Raster data is spatial data made of pixels, usually regularly spaced and square, where each pixel has its own value or class. Similar to a digital photograph, the quality of data will break down when zoomed in.

**Representation score**

In SCP, a representative score captures a full range of planning features (species, ecosystems, and ecosystem services) occurring within the planning region, not just iconic species. In the ELSA analysis, the representation

score is used to measure how well the ELSA areas capture or represent planning features relative to a more directed planning approach focused only on biodiversity, climate change, or human well-being.

**Restoration**

This nature-based action often is defined as the regeneration of degraded or fragile ecosystems, including wetlands and mountainous areas. However, countries may choose to use a different definition when setting up the parameters for their ELSA analysis. ELSA maps show areas where sustainable management, along with protection and restoration, can help the country achieve its goals related to nature, climate, and sustainable development.

**Spatial data**

Sometimes referred to as geospatial data or geospatial information, spatial data provides information on the location of features through time and space.

**Spatial optimization tools**

Spatial optimization tools provide a simple calculation that can identify the optimal area to conserve based on the end goal and any financial or political constraints. Through the ELSA process, countries build their own spatial optimization tool called the ELSA webtool.

**Systematic Conservation Planning**

SCP is a participatory method for identifying potential areas for conservation management to most efficiently achieve a specific set of objectives. SCP typically involves a scoping process, participatory planning and stakeholder consultations, selection of new conservation areas using spatial optimization software and the implementation and monitoring of new strategies. The effectiveness of SCP stems from its ability to make the best use of limited resources toward achieving conservation goals and do so in a manner that is defensible, accountable, and transparently recognizes the requirements of different resource users. The ELSA process builds on the SCP method by enabling countries to identify possible areas for more than one type of nature-based action, not just conservation.

**Trade-off score**

The trade-off score is calculated by comparing the degree to which each planning feature is represented in the ELSA map, compared to how well it is represented under a targeted planning scenario. In cases where the ELSA map represents substantially less of a given feature than the more targeted scenario (typically identified as 80 percent or less), the ELSA science team works with national stakeholders to determine if they should increase the weight of the given planning feature.

**The UN 2030 Agenda for Sustainable Development**

A plan of action adopted by all United Nations Member States in 2015, which provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 SDGs, which are an urgent call for action by all countries - developed and developing - in a global partnership.

**UNBL**

UN Biodiversity Lab (UNBL) is a free, open-source platform that enables governments and others to access state-of-the-art maps and data on nature, climate change, and human development in new ways to generate insight for nature and sustainable development. Developed jointly by UNDP, United Nations Environment Programme (UNEP), United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), and Convention on Biological Diversity (CBD), UNBL is freely available online to governments and other stakeholders as a digital public good. With over 400 of the world’s best data layers on nature, climate change, and sustainable development, UNBL enables policymakers and other stakeholders to use spatial data to take action for people and the planet. UNBL can be accessed at [www.unbiodiversitylab.org](http://www.unbiodiversitylab.org).

**UNBL workspaces**

UNBL can play a core support role in the implementation and long-term monitoring of the ELSA project. The platform offers free workspaces to ELSA countries who need a secure area to access and use the ELSA map, in addition to other national and global maps. The workspaces can serve as a common data repository, offer a collaborative work environment, and enable countries



to calculate dynamic indicators for a subnational or transboundary area of interest. They offer a secure area to visualize and explore data regardless of Geographic Information System (GIS) experience.

Urban greening

Urban greening is usually defined as ecological restoration and reforestation in urban areas that increase carbon sequestration, reduce urban heating, and/or provide protection from extreme weather phenomena. If a country wishes, they can include urban greening in their ELSA analysis so that maps show where urban greening can contribute to national policy targets, along with other nature-based actions.

Vector data

Vector data is spatial data composed of vertices and paths, including points, lines, and polygons (among these, only polygons can be used in the ELSA process). Unlike raster data, no matter how far you zoom in, vector data will maintain its same clarity.

Weights

Weights are a way to prioritize some planning features over others in the ELSA analysis. Through a stakeholder engagement process, national experts assign weights to each of the planning features to reflect the comparative importance of that planning feature and the confidence that they have in its accuracy. Values are relative and typically range from ‘0’ (no importance) to ‘5’ (extremely high importance). Planning features with a weight of 5, for example, will be prioritized over features with a weight of 3 in the ELSA map. Planning features with a score of zero will not be considered in the analysis.

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## Endnotes

- 1    Designed by Dr. Oscar Venter at University of Northern British Columbia and Dr. Richard Schuster at Carleton University.
- 2    IBM (2021). What is integer programming? Retrieved August 2022 from <https://www.ibm.com/docs/en/icos/12.8.0.0?topic=problem-what-is-integer-programming>



