Mainstreaming of Natural Capital and Biodiversity into Planning and Decision-Making:

Cases from Latin America and the Caribbean

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ACRONYMS

CAFE	Consortium of African Funds for the Environment
CBFM	Community-based fisheries management
CCCRA	CARIBSAVE Climate Change Risk Atlas
CSA	Cuenta Satélite Ambiental
CTF	Conservation Trust Funds
EBA	Ecosystem-Based Adaptation
ECLAC	Economic Commission for Latin America and the Caribbean
ESMR	Environmental and Social Management Report
FAO	United Nations Food and Agriculture Organization
GDP	Gross domestic product
GEF	Global Environment Facility
GGGI	Global Green Growth Institute
ICZM	Integrated Coastal Zone Management
IDB	Inter-American Development Bank
IIED	International Institute for Environment and Development
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
ISPS	Intensive Silvopastoral Systems
IUCN	International Union for Conservation of Nature
LAC	Latin American and Caribbean
MAR	Mesoamerican Reef
NAMA	Nationally Appropriate Mitigation Actions
NBS	Nature-Based Solutions
NCAVES	Natural Capital Accounting and Valuation of Ecosystem Services
NCEA	Natural Capital and Ecosystem Accounting
NGO	Non-governmental organizations
PA	Protected Areas
PADDD	Protected Area Downgrading, Downsizing, and Degazettement
PES	Payment for Ecosystem Services
PNGIBSE	Para la Gestión Integral de la biodiversidad y sus Servicios Ecosistémicos
PSA	Por servicios ambientales en América
REDD	Reducing emissions from deforestation and forest degradation
RFF	Resources for the Future
SEEA	System of Environmental Economic Accounting
SSF	Small-scale fisheries
WAVES	Wealth Accounting and Valuation of Ecosystem Services

ABSTRACT

The Latin American and Caribbean (LAC) region enjoys an exuberant natural wealth; with 16 percent of the planet's land, the region is home to 40 percent of the world's biological diversity. This report investigates and provides a good overview of the region's efforts to mainstream natural capital and biodiversity concerns into public policy. It also provides a series of policy tools and instruments: payments for ecosystems services, innovation in managing protected areas, conservation trust funds, nature-based solutions for infrastructure, small-scale sustainable fisheries management, natural capital and ecosystem accounting, and ecosystem-based adaptation in agriculture. Two key lessons emerge from this report. First, mainstreaming natural capital and biodiversity considerations into day-to-day activities inevitably requires the involvement of multiple stakeholders (from communities to private firms) that should become central players in constructing and governing LAC's natural wealth. Still, all the tools described in this report share a common feature: strong endorsement and support from government institutions, well beyond environmental authorities. Second, the lessons derived from policy tools with a longer history are evidence of the constant political, financial, and technical challenges faced by these policies for long-term sustainability. Although some of the policy tools described in this report have a long history, none of them can take their survival for granted. Solving the financial and technical challenges is typically the only functioning strategy to deal with political issues. The report suggests a series of key enabling conditions that facilitate mainstreaming natural capital and biodiversity considerations into public policy.

1 OVERVIEW AND OBJECTIVES

Biodiversity is the support system of life itself. In more formal economic terms, biodiversity is essential to maintain the functions and services of the ecosystem that sustain human well-being, such as food and water, energy, medicine, and cultural spaces (Ruijs and Vardon, 2018; IPBES, 2019). Latin America and the Caribbean (LAC) is home to more than 40 percent of world's biodiversity, half of the tropical forests, 12 percent of the mangrove forests, and six of the mega-diverse countries (UNEP-WCMC, 2016).

Unfortunately, ecosystems worldwide, and LAC is no exception, are threatened by human actions (Díaz et al., 2019). Many of the drivers that threaten biodiversity and ecosystem services are related to market failures that stem from an inadequate perception and valuation of the contribution of biodiversity to human welfare, as well as missing policies or perverse incentives. The resulting patterns of production and consumption in turn threaten the very foundation of the economic system—providing ecosystem functions and services. To break this cycle and achieve long-term prosperity, the goals of economic growth and the protection of biodiversity and natural capital must be aligned: trade-offs should be minimized and synergies encouraged. In the past couple of decades, conservationists and international organizations have developed and actively supported a new conservation paradigm, **biodiversity mainstreaming**, the objective of which is integrating and embedding biodiversity values into policies, strategies, and practices of public and private actors as a means of promoting conservation and sustainable use of natural resources (Huntley and Redford, 2014; Whitehorn et al., 2019).

The LAC region has been making progress in mainstreaming biodiversity into policies and public planning through several initiatives. This report presents a synthetic overview of some of the most important policy tools and approaches that have been used in the region over the past two decades in order to incorporate natural capital and biodiversity into economic development planning and national budgeting. It summarizes successful experiences across different sectors of the economy, highlighting the active involvement of stakeholders beyond the traditional confinement of government institutions in charge of environmental issues. In addition, the report presents a summary of the most important challenges to the long-term sustainability and the scaling-up and scaling-out of these initiatives.

Given the very nature of this report, the selection of policies is eclectic, and we do not attempt to be exhaustive in terms of coverage. We focus on describing and briefly analyzing the use and effectiveness of the selected policies, programs, or instruments in LAC as a whole, without going deep into a particular country. However, we offer a country focus whenever it helps illustrate regional differences in policy implementation and effectiveness. The three appendices to this report provide an opportunity to describe more deeply some of the policies that are particularly relevant in the LAC context at a more focused country level.

The following policies and approaches for mainstreaming biodiversity in LAC are presented in this report:

1. **Protected Areas (PAs):** The percentage of PAs in the region is above the worldwide average (Blackman et al., 2014; UNEP-WCMC, 2016), making this tool the main policy instrument for biodiversity conservation in LAC. Interestingly, many of the governments in

LAC have realized the limitations of the traditional PA model, administered and financed only by central governments and with few possibilities for the sustainable legal use of natural capital. Therefore, various stakeholders have sought alternative models of shared management and multiple uses, in which the participation of the private sector, indigenous communities, and other local actors plays a key role in effective and well-funded PAs.

2. **Payment for Ecosystem Services (PES):** The LAC region has been a pioneer in implementing PES schemes, with several large-scale programs, such as those in Mexico and Costa Rica (Alix-Garcia et al., 2012; Pattanayak et al., 2010). Despite significant advances in consolidating many PES programs in the region, there are still important challenges to overcome to consolidate this policy tool. For instance, measuring the impacts of these schemes on biodiversity and ecosystem services has not been carefully assessed, limiting stronger support (Huntley and Redford, 2014; OECD, 2018; Porras et al., 2013). Similarly, financial aspects pose limitations for further expansion. Generally funded through government and international funds, PES programs are vulnerable to political priorities and macroeconomic conditions. Nevertheless, some schemes are transitioning to a more diverse financial base by using tools such as matching funds with local entities and endowment funds (FAO, 2013; Huntley and Redford, 2014).
3. **Nature-Based Solutions (NBSs) for Infrastructure:** There is increasing demand for gray infrastructure such as roads, bridges, water supply, sewers, electrical grids, and telecommunications in the region. At the same time, there is strong acknowledgment of the importance of the role that nature can play in supporting gray infrastructure or as infrastructure in and of itself. Ecosystems such as forests, wetlands, and mangroves provide important benefits by protecting roads from natural hazards such as landslides and flooding, and by reducing deterioration by protecting against erosion (Mandle et al., 2016; WWAP, 2018). Nature can also provide coastal protection, act as a filter for wastewater, improve water quality, stabilize water quantity, and more. Examples in LAC demonstrate how innovative approaches are incorporating NBSs as part of regular infrastructure planning in collaboration with various stakeholders.
4. **Conservation Trust Funds (CTFs):** Worldwide, the LAC region is the major recipient of international biodiversity financing. Still, funding remains insufficient for the challenges faced and needs to be scaled up. Various regional and national funds have been created in order to better channel domestic and international financing for biodiversity (OECD, 2018). CTFs operate at both the regional and national level using diverse financing mechanisms. They are designed to mobilize funds from a range of sectors, thereby initiating and strengthening inter-sectoral collaboration. Biodiversity conservation needs to evolve to be more technically and financially sophisticated, thereby attracting a larger and more varied pool of donors and producing more effective investments in conservation. CTFs bridge the gap to technical effectiveness and financial transparency in managing funds for conservation, both prerequisites for mainstreaming biodiversity and natural capital.
5. **Small-Scale Sustainable Fisheries Management:** Experiences with fisheries management strategies worldwide indicate that allocation of rights to fishing communities and

their strong participation in management is crucial to improve sustainability (Gutiérrez et al., 2011). Community-based fisheries management (CBFM) gives communities leading responsibility for managing fishing in their community. These programs started to gain ground in LAC because of the need to protect small-scale fisheries from overexploitation and ecosystem degradation, and the lack of efficient government measures. LAC is at the forefront of implementing CBFM programs and provides a wide range of successful experiences and best practices to achieve the Aichi Targets (Leadley et al., 2014) and the Sustainable Development Goals (SDGs) (UN, 2019).

6. **Natural Capital and Ecosystem Accounting (NCEA):** Over the past decade, NCEA has gained relevance as a mechanism to inform decision-making processes and formulate public policy in LAC countries. NCEA, together with other international statistics standards, allow relevant questions concerning biodiversity to be answered, including topics such as status and trends, synergies and trade-offs, and policy responses. As such, NCEA constitutes a basic building block to mainstream biodiversity and natural capital into public policies and strategies. Natural capital represents an average of 18 percent of the total wealth of LAC, compared to the world average of 9 percent. Acknowledging the relevance of accounting for the share of overall wealth that comes from natural resources, LAC has insightful examples of countries that have successfully institutionalized environmental accounting.
7. **Ecosystem-Based Adaptation (EBA) in Agriculture:** The expansion of the agricultural sector continues to be the main driver of deforestation and land-use change (FAO, 2018), with agricultural lands currently covering 38 percent of LAC territory (OECD/FAO, 2019). Trends in population growth indicate the need to improve food production systems to satisfy future demand. However, climate change threatens the capacity of these systems to fulfill these urgent necessities. As a response to these challenges, EBA practices have proven to be effective at tackling biodiversity conservation and adaptation to climate change while also supporting farmer livelihoods.

To gain further understanding and capture the complex nuances of implementing these policies and approaches, the report also provides a deeper overview of three of the policy tools mentioned above by providing a more detailed description of three illustrative cases:

1. **PES in Costa Rica:** Costa Rica has a long-standing tradition of innovation in policy instruments for environmental management. This nation is globally recognized as one of the pioneer countries implementing PES since 1997. The PES scheme was deployed as part of an innovative blend of economic and regulatory instruments to manage the environment. It provides a valuable source of inspiration for other countries that are looking for effective ways to preserve and regenerate ecosystems. As such, the Costa Rican experience with PES carries significant potential for South–South learning.
2. **Mainstreaming Biodiversity in Colombia:** Colombia is listed as one of the world's mega-diverse countries, hosting nearly 10 percent of the planet's biodiversity (CBD, 2020). Recently, it has been promoting ambitious initiatives to mainstream biodiversity into public policies and private businesses that historically have been opposed to policies

and programs to conserve biodiversity (BIOFIN, 2016). In fact, Colombia is now considered one of the more experienced countries in biodiversity mainstreaming projects (GEF, 2019). The process of biodiversity mainstreaming in Colombia is interesting because it shows a country-wide, systemic effort to generate a comprehensive policy framework guiding specific plans and government strategies for the sustainable use of biodiversity, while also promoting the active engagement of stakeholders at different levels.

3. **Sustainable Infrastructure Framework applied to Andros Island, Bahamas:** Although awareness of the role that ecosystems play in shielding coastal communities from climatic events has recently increased significantly due to major catastrophic hurricanes, the implementation of nature-based approaches is still quite limited as a protective mechanism against these disasters (Arkema et al., 2017). Andros Island, Bahamas, is a notable exception, having developed sustainable infrastructure services that incorporate natural capital. The crux of this innovative approach is the creation of a national cross-sectoral planning framework and the development of a Sustainable Development Master Plan specifically tailored for Andros, driven by a stakeholder-led process, and informed by sound scientific advice. The lessons from this case are particularly useful for small island developing states aiming to develop similar processes, including natural capital as a key asset for sustainable development in the face of climate change.

To facilitate comparison, all policies, programs, and initiatives (from here on referred to as policies unless referring to a specific program, policy, or initiative) in this report are analyzed following a common structure. We provide a short summary of the policy, justifying its inclusion in this report because of its relevance in mainstreaming natural capital and biodiversity in LAC. Whenever needed, clear and concise definitions are provided at the very start. We stress the importance of the policy for the LAC region. A particularly interesting part of the description is the identification of significant regional variations in the use of the policy in LAC.

For the purpose of exploring whether a policy can be replicated elsewhere, it is important to understand several of its key elements. For example, it is important to analyze whether the scale of implementation is local, federal, or national. If the policy has been applied at all levels, we describe how it was adapted to each scale. Another key aspect of the policy is its stakeholders. We describe the kind of actors typically behind the policies as leaders and/or implementers. Is it mostly a government-driven program (like PES in Costa Rica) or is there substantial civil society involvement? What is the role of the local government? What is the role of the private sector? What is the role of the affected communities? Importantly, whenever relevant, we provide a brief description of the interaction (direct or indirect) between government institutions with an environmental mandate (e.g., ministry of the environment) and other government, but non-environmental, entities (e.g., ministry of finance). We explore whether policies allow natural capital and biodiversity to be mainstreamed beyond the mandate of environmental authorities.

We also try to provide insights regarding the effectiveness of policies targeting natural capital and biodiversity. The impact of a given policy is frequently hard to establish. Credible evidence of the effectiveness of such policies is not only scarce, but frequently misleading as it is based on limited data and inadequate controls. The inadequate control is frequently the result of broad policy design that makes suitable controls hard to establish (Blackman et al., 2014). Inas-

much as possible, we describe the observed or expected effectiveness of each policy, focusing on its main target outcome. In addition, policies are frequently designed with indirect outcomes in mind or with the specific intention of avoiding negative indirect outcomes that could jeopardize the future sustainability of the policy itself. Whenever possible, we describe indirect outcomes, like income, employment, CO_2 mitigation, adaptation to climate change, and health.

Ultimately, policies deployed with the objective of mainstreaming natural capital and biodiversity into investment decisions, new infrastructure, and markets could inevitably have consequences for the broader economy. For example, the decision to implement a natural resource accounting framework as part of the regular national accounts of countries in LAC entails a commitment to information-based planning for the future, paying attention to the impact of decisions on natural capital.

In terms of the replicability of each of the policies in other conditions or on different scales, it is important to first understand the key enabling conditions for deploying the policies studied. We ask whether the policy can be used in other countries or settings. For instance, secure property rights are needed for PES and promoting agroforestry systems or capital investments would require accessible sources of funding from the private sector.

The goal of mainstreaming natural capital and biodiversity is to achieve predictable and sufficient resources, as opposed to short-term, limited, and opportunistic funding from environmental agencies. The analysis explores the financial and political sustainability of the policies discussed in the report. To conclude, we revisit the description of the practices and ask what makes LAC a pioneer or innovator in implementing the policy and what particular features can be learned from the LAC experience.

2 EXAMPLES OF GOOD PRACTICES FOR MAINSTREAMING

2.1 Payment for Ecosystem Services: Achievements and Challenges Ahead

PES is a complex, multi-goal, market-oriented policy tool that provides economic incentives to providers (e.g., farmers and forest owners) of ecosystem services. Incentives are conditional on agreed rules for service provision, such as restrictions on land management (Alpízar and Madrigal, 2017; Persson and Alpízar, 2013; Wunder, 2015). In the 1990s, PES schemes emerged as part of forest conservation initiatives in LAC as an alternative, or a complement, to traditional command and control approaches (e.g., government-protected areas). LAC hosts some of best-known large-scale programs, such as national PES schemes in Costa Rica and Mexico (Alix-Garcia et al., 2012; Pattanayak et al., 2010). Despite the leadership role of central governments in these programs, many PES schemes in LAC have been developed at local levels with the participation of various stakeholders, such as private and public companies, and municipalities, among others. Nevertheless, central governments have been responsible for creating the legal and political conditions necessary to enable their deployment.

Looking ahead, many PES schemes have to go beyond evaluating their impact on forest coverage to demonstrate more robust and quantitative evidence of their effect on providing ecosystem services (Börner et al., 2017). Moreover, some programs need to ensure their long-term financial sustainability (Fehse, 2012; Kim et al., 2016) and improve targeting criteria to include areas with the most potential to provide additional ecosystem services (Engel, 2016). This section reports on the milestones of PES in LAC, highlighting achievements of some of the most recognized programs and discussing their main challenges. We conclude with some insights to replicate PES schemes and use this tool to effectively mainstream biodiversity into public policy.

In the past two decades, the number of PES schemes has significantly increased; currently there are around 550 PES programs worldwide (Salzman et al., 2018) and approximately half of these are being implemented in LAC (UNEP-WCMC, 2016). This large number of PES programs encompasses great diversity in the degree of conditionality on payments, the type of intermediary administering the scheme, the sources of income, the ecosystem services prioritized, the amount of payments, and the length of contracts, among other critical features (Wunder et al., 2018). A first key lesson has emerged from this diversity of PES designs: the effective and sustained achievement of environmental and social outcomes resulting from a PES scheme is very sensitive to key elements in the design. Small changes in PES design can result in no identifiable outcome or, alternately, in a very successful program (Lundberg et al., 2018; Alpízar et al., 2017; Nordén et al., 2012). This was predicted by much of the early literature on PES, which drew from previous experience with market-based instruments for environmental regulation (Jack et al., 2008; Zilberman and Segerson, 2012; Jack et al., 2008).

PES programs have targeted various ecosystem services and biodiversity goals, although there is a tendency to focus on services related to providing water. PES schemes exclusively focused on biodiversity and habitat loss are the least developed in LAC and they face various implementation challenges, such as the widespread nature of their beneficiaries, a lack of intermediaries (e.g., actors playing the role of utility companies to collect water fees), and a lack of common met-

rics to measure goals (Salzman et al., 2018). As a response to these problems, wetland and stream mitigation programs provide low-cost metrics, though their accuracy is still contested (Salzman et al., 2018).

Worldwide, from a population of 550 PES schemes (Salzman et al., 2018), there are currently 120 biodiversity and habitat PES programs, mostly financed by offset mechanisms responding to the need for compliance with regulatory obligations. These types of PES operate predominantly in Europe, the United States, and Asia. Nonetheless, PES schemes focused on watershed and carbon sequestrations can positively impact the achievement of biodiversity goals by avoiding habitat loss and degradation, especially when payments are provided in areas with a high risk of biodiversity loss (OECD, 2010). Furthermore, it is worth mentioning that PES programs on a national scale in Mexico, Costa Rica, and Ecuador have specific criteria to allocate payments for biodiversity conservation. Some programs (as in Costa Rica) target multiple ecosystem services and biodiversity by bundling or layering them, which can allow a broader range of benefits to be obtained through a fixed budget.

Another strand of diversity relates to the scale of implementation of PES. PES schemes have been implemented at the (i) national level in Colombia,[1] Costa Rica,[2] Ecuador,[3] Mexico,[4] and Peru[5]; (ii) regional (or subnational) level (e.g., in the Brazilian states of Amazonas and Acre), supported by state legislation (Duchelle et al., 2014; Kim- Bakkegaard and Wunder, 2014); and (iii) local level, representing the vast majority of LAC programs implemented in several countries (Madrigal and Alpízar, 2008; Porras et al., 2008; Grima et al., 2016).

Central national and subnational governments are the key stakeholders when it comes to creating and administering national and subnational schemes, but indirectly they also have an influence on local schemes by developing enabling conditions for their operation (e.g., strengthening land property rights). International organizations (e.g., multilateral donors and banks) have played an important role as catalyzers, working directly with governments and local organizations, offering capacity building and financial support, and actively participating in designing and implementing PES programs.[6] Many of the PES programs that emerged at the local level focused on watershed protection. For instance, approximately 57 water funds (a PES-like mechanism) have been created in South America, encompassing a wide range of approaches for PES implementation and provider compensation (Salzman et al., 2018). Several other programs have emerged in the framework of reducing emissions from deforestation and forest degradation (REDD+) to reduce deforestation and forest degradation, such as the Suruí Carbon Project in Brazil, which intends to preserve and restore forested areas in the Suruí indigenous reserve (Charchalac Santay, 2012).

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1 https://www.finagro.com.co/productos-y-servicios/incentivo-forestal
2 http://www.fonafifo.go.cr/es/
3 https://www.ambiente.gob.ec/programa-socio-bosque/
4 https://www.gob.mx/conafor
5 http://www.minam.gob.pe/economia-y-financiamiento-ambiental/mecanismos-de-retribucion-por-servicios-ecosistemicos-mrse/
6 Entities such as GEF, GIZ, CBD, the Nature Conservancy, Conservation International, the World Bank, and the Inter-American Development Bank have been involved in developing PES schemes in various LAC countries.

A large share of PES schemes in LAC rely on local and national government budgets as well as international assistance (Grima et al., 2016). However, recently, PES schemes have been exploring options to diversify their financial base through innovative financial tools, such as matching funding, environmental funds, and public–private partnerships (CONAFOR and SEMARNAT, 2010; Herbert et al., 2010; Kim- Bakkegaard and Wunder, 2014; Kim et al., 2016; Porras and Chacón-Cascante, 2018; Salzman et al., 2018). Private sector participation has been more prominent when complementary policies create sustained demand for ecosystem services, such as caps on carbon emissions or requirements to offset biodiversity (Engel, 2016).

The private sector has typically assumed a secondary role in implementing PES schemes in LAC, although it has strong potential to finance these schemes as a key strategy to sustain its businesses. The most common cases so far relate to private companies that have vested interests in continuing to provide specific ecosystem services, such as water for hydroelectric companies and biodiversity conservation for ecotourism operators. Firms often get involved by voluntarily purchasing compensatory credits (e.g., Walt Disney and Natura Cosmetics [Gonzalez, 2013, 2015]), investing in funds (e.g., Bradesco's support of Bolsa Floresta, Brazil [Kim- Bakkegaard and Wunder, 2014]), or even in some cases by managing a PES scheme to provide water (e.g., *Empresa de Servicios Públicos de Heredia*, or ESPH, in Costa Rica). Last but not least, given the voluntary nature of PES programs, such mechanisms depend on the willingness of ecosystem service providers to participate. These stakeholders are typically individual or community land owners that can meet land titling requirements and engage in contractual relationships of five or 10 years. It is important to note that many PES schemes have designed or adapted enrollment criteria to ease the participation of indigenous and rural communities through lax land titling requirements in order to target more socially vulnerable areas (Kim et al., 2016; Engel, 2018).

Some of the most salient cases of PES in LAC are described in more detail below. We tried to highlight cases with biodiversity conservation goals, although they might have other priorities as well (Appendix 3 pays special attention to the pioneering and long-standing case of a Costa Rican PES program).

- ***PES in Mexico:*** Established in 2003 and administered by the Forestry National Commission (CONAFOR), the Mexican Payment for Hydrological Services Program (PSA) has since become the world's largest PES program, covering 3.25 million hectares throughout the country (OECD, 2018). The program focuses on providing hydrological environmental services and conserving biodiversity (INECC, 2015) through three different schemes: (i) the National (Federal) PES Program, funded by federal budgets; (ii) Local Mechanisms of PES, a matching fund program created in 2006 by CONAFOR, in which the federal government matches up to 50 percent of private funding to implement local schemes that benefit from the financing and operative capacities of local interested actors (e.g., companies, NGOs, and state and municipal governments) (CONAFOR and SEMARNAT, 2010); and (iii) the Biodiversity Endowment Fund, created in 2010 to provide long-term financing (i.e., more than 20 years) to conserve forest ecosystems that harbor globally significant biodiversity (Bauche, 2012; FAO, 2013). The overall program

has adapted its enrollment and targeting criteria to prioritize more socially vulnerable areas with a high risk of deforestation and habitat loss, using variables such as distance to the nearest town, slope, proximity of the agricultural frontier, location within Ramsar Sites or areas of bird conservation, biological corridors, and with a predominance of high evergreen forest (OECD, 2010; Sims et al., 2014; INECC, 2015).

- ***Monarca Trust Fund:*** In the early 2000s, the Monarca Trust Fund was established to offer economic incentives to farming organizations, indigenous communities, and private property owners in the core areas of the Monarch Butterfly Biosphere Reserve[7] in Michoacán, Mexico. These incentives reward the provision of hydrological ecosystem services and biodiversity conservation that contribute to maintaining the migratory phenomenon of the monarch butterfly. Together, the trust fund and the butterfly reserve command and control instruments (PAs) and a market-based tool (PES) in a context where Ejidos (a specifically Mexican type of community land rights) exist and communities live inside the riparian and buffer zones of PAs (Berger-Garcia, 2015). The fund is supported by an endowment created by the Packard Foundation; the Michoacán local government; the State of Mexico; and the Environment, Natural Resources, and Fishing Secretariat of Mexico (SEMARNAT) (Herbert et al., 2010). The PES initiative emerged after a conservation decree in 2000 prohibited all timber-based exploitation within the core area. This decree inevitably wiped out traditional livelihoods with no compensation, which would have led to illegal logging and hunting. While in the earlier years of this initiative (2000–12) deforestation and degradation were reduced (Berger-Garcia, 2015), more recently (2012–18) forest loss due to climate-related factors and illegal logging has again been recorded (Flores-Martínez et al., 2019).
- ***Socio Bosque Program in Ecuador:*** The Ecuadorian government established this nationwide program in 2008, aiming to protect four million hectares of forest (about 16 percent of the country's landmass) and seeking to reverse the high deforestation trends that the country was experiencing. Socio Bosque was designed to specifically support about one million people in the poorest communities; through 2016, the program had disbursed US$61 million through 2,800 agreements (20-year contracts) with forest landowners and communities, protecting roughly 1.5 million hectares that are monitored through satellite imagery (Initiative 20x20, 2020). The program is largely funded through the government's budget, but it is seeking to diversify its financial base through new taxes, compensatory payments from extraction activities, voluntary contributions, and REDD+ payments. Socio Bosque's design took advantage of pre-existing local PES initiatives, such as the PES scheme established in 2005 with Chachi indigenous communities in the Chocó region, as well as other national PES in Costa Rica and Mexico (Fehse, 2012).

PES programs face various challenges on their way to consolidation. The vast majority lack rigorous impact assessments and clear information about their effectiveness, while the studies that have been conducted have shown varying results (Engel, 2016; Karousakis, 2018; Salz-

[7] Areas where most monarch winter colonies occur (Flores-Martínez et al., 2019).

man et al., 2018). Despite the fact that the main goals of PES programs are to secure continued provision of ecosystem services in a specific area, most studies look solely at forest cover as an observed proxy to evaluate the impact of PES schemes (Börner et al., 2017; Karousakis, 2018). Few if any studies look at changes in the provision of ecosystem services as a result of the payments (i.e., biodiversity indices or additional volume of water available). It is worth mentioning that this problem also relates to the procedures for operational verification of compliance with PES contracts. These procedures tend to verify forest existence per hectare or the number of soil conservation practices implemented, but not the flow of ecosystem services generated from them.

Some salient rigorous studies on impact evaluation found positive effects on deforestation rates (mostly because successful programs have specific target criteria for this purpose), while others did not. For instance, a recent assessment (2019) of the Mexican PES found that communities enrolled in that PES program increased forest management and conservation activities (i.e., patrolling and erosion control practices) by 48 percent and reduced deforestation in areas of high risk by 29–38 percent. Similar results were found in previous studies (Alix-Garcia et al., 2012; Alix-Garcia, Sims, and Yañez-Pagans, 2015), which found that deforestation rates among a pool of approved applicants were 40–50 percent lower than those that were rejected. In the same way, a program to conserve the monarch butterfly in Mexico was found to have protected between 3 and 16 percent of the forest that is monarch habitat but only affected the total forest cover by between zero and 2.5 percent (Honey-Rosés, Baylis, and Ramirez, 2011). In contrast, other assessments have found that payments had a relatively small effect on reducing deforestation, such as local PES schemes in São Paulo and Minas Gerais in Brazil, where payments only added 2.8 to 5.6 percent to the forest cover (Ruggiero et al., 2019). Other studies conducted at the national level in Costa Rica found that the PSA contributed to, at most, a 1 percent reduction in deforestation rates (Robalino and Pfaff, 2013; Sanchez-Azofeifa et al., 2007).

Some final points are interesting to highlight in relation to evaluating impacts. First, PES programs have been used mainly as an instrument to address environmental conservation, but some countries have combined PES schemes with poverty reduction goals, adjusting criteria of enrollment and targeting to prioritize poor rural landowners (Adhikari and Boag, 2013; OECD, 2018). These adjustments were expected to increase the credibility, support, and maintenance of rural communities, along with community participation (Adhikari and Boag, 2013; Börner et al., 2017; Landell-Mills and Porras, 2002). However, income and welfare indicators tend not to be substantially affected by PES even though some existing studies have found small positive impacts or have ruled out large negative ones (Arriagada et al., 2015; Robalino et al., 2014; Sims and Alix-Garcia, 2017). A study in Mexico found positive effects on community social capital while increasing land management (Alix-Garcia et al., 2018). Second, little information is available regarding the long-term impacts of PES schemes once payments cease (Börner et al., 2017), except for a case of Colombian ranchers, who continued to implement best agricultural practices long after a PES program to promote silvopastoral practices was discontinued (Pagiola, Honey-Rosés, Freire-González, 2016).

PES program effectiveness cannot be measured solely in terms of economic efficiency (Adhikari and Boag, 2013). The fairness of the distribution of costs and benefits among partici-

pants is a key determinant of local acceptability of a PES program and therefore of its success (Adhikari and Boag, 2013). This suggests that less acceptable PES schemes in LAC are those that implemented practices that unfairly distributed benefits and that failed to improve the livelihoods of local populations (Grima et al., 2016).

Financial sustainability is another key challenge for PES programs. As most PES schemes in LAC depend on government budgets and international assistance (Grima et al., 2016), they tend to be vulnerable to changing political and macroeconomic conditions (Blackman and Woodward, 2010; Bose, Dong, and Simpson, 2019). Therefore, structures to diversify PES funding and combine private and public resources are needed to ensure the resilience and long-term sustainability of the programs. This mandate requires innovation, sound science, and clear communication of PES benefits and outcomes to potential investors and beneficiaries (Kim et al., 2016).

Furthermore, the financial request for applications from aspiring ecosystem services providers frequently exceed the available budgets of PES, a challenge that can be addressed either by increasing available funding or by implementing targeting approaches aimed at cost-effective interventions (Börner et al., 2017; Engel, 2018). Moreover, poor landholders still face barriers to participation, such as high transaction costs, lack of access to information and credit, and lack of trust in government programs. PES can address these barriers by keeping transaction costs low (i.e., allowing group applications and softening land titling requirements), providing access to credit and inputs, and choosing credible and transparent intermediaries (Kim et al., 2016; Grima et al., 2016; Engel, 2018).

Finally, PES schemes do not emerge and sustain in a vacuum. They are nurtured under specific conditions, facilitated in many instances by the role of central governments and other key stakeholders. Some of the most important enabling conditions for PES schemes include: (i) a supportive national legal framework and complementary policies, such as the creation of PAs and prohibition of certain land uses, and the lack of perverse incentives (i.e., subsidies for extensive agriculture); (ii) secure property rights over the land, which allows contractual obligations to be established; (iii) clear demand for ecosystem services and effective communication of the program's benefits, which can secure social acceptability; and (iv) availability of reliable social and environmental information to support adequate targeting of project sites.[8]

Two decades of lessons learned from implementing PES in LAC provide the knowledge to delineate a path forward for similar initiatives to leapfrog current trends in practice and allow practitioners to design more complete and effective schemes that respond to local circumstances in other countries and regions. These lessons include the need to prioritize and to target project sites based on available information, ensuring additionality and baselines for evaluation and monitoring, diversification of funding, and inclusion of vulnerable communities. Therefore, there is hope that a new generation of PES will build on lessons learned and achieve positive results to consolidate PES as a reliable tool for internalizing the costs and benefits of using natural capital in public and private decision-making.

[8] Kim et al. (2016) and Grima et al. (2016) explained these conditions.

2.2 Protected Areas with Innovative Stakeholder Involvement (Co-management)

PAs are recognized as the most relevant biodiversity conservation policy worldwide and LAC has been at the forefront of their implementation (Blackman et al., 2014; UNEP-WCMC, 2016). One of the main goals of this section of the report is to highlight the factors that explain LAC's success in using PAs as a conservation tool. In particular, we are interested in emphasizing that many LAC governments have realized the limitations of the traditional PA model, administered and financed only by central governments and focused only on strict conservation outcomes. Therefore, alternative models of shared management and multiple uses have been sought, in which participation of the private sector, indigenous communities, and other local actors plays a leading role in administration and financing. These alternative governance models could be useful in other regions to minimize the trade-offs between absolute conservation and satisfying the needs of growing populations whose livelihoods depend directly on natural resources. In particular, co-management of PAs represents a promising approach to mainstreaming biodiversity because it integrates a collective effort among diverse actors and, at the same time, it expands PA conservation objectives by considering the livelihoods of local populations.

LAC's leading role in implementing this policy tool is clearly supported by statistics. In recent years, this region significantly increased its coverage of land and marine PAs and has the highest proportion of protected land area at 23 percent compared to an average of 13 percent in the rest of the world (Blackman et al., 2014; UNEP-WCMC, 2016). Also, the LAC region exceeded Aichi Target 11,[9] which establishes that by 2020, at least 17 percent of the land area and 10 percent of the marine-coastal area should be PAs.. Although historically most PAs are in terrestrial areas, currently 12 percent of coastal and marine areas are under marine PAs (WWF, 2019). Chile, Brazil, Cuba, Mexico, Ecuador, and Panama are the countries with the most established marine PAs that aim to reduce the degradation and overexploitation of coastal and marine resources (Bezaury-Creel, Gutiérrez-Carbonell, and Sánchez-Ibarra, 2017; Redparques, Proyecto IAPA, and Pronatura México, 2018).

The diversity of PAs in LAC is wide, ranging from strict protection to categories that allow multiple uses (Dudley, 2008). Multiple uses include recreational and tourist services as well as sustainable productive activities (Dudley, 2008). LAC has established the most mixed-use PAs worldwide, at 33 percent of its area compared to 6 percent in Africa and 22 percent in Asia (Blackman et al., 2014).

PAs are typically implemented under a national system of PAs that are organized by national subsystems and cover various categories of protection to meet the conservation objectives of each country (Elbers, 2011). In LAC, government agencies that ensure conservation (i.e., ministries, secretariats, and departments) are usually in charge of managing national PAs, making them the predominant actors (Elbers, 2011).

[9] https://www.cbd.int/sp/targets/rationale/target-11/#footnote41

Although historically in LAC PAs are most frequently administered by the government, there is a strong movement to administer them through shared governance or co-management schemes, in which the governments and different stakeholders have formal agreements to share rights and responsibilities (UNEP-WCMC, 2016). Among the actors that generally co-manage PAs in the region are indigenous communities,[10] community associations, municipalities, non-governmental organizations (NGOs) and, in some cases, universities (De Pourcq et al., 2015; FAO, 2008; UNEP-WCMC, 2016). In fact, globally, LAC leads other developing regions in establishing multi-use and co-managed PAs. Currently, in LAC 33 percent of PAs are multiple-use and 31 percent are co-managed with indigenous reserves (Blackman et al., 2014; FAO, 2008; UNEP-WCMC, 2016). The following are examples of co-management in the region:

- In Brazil, indigenous territories are recognized by the government as PAs and are an essential part of the country's conservation policy. Indigenous lands occupy approximately 13 percent of the country's area, of which 98 percent is in the Amazon, thus conserving unique ecosystems of global relevance (Brazil Ministry of Environment, 2007). These PAs have functioned as an effective policy to prevent deforestation (Brazil Ministry of Environment, 2007; Herrera, Pfaff, and Robalino, 2019; UNEP-WCMC, 2016).
- In Guatemala, the government granted sustainable forest management concessions to indigenous communities located within the Maya Biosphere Reserve PA. Forest concessions have been established in the past 20 years to give forest access to local communities. In exchange, these communities are required to reduce overexploitation by abiding by a sustainable forest management plan certified by the Forest Stewardship Council. Evaluations show that the effect on the incomes of local villagers are generally positive (Bocci et al., 2018) and that deforestation is reduced (Blackman, 2015).
- In countries like Argentina, Brazil, Colombia, Chile, and Paraguay, private PA networks have been developed. In this way, private landowners have become involved in conservation by voluntarily declaring their lands as Private Nature Reserves in exchange for tax and other incentives.[11] These reserves are incorporated into the national systems of PAs and are managed under a private governance scheme (Chacón, 2008; Hora, Marchant, and Borsdorf, 2018). Brazil's private reserve network is especially strong, with hundreds of private natural heritage reserves spanning nearly 480,000 hectares (UNEP-WCMC, 2016). One of the main features of this governance modality for conservation is its contribution to promoting ecological connectivity between PAs and supporting landscape approaches to ecological management (UNEP-WCMC, 2016).
- In Mexico, 80 percent of the country's highly biodiverse lands are under private or community-based property management (known as Ejidos), many of them under a special

[10] Indigenous communities participate mainly in Brazil, Peru, Bolivia, Colombia, and Mexico (FAO, 2008; Blackman et al., 2014; UNEP-WCMC, 2016). Of the PAs in LAC, 9 percent are reported as under the governance of indigenous peoples and local communities, while less than 3 percent are reported in this way for all other regions (UNEP-WCMC, IUCN, and NGS, 2018).

[11] Incentives include institutional support and legal tenure security to deal with threats such as illegal logging, hunting, or illegal settlers; participation in conservation projects; technical assistance; and tourism promotion (Chacón, 2008; Hora et al., 2018; UNEP-WCMC, 2016).

protection category[12] (Pérez-Bocanegra, Isaac-Márquez, and Ayala-Arcipreste, 2014). Currently, 354 properties are managed in this way, representing 554,206 hectares, of which 45 percent are privately owned and 53 percent are community owned (CONANP, 2019). Properties under this protection category can access funding for carbon sequestration and ecotourism projects, as well as technical and legal support to mitigate threats such as illegal logging and hunting.

In general, studies in LAC show that PAs generate important local economic benefits by promoting ecotourism and generating ecosystem services that are important for sustaining local livelihoods and economic growth (Blackman, 2015; Bovarnick et al., 2010). Similarly, the increase in tourism visits to PAs can have a positive impact on the employment and wages of local populations around the entrances to these parks, as, for example, in Costa Rica (Robalino et al, 2015). Furthermore, PAs can reduce the poverty levels of the surrounding populations. Studies in Costa Rica and Bolivia showed declines in poverty levels in surrounding populations (Andam et al., 2010; Canavire-Bacarreza and Hanauer, 2013; Ferraro, Hanauer, and Sims, 2011); however, studies in Peru and Mexico did not show large positive results (Miranda et al., 2016; Sims and Alix-Garcia, 2017).

Aichi Target 11 states that PAs should be "effectively managed." As reported by UNEP-WCMC et al. (2018), over the past decade, management effectiveness data have been gathered from 169 countries globally, resulting in the Global Database on Protected Areas Management Effectiveness. To date, only 21 percent of countries meet the management effectiveness target of having at least 60 percent of their PA coverage assessed on land and 16 percent of countries meet the target in the ocean. In terms of regional differences, no region meets the management effectiveness target. Africa and North America have slightly more than 30 percent of the total area of their PA network assessed. Not far behind, LAC has nearly 30 percent assessed.

In terms of specific outcomes, there is mixed evidence worldwide on the effectiveness of PAs for reducing deforestation. This is mostly because the effectiveness depends on factors such as the pre-existing characteristics of the location affecting deforestation rates (e.g., accessibility), the quality of monitoring and of enforcement of protection rules defined by PAs, and the level of financing and coordination with local communities (Andam et al., 2010; Blackman et al., 2014; Bovarnick et al., 2010). Nevertheless, rigorous studies of impact evaluation done in LAC have found that some PAs have managed to stop land-use change and degradation, particularly in cases where PAs use co-management and allow multiple uses (Blackman et al., 2014; FAO, 2008; Herrera et al., 2019; Nelson and Chomitz, 2011; Pfaff et al., 2009; Robalino et al., 2015; Sims and Alix-Garcia, 2017; UNEP-WCMC, 2016). For instance, a remarkable study found that PAs with strict protection reduce the incidence of fires (as an indicator of deforestation) by 3–4 percentage points, those of multipurpose protection reduce it by 5–6 percentage points, and PAs co-managed by indigenous areas reduce it by 16–17 percentage points (Nelson and Chomitz, 2011). Despite this positive evidence, there are important future challenges to the effectiveness of PAs in deterring deforestation. Projected natural habitat loss due to urban growth and human pressure is a

[12] They are known as Voluntary Areas for Conservation.

major threat in the near future (Geldmann, Joppa, and Burgess, 2014; TNC, 2018) and this trend could degrade the global network of PAs and the ecosystem services they provide. A global report from TNC (2018) established that negative impacts from cities on PAs become more frequent when there is less than 50 kilometers between a PA and a city. By 2000, countries in LAC had a relatively low fraction of PAs within 50 kilometers of a city compared other regions. By 2030, the biggest increase in proximity of PAs worldwide will occur in LAC, the Indian subcontinent, and parts of sub-Saharan Africa. In addition, research shows that another important challenge to the effectiveness of PAs in LAC and other regions relates to governments eliminating legal protections for some PAs, a process called Protected Area Downgrading, Downsizing, and Degazettement (Mascia et al., 2014; Mascia and Pailler, 2011).

The success of PA implementation in LAC is also attributable to a set of enabling conditions acceptable to (or supported by) central governments, including the security of the property rights of indigenous peoples over their territories, more flexible and integral national policies on PAs and biodiversity conservation, compliance with international frameworks (e.g., Aichi Targets), and international cooperation and support from NGOs (Bovarnick et al., 2010; Elbers, 2011; FAO, 2008). It is worth mentioning that the active participation of LAC countries in global strategies such as REDD+ has motivated governments to conserve or declare areas with significant carbon reserves as PAs (UNEP-WCMC, 2016).

Despite the high coverage of PAs in LAC, implementing this conservation tool has not yet reached a maximum. For various reasons, new PAs are expected to continue emerging within some countries. First, although PA coverage in LAC is high, compared to other regions there is still little representation of biomes other than tropical forests (Blackman et al., 2014). Second, many of the PAs are small and fragmented, so expanding PA systems is important to guarantee their biological functionality (Blackman et al., 2014; UNEP-WCMC, 2016). Third, the criteria for establishing new PAs are expected to evolve, meaning that, in addition to general biodiversity conservation goals, criteria to protect certain ecosystem services (e.g., water provision) will also be included, which may foster the interest of local governments and populations in establishing new PAs (UNEP-WCMC, 2016).

Creating new PAs and strengthening existing PAs to achieve their goals in the region depend on the availability of stable sources for adequate funding. Unfortunately, financial challenges are vast and many PAs have deficits (Bovarnick et al., 2010). Most funding comes from government budgets and international cooperation, which tend to be unstable for many reasons (Bovarnick et al., 2010). Despite this weakness, in LAC there has been success diversifying PA financing (Tlaiye and Aryal, 2013). Among these experiences, it is worth highlighting CTFs.

CTFs are grant-making entities that provide sustainable financing for biodiversity conservation and related sustainable development for PAs. They use diverse mechanisms to mobilize and invest funds from a range of sectors, thereby initiating and strengthening inter-sectoral collaboration. More than 70 CTFs now managing US$400 million[13] have been established

[13] https://www.cbd.int/doc/meetings/ecr/cbwecr-2014-03/other/cbwecr-2014-03-day2-04-en.pdf

worldwide, with the majority in LAC. Best practices have been shared among networks such as RedLAC (Latin American and Caribbean Network of Environmental Funds), which inspired countries in Africa to establish CAFE (Consortium of African Funds for the Environment) and in the Asia-Pacific region to found APNET (the Asia-Pacific Conservation Trust Fund Network). More details about CTFs are provided in Section 2.4 of this report.

In conclusion, it is fair to say that globally LAC has led the establishment of PAs. Additionally, recent governance innovations show that collaborative management of PAs and mixed-use schemes might dramatically outperform strict conservation PA models based on traditional command and control approaches. Consolidating co-management approaches requires enabling conditions in legal, political, and financial domains. These conditions will facilitate the emergence of synergies and successful collective action and cooperation among local communities, government actors, and international entities, among others. This shared governance, strongly grounded in the compatibility of incentives between different actors, promises to be a solution that can be replicated in numerous LAC countries and other world regions to sustainably use biodiversity.

2.3 Nature-Based Solutions for Infrastructure

This section highlights the distinctive features of NBS for infrastructure and the advances for its implementation in LAC. Successful examples of this approach take place at regional, national, and landscape-based levels and have one element in common—they all use a multi-sector approach. These cases have shown the importance of collective action within and across ministries and NGOs, but also the assistance of an appropriate regulatory framework. As such, developing plans and policies for nature-based infrastructure includes more of a range of stakeholders than traditional infrastructure projects.

NBSs are defined by the International Union for Conservation of Nature (IUCN, 2017) as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits." These actions are inspired and supported by nature to tackle challenges such as climate change, food security, disaster risk management, and water availability, often being more cost-effective than traditional alternatives (Cohen-Shacham, Walters, Janzen, et al., 2016; EC, 2016). The term NBS is recently coined and evolving, and is often used as an umbrella concept for other established ecosystem-based approaches, such as ecosystem-based adaptation and mitigation, green/blue infrastructure, disaster risk reduction, and natural capital and ecological engineering (Calliari, Staccione, and Mysiak, 2019; IUCN, 2017; Kabisch et al., 2016; Nesshöver et al., 2017).

In LAC, a growing population and an expanding economy are increasing demand for gray infrastructure such as roads, bridges, water supply and sewers, electrical grids, and telecommunications. To meet these demands, the region needs to boost its investment in infrastructure by at least 2 percent of its gross domestic product (GDP) over an extended period (Serebrisky, 2014). As a region in need of a high volume of infrastructure investment and where climate impacts are acute, LAC is an ideal setting in which to implement multifunctional solutions that improve resilience to climate change and natural disasters, and support sustainable development (Watkins et al., 2019).

Ecosystems, such as forests, wetlands, and mangroves, provide important benefits by protecting roads from natural hazards such as landslides and flooding, and reducing deterioration by protecting against erosion (Mandle et al., 2016; WWAP, 2018). These multiple benefits from nature have generated several typologies of NBS for infrastructure, but they mainly refer to all the natural, semi-natural, or artificial constructions that mimic natural systems and processes and contribute to conserving or restoring biological diversity and enhancing ecosystem services at the same time supporting communities, economies, and environmental resilience (Maldonado et al., 2020).

Overall, LAC has taken the approach of incorporating nature into supporting infrastructure and using nature as infrastructure. This approach addresses a project's economic returns and associated direct effects and, more importantly, its interaction with existing infrastructure. The approach also considers how a project affects land use, its influence on and resilience to climate change, the various alternatives for its financing, and the associated governance to ensure its sustainability (Serebrisky, 2014). This approach has become an important tool to mainstream biodi-

versity and ecosystem services. International organizations[14] have played an important role in conceptualizing, defining guidelines, and increasing the visibility of this approach, while also encouraging and financially supporting other actors, such as local and national governments, to adopt nature-based infrastructure (Browder et al., 2019; IUCN, n.d.; WWAP, 2018). Unfortunately, the private sector's involvement is often limited to corporate social responsibility programs, with very little implementation driven by business rationale (Watkins et al., 2019). One key incentive for the private sector to participate would be clear and accessible evidence of the cost effectiveness of NBS compared to alternatives.

Given the broad definition of NBS for infrastructure, examples of implementation in LAC refer to regional, national, and landscape projects. These examples use a multi-sector approach adapted to the specificities of the context and problem. Broadly, in urban planning, the approach is increasingly being adopted to reduce temperature, enhance ecological connectivity, and manage storm water by restoring riverine areas, converting paved areas into gardens and rain gardens, and establishing green roofs and terraces (EDU, 2019; Kabisch et al., 2016). In coastal areas, NBSs such as wetland and mangrove restoration, dune and beach rehabilitation, and the implementation of artificial coral reefs and dunes are being used as alternatives to protect against and adapt to climate change (Schueler, 2017; Silva et al., 2017). Furthermore, countries in the region,[15] through national, regional, and local PES schemes, have developed NBS to complement gray infrastructure in the water sector. These schemes aim to ensure the availability and quality of water through watershed management, investment in protecting and rehabilitating forests and river banks, agroforestry, and sustainable agriculture, among others, mainly implemented by utility companies and funded through water funds[16] (Grima et al., 2016; IUCN, 2017; Watkins et al., 2019; WWAP, 2018).

The following examples provide more detail about NBSs to improve the performance and resilience of gray infrastructure in different sectors in LAC.

- In Medellín, Colombia, the local authorities have implemented 30 green corridors across the city, rehabilitating riverine zones and verges of roads, and converting previously paved areas into gardens, all of which—according to the authorities—have contributed to "cooling" the city (EDU, 2019; UNEP, 2019). Cities like Canoas, Porto Alegre, Guarulhos, and Recife in Brazil, and Buenos Aires[17] and Córdoba in Argentina, have established mandatory requirements and incentives to include green roofs, terraces, and walls in new buildings.
- In Cassino Beach, Brazil, a dune rehabilitation project restored 800 square meters of dunes as a strategy to reduce flood risk for urbanized areas and saltwater contamination, and to preserve biodiversity (NEMA, 2008; Portz, Manzolli, and Corrêa, 2011; Silva

[14] Such as the International Union for Conservation of Nature, Conservation International, the World Wildlife Fund, The Nature Conservancy, the IDB, the Water Resources Research Institute, and the World Bank.

[15] Including Mexico, Costa Rica, Colombia, Brazil, Ecuador, and Peru.

[16] See more in section *2.1. Payments for Ecosystem Services: Achievements and Challenges Ahead*.

[17] Law 4428 of The Legislature of the Autonomous City of Buenos Aires, available at: http://www2.cedom.gob.ar/es/legislacion/normas/leyes/ley4428.html.

et al., 2017). Also, Belize's Integrated Coastal Zone Management Plan (ICZM) includes implementing nature-based infrastructure to create a model for marine spatial planning that can be used broadly by coastal and ocean planners to assess risk to habitats under current and future management scenarios (Arkema et al., 2014).

- The economic life expectancy of the Itaipu Hydropower Dam in Brazil/Paraguay, one of the world's largest, was increased six-fold by applying improved landscape management and farming practices in the catchment to reduce sedimentation in the reservoir, while simultaneously improving farm productivity and farmer income (WWAP, 2018).

There are a multitude of co-benefits derived from implementing NBSs, making it challenging to distinguish primary benefits from co-benefits. NBSs prevent degradation, disturbance, and deforestation of the region's forests and help prevent climate-warming emissions from entering the atmosphere, while also protecting critical local water and species. Similarly, protecting and restoring mangrove forests and wetlands also protects coastal communities from storms and flooding, and increases habitats for biodiversity, which directly benefits fishing and tourist activities (WWAP, 2018; Watkins et al., 2019).

Nature-based infrastructure has the potential to reduce operational and maintenance costs compared to gray infrastructure, while also being able to self-maintain and self-repair after damaging events, offering a good alternative for projects addressing adaptation to climate change. Moreover, NBSs can offset carbon emissions associated with infrastructure construction, mitigate the impacts of roads on air quality by trapping and filtering pollutants, and reduce flood risk to roads and urbanized areas, among many other positive outcomes (Mandle et al., 2016).

Despite this potential, a major sticking point for including NBSs in infrastructure projects is the ability to demonstrate their cost effectiveness compared to gray infrastructure, which influences the involvement of the private sector (Watkins et al., 2019). However, emerging literature and economic analyses of investments in NBSs demonstrate cost savings. For instance, in Brazil, an investment of US$37 million to preserve and restore 4,000 hectares of native forest to reduce sedimentation for water operators was found to generate avoided costs (i.e., water treatment and equipment maintenance) of about US$106 million over 30 years for the local water utility company. These costs would continue to be generated after this period if the natural infrastructure is maintained (Ozment et al., 2018). A similar study in Rio de Janeiro found that the city could save up to US$79 million in water treatment and also dramatically reduce the amount of chemicals used by restoring the city's forests (Feltran-Barbieri et al., 2018).

Despite some key successful cases, NBSs have not yet been widely deployed to improve infrastructure resilience in LAC because of challenges related to the lack of awareness of benefits and co-benefits among various actors (especially the private sector), lack of representation in policy frameworks, and the dissociation of ministries and departments managing natural capital (i.e., ministries of environment) from those responsible for economic functions and sectors (i.e., ministries of finance and infrastructure). In this context, better coordination among relevant stakeholders is required to lay the foundations for a wider and more wholesome adoption of NBSs in infrastructure projects. Further, generating and disseminating information about nature-based alternatives and their benefits is crucial for them to be mainstreamed (Watkins et al., 2019).

Based on the experiences in LAC, it is clear that optimal conditions for planning and policies that include nature-based infrastructure require governments (national, regional, and local) willing to look at the social, environmental, and economic benefits of a range of solutions. A multi-sector approach requires interaction with governments at multiple levels—from political leaders to government ministries—for assistance with policies, laws, regulations, research, and community outreach (Browder et al., 2019). It is also critical to include science and diverse stakeholder participation. In general, developing plans and policies for NBSs requires the involvement of a wider range of stakeholders than do traditional gray infrastructure projects. It also requires authorities to look beyond project engineering into sector planning and national policy, and to foster collective action within and across ministries to facilitate appropriate laws, regulations, and coordination of NGOs and scientific entities (Browder et al., 2019; Quintero, 2012). For instance, in Belize and The Bahamas, local governments, in concert with representatives of various sectors and ministries, worked to grow higher level master plans to develop and manage coastal zones. In Belize, the project was driven by one of the government's natural resource agencies, while in The Bahamas, the project was led by the Office of the Prime Minister (Arkema and Ruckelshaus, 2017, explained further in Appendix 3).

The takeaway from nature-based infrastructure in LAC is the need for a systematic multi-sectoral approach to scale up within countries. Individual projects need to look beyond project engineering into sector planning and national policymaking (Quintero, 2012). Projects like the inclusion of nature-based infrastructure in the ICZM plan for Belize create a model for marine spatial planning, which in turn illustrates an approach that can be used broadly by coastal and ocean planners to assess risk to habitats under current and future management scenarios (Arkema et al., 2014). Nature-based infrastructure initiatives have a high likelihood of long-term sustainability as they are oftentimes part of the planning of long-term initiatives, strategic plans, and policies. Embedding nature-based infrastructure in high-level planning helps ensure projects will not be treated as one-off ventures that require external funding.

2.4 Conservation Trust Funds

CTFs are commonly defined as legally independent, private, grant-making institutions that provide sustainable financing for biodiversity conservation and related sustainable development (Spergel and Taïeb, 2008). CTFs operate both regionally and nationally using diverse financing mechanisms. They have emerged to overcome the challenges faced by governments with limited financial and technical resources to manage their natural resource base. They have contributed to strengthening the governance of natural resources and mainstreaming biodiversity by mobilizing funds from a range of sectors, thereby initiating and strengthening inter-sectoral collaboration, building institutional capacity, and creating decentralization, accountability, and transparency in managing conservation funds. This section describes the leading role that LAC has had in implementing CTFs in a wide variety of institutional settings. It highlights the fact that CTFs are much more than mere financial mechanisms—that they constitute an innovative and effective instrument of inter-sectoral governance to mainstream biodiversity.

The first CTFs emerged in the early 1990s as mechanisms to manage the capital generated from debt-for-nature swaps made in partnership with national governments (Bayon et al., 1999). More than 70 CTFs have since been established, the majority in LAC, managing close to US$800 million (RedLAC, 2012). Best practices have been shared among networks, such as RedLAC, which inspired the establishment of the CAFE and the APNET.

CTFs can be described as a bridge between donors and implementing organizations such as local non-governmental actors and government agencies (e.g., FUNDESAP provides funding for the management plans of PAs in the Bolivian Amazon and Chaco regions). CTFs generally do not carry out conservation activities directly; rather, they are designed to mobilize funds from a range of sectors to redistribute to a range of stakeholders. Furthermore, they differ from other grant-making organizations because they tend to carry out more targeted actions, like investing locally in a country or region. In most cases they combine private funds (from foundations or philanthropists) with funding from public sources such as carbon taxes, PES, and/or multilateral and bilateral funding (from organizations such as the World Bank, the Global Environment Facility [GEF], and the German Development Bank [KfW]).

The structures and strategies of CTFs and the ways in which they are established vary considerably according to purpose, legal and political context, human resource capacity, and donor requirements. Differences have been noted between CTFs that support PAs and those that channel funds for a broader range of conservation objectives (Global Environmental Fund, 1998; Oleas and Barragan, 2003). Nevertheless, the key building blocks of a CTF are the institutional structure, fund generation, and fund delivery mechanisms (Norris, 2000).

Not only can CTFs lead to financial sustainability by diversifying financing mechanisms, they can also help initiate and strengthen inter-sectoral collaboration and build institutional capacity at local and national levels. CTFs have contributed to filling financial and technical capacity gaps left by national governments due to fiscal constraints and political cycles by providing long-term planning, accurate costing of conservation activities, transparency through performance indicators, and more stable financing. In addition, they have demonstrated the potential to advance economic incentive mechanisms such as PES by serving as an instrument for financial administra-

tion and an intermediary between buyers and sellers of ecosystem services (Spergel and Taïeb, 2008).

The geographic scope of CTFs includes funds with a multi-national focus, as in the case of the Mesoamerican Reef Fund (MAR Fund), which includes four CTFs in each country with an ecoregional approach. Funds with a national scale, like the Mexican Fund for Conservation (FMCN), use an umbrella fund approach to manage different topics such as regional conservation or thematic issues such as marine conservation.

Most CTFs involve five key actors (CFA, 2005).

1. Donors provide the funding that makes CTFs possible. The GEF and KfW have been the single largest supporters of CTFs. Donors are interested in leveraging their funds to have the greatest impact on their conservation objectives. Normally, donors are involved in advising on establishing the legal framework and in approving the financial terms of the CTF. They also monitor project performance as they would for any donor-funded project. Donors are also attracted to CTFs to channel support through non-government actors, resulting in increased decentralization, accountability, and transparency in project fund management, and other benefits such as strengthening the NGO sector.
2. An international conservation NGO often serves as a catalyst for CTFs, carrying out feasibility and design stages, providing technical assistance for debt-for-nature swaps and CTF establishment, and other forms of support. These NGOs are typically keen on setting up a long-term funding mechanism such as a CTF to support conservation objectives, particularly through CTFs that have public–private governing boards and provide grants to NGOs. Profonanpe (the Peruvian Trust Fund for National Parks and Protected Areas) facilitated five debt-for-nature swaps for more than US$40 million that benefited the national PAs system.
3. Governments of developing countries typically support CTFs based on their interest in generating increased investment in conservation that their current institutions cannot attract or manage because of legal or operational limitations. The host government's resource management agencies are motivated by the opportunity to attract outside funding for their operational costs and to access funds previously beyond their reach from their own governments (e.g., proceeds from a debt swap). In general, host government agencies (e.g., PA management) seek significant roles in the governance of CTFs in order to direct the grant-making toward national priority projects.
4. Non-government institutions (NGOs, universities, and research institutions) in the host country typically support CTFs in order to receive grants through a newly established funding mechanism.
5. The governing board is typically public–private, including individuals from a range of key government and non-government stakeholder groups.

The following are some examples of CTFs in Latin America that show the different kinds of implementation and institutional arrangements:

- **Mexican Fund for the Conservation of Nature** (US$180 million): The FMCN was established in 1994 as a non-profit civil association, following a three-year participatory consulting process funded by U.S. government agencies and several philanthropic organizations. It is one of the largest CTFs in the world, both in terms of revenue generated and number of projects supported. The FMCN was created to finance biodiversity conservation in Mexico through four conservation programs: PAs, forests and watersheds, oceans and coasts, and special projects, including business sustainability projects and cooperation schemes (e.g., with RedLAC and the MAR Fund). It has distributed over US$85 million in support of nearly 1,500 conservation projects, helping promote sustainable business and public–private partnerships, build institutional capacity, and play a role in consolidating and improving Mexico's PA system (Bladon, Mohammed, and Milner-Gulland, 2015).
- **Mesoamerican Reef Fund** (MAR Fund) (US$35 million): The MAR Fund was created in 2004 to help finance the conservation and sustainable use of the marine and coastal ecosystems of the Mesoamerica Reef, an ecoregion shared by four countries (Mexico, Belize, Guatemala, and Honduras). By encompassing an entire, single ecoregion, the MAR Fund focuses resources on common and strategic objectives through local action. The fund is an example of how a large-scale regional CTF can benefit from the experience and coordination of pre-existing CTFs—bringing together four national CTFs enabled the establishment of the fund.
- **Fondo Acción** (US$120 million): Fondo Acción (the Fund for Environmental Action and Childhood) was established in 2000 to co-finance projects intended to protect and sustainably manage Colombia's natural resources while promoting childhood development. Fondo Acción provides an example of how one CTF can manage multiple accounts with different areas of focus, which is a more cost-effective approach than creating multiple, separate CTFs. It also demonstrates how operations can be improved through formalized systems of management and communication. It is one of only two Latin American CTFs to have its own quality management standard, like those of private enterprises, that standardizes processes and has been particularly useful for the arrival of new members.

The success of a CTF should be assessed by its conservation impacts, but these may not be seen for many years after establishment (GEF, 1998; RedLAC, 2012). However, there has been very little evaluation of these impacts because of methodological limitations, a lack of baseline data, poor monitoring and evaluation strategies, and the fact that many CTFs are fledgling. Successes and failures are influenced by a multitude of factors, including external factors such as economic and political climates. Most CTFs have taken many years to become established (e.g., the MAR Fund) or are still in the midst of the process (e.g., Caribbean Biodiversity Fund) sustainability, while others (e.g., Yasuni-ITT in Ecuador) have failed to establish themselves at all (Bladon, Mohammed, and Milner-Gulland, 2015).

The literature indicates that, though CTFs do a good job of monitoring institutional performance, actual impacts on biodiversity conservation are rarely known and their measurement is key to improving CTF strategy. Indeed, a common criticism of CTFs is the need to develop technical capacity to monitor their effects on biodiversity. Therefore it is paramount to shape biodiversity indicators from the beginning, something which many of the more mature CTFs (e.g., the FMCN) did not do but that new CTFs are now trying to do. However, the limits and challenges of monitoring and evaluating the biodiversity impacts of CTFs are well recognized (RedLAC, 2008). It may be simpler for CTFs that finance PAs than for those with broader objectives, where it is difficult to aggregate results from individual grants (Spergel and Taïeb, 2008) and where a great deal more progress has been made (RedLAC, 2012).

Practice standards require that reporting, monitoring, and evaluating be conducted at four levels—grantee, CTF, donor, and government—in the countries where the CTF is registered or operates (Spergel and Mikitin, 2013). Many CTFs have deprioritized these duties in the past. It is therefore essential that a CTF considers the need to monitor, evaluate, and report at an early stage and incorporate these processes into strategic and financial planning (Spergel and Taïeb, 2008). For instance, the operations of Fondo Acción have improved since the fund introduced a more organized reporting system.

A CTF should also monitor and evaluate its institutional performance and conservation impacts. It should require grantees to develop goals and indicators for biodiversity conservation in their proposals, to collect relevant baseline data, and to submit data multiple times during implementation and after grant completion. And the CTF should help grantees build the capacity to do such monitoring and evaluation (Spergel and Mikitin, 2013; Spergel and Taïeb, 2008).

There are three indirect effects of developing and implementing CTFs in some of the countries where they have been established:

1. **Capacity building:** There is a new generation of project managers in the natural resources sector, which historically has depended on international development aid and, in some instances, foreign expertise. For example, the Brazilian Biodiversity Fund FUNBIO is now supporting funds in Portuguese-speaking African countries.
2. **Strategies that go beyond traditional PA financing:** Some funds are now developing public–private partnerships in diverse areas, such as the FMCN and IMAX film production.
3. **Planning and costing capacity:** Some funds are developing the capacity to plan and measure conservation with a long-term horizon, which is absent or outdated in many developing countries.

Since many CTFs have improved planning, costing, and governance for PAs, there is more data on and public awareness of the lack of investment and funding gaps in the natural resource and conservation sectors. Having more precise information (e.g., Profonanpe in Peru, Patrimonio Natural in Colombia, and FUNBIO in Brazil) has allowed ministries of environment to secure more government funding and international development aid.

The following are some of the enabling conditions for establishing CTFs (CFA, 2005; RedLAC, 2008; Spergel and Taïeb, 2008):

- Absence of major threats requiring urgent mobilization of large amounts of money (i.e., the conservation action required is long term and can be addressed with the annual financial flows that a trust fund could produce).
- If the fund is private, government support for the concept of a fund outside government control that involves both the public and private sectors. The support should be active and broad-based, from senior political leaders to regional and local bodies, extending beyond environmental ministries and departments to include ministries of finance and planning.
- A reasonable financial contribution from government to project activities, if not directly to the fund.
- Strong coordination among host country government agencies from relevant sectors in planning the CTF (e.g., forests and PA management).
- For private funds, tax exemptions for the fund and tax incentives for fund donors to facilitate mobilizing resources. If such laws are not already in place, a government willing to support such a framework is ideal.
- People with a common vision—NGOs, government, academia, private companies, donor agencies, and communities—that can work together despite their different approaches to conservation. The support and involvement of business leaders is crucial to bring in private sector management skills, especially skills in financial management.
- A basic fabric of legal and financial practices and functional supporting institutions (e.g., banking, auditing, and contracting).
- A participative process that involves a broad set of stakeholders during the design process and willingness of stakeholders to use CTF mechanisms.
- Availability of one or more mentors, for example, an experienced donor agency or international NGO twinning with another, more experienced trust fund that can provide technical, fundraising, and other support during start-up and early implementation.
- Realistic prospects of attracting diverse capital adequate for the fund to support a significant program. In most cases this means having clear commitments from other donors beyond the GEF or established debt swap mechanisms before starting the fund.
- Opportunities to harness in-country resources (e.g., user fees, taxes and levies, and donations) to ensure long-term financial sustainability.

The cooperation between RedLAC and CAFE is an example of how South–South cooperation is facilitating scaling-out CTFs in Africa, creating a tool to better manage and fund conservation. Applying the lessons learned from more than 25 years of experience in LAC has helped the CTFs in Africa avoid many of the mistakes made by other CTFs in the region and take advantage of the technical capacities of staff from the RedLAC members. For example, a series of capacity-building workshops on fundraising, financial management, and monitoring have been developed by RedLAC to train CTF staff.

Although independence is desirable, it is also essential to establish and maintain government links, which should be established at an early stage. For example, involving government

officials in the FMCN's advisory committee is thought to have played a role in that CTF's successful capitalization. Choosing a high-level government representative for the board, often from the ministry of finance or environment, can increase support and acceptance, help build the reputation of the CTF, and facilitate national ownership. Furthermore, support from government officials or ministries can increase funding opportunities and, in the case of multilateral donors, government support is often a prerequisite (Norris, 2000). For example, Costa Rica Forever was conceived with the support of the Presidential Office in Costa Rica.

Support can even have a positive impact on national environmental policy and conservation strategies, as evidenced by the FMCN. Political support is essential since in many cases the creation of a CTF requires the adoption of new legislation (Klug, Moye, and Carr-Dirick, 2003). But difficulties are often encountered where CTFs intend to mobilize resources through public revenues such as taxes (e.g., PACT in Belize). The concept of a government channeling resources through an institution over which it does not have any control is likely to lead to some objections. Some countries lack a tradition of public–private initiatives, making it difficult for governments to accept the principle of mixed management where they do not hold the majority position. To an extent, the political will is either there or it is not. The FMCN benefited from excellent timing with respect to the international and national political climates (Locker and Rosenzweig, 2011). Without allies in the Mexican government, its creation may have been more difficult. On the other hand, in some countries, the government may not be receptive to the idea regardless of efforts to persuade it. Political support should also be approached with caution; as previously mentioned, a CTF needs the commitment and support of someone without a political agenda to get it off the ground.

Managing natural resources and conserving biodiversity need to evolve technically and financially to attract a larger and more varied pool of donors and to produce more effective investments in conservation. Increased technical effectiveness and financial transparency is a prerequisite to mainstream biodiversity and natural capital. With good design and management, CTFs can provide the institutional capacity for transparent and accountable fund generation and allocation that is often lacking in the field of conservation. As independent third-party entities, they also boast flexibility and efficiency more akin to private sector corporations than government agencies or NGOs. Their professionalism and business-like approach complements the more traditional activities of the conservation sector.

2.5 Small-Scale Sustainable Fisheries Management

Experiences with fisheries management strategies worldwide indicate that allocation of rights to fishing communities and their strong involvement in management is crucial to improve sustainability (Gutiérrez et al., 2011). Community-based fisheries management (CBFM) programs give communities lead responsibility (Blythe et al., 2017; Cudney-Bueno and Basurto, 2009). These programs started to gain ground in LAC because of the need to protect small-scale fisheries (SSF) from overexploitation, ecosystem degradation, and the lack of efficient government measures to support their management. Therefore, the traditional top-down model to govern fisheries has evolved into more inclusive approaches led by local fisher communities. However, this does not imply that central governments have no influence on the success of CBFM. On the contrary, they have to provide the enabling conditions for this approach to be sustainable (e.g., property rights to local fisheries) and facilitate truly inter-sectoral coordination between environmental ministries and non-environmental ministries (e.g., ministries of development and agriculture, and Afro-American and indigenous rights groups). This section provides an overview of the evolution of CBFM in LAC, highlighting some of the most recognized successful examples of its implementation.

According to the global information system on SSF, LAC is at the forefront of implementing CBFM programs aimed at promoting the sustainability of SSF, with 27 percent of study cases (of a total of 192 LAC-SSF profiles) being managed under the CBFM approach (compared to 24–33 percent in Africa, 21 percent in Asia, 6 percent in Europe, and 4 percent in the United States) (Chuenpagdee et al., 2019). LAC demonstrates a wide range of successful experiences and best practices to achieve the Aichi Targets (Leadley et al., 2014) and the SDGs (UN, 2019). Considering marine fauna in LAC represent 23 percent of species worldwide, LAC-CBFM programs are an important element of mainstreaming management of SSF (Reis et al., 2016). Further, the region contributes 16 percent to global SSF catches and 20 percent of the total landed value (TBTI, 2018). Other regions may benefit from the LAC experience since CBFM programs contribute to increasing food security and alleviating poverty, and improve the performance of fisheries (Anderson et al., 2015; Béné, Macfadyen, and Allison, 2007).

The main task of CBFM supporting agencies (e.g., governments, NGOs, and fishing associations) is to create a strong sense of ownership within the community. CBFM programs are a site-specific tool (i.e., their design needs to be responsive to local contexts), they are usually permanent, and they require plans of action and lasting community-level infrastructures; however, they may take different forms depending on local fishery contexts, ecosystem dynamics, and governance already in place. Major categories of CBFM programs in LAC include: (i) territorial use privileges or concessions to fisher organizations (e.g., fishing cooperatives in Mexico and unions or artisanal fishing communities [AMERBs] in Chile); (ii) territorial communal rights granted to traditional and indigenous users (e.g., marine extractive reserves [RESEXs] in Brazil, Afro-American communities [Law 70, 1993], and Exclusive Zones of Artisanal Fishing [ZEPAs] in Colombia); and (iii) limited entry with fishing quotas (e.g., Galapagos Islands of Ecuador).

All CBFM programs are local, based on bottom-up governance approaches, and recognize the existence of multiple actors with complex relationships. These programs are based on the belief that local communities must play a leading role in managing SSF and adjacent coastal

areas in partnership with a supporting agency, although in some cases supporting agencies are absent. Communities replace the role of external authority and create their own institutions, but successful long-term governance is the result of collaborative efforts between fishery actors. Key fishery actors are typically grouped in the following categories:

- local community development committee of area residents who directly use the resource;
- members of regional or national agencies that have functions related to compliance and enforcement, funding and training programs, and networking;
- representatives of national or regional NGOs, aid agencies, and research institutions that contribute to stock assessment, technical advice, and data collection; and
- representatives of the private sector who have functions related to marketing, product development, and job creation.

Actors who contribute to improving knowledge of the underlying stock are key since good fisheries management is not possible without a firm grasp of the dynamics of the resource (Hilborn et al., 2020).

The LAC experience shows that CBFM programs contribute to mainstreaming biodiversity and natural capital because coordination with local communities, and their varied list of priorities, also requires strong coordination between environmental agencies (e.g., ministries of environment and resource management) and non-environmental agencies (e.g., ministries of interior, development, or agriculture, and Afro-American and indigenous rights groups).

LAC has some of the most representative CBFM programs in the world; for example:

- The **Chilean AMERBs** (Spanish term for Management and Exploitation Areas for Benthic Resources) program is among the largest area-based rights programs in the world (Gelcich et al., 2017) and includes more than 30,000 fishers (TBTI, 2018). The AMERBs program started in 1995 as a response to the crisis in the Chilean abalone (*Concholepas concholepas*) fishery. Its collapse opened the door for management reforms whereby fisher associations were granted exclusive access to harvest resources within well-defined areas. By 2018, there were 707 areas decreed to fishing communities. Interestingly, communities perceive that the program is not always fulfilling the economic objectives, but they are unwilling to relinquish it (Gelcich et al., 2016). This observation highlights the multidimensional nature of the program.
- The nine **RESEXs** from Pará (Brazil) integrate the world's largest area of mangrove forests and swamps (Orensanz and Seijo, 2013). RESEXs were created in Brazil in 1992 as multiple-use PAs emphasizing the benefits of common property. As such, rights are granted to local communities and they are not transferable by local users. Since 2007, they have been implemented by an environmental agency (ICMBIO). By 2018, there were 24 marine RESEXs.
- **Territorial communal rights programs** received great attention in Colombia once the Constitution acknowledged, in 1991, the right to collective entitlement of historic territories occupied by Afro-American communities. In the Colombian Pacific, these communities represent close to 90 percent of the population and are highly vulnerable to violence

and drug trafficking (Saavedra, Pomeroy, and Rosenberg, 2016). The program regulates an extension of six million hectares where the main resource being exploited is a bivalve mollusk (*Anadara tuberculosa*) (Orensanz and Seijo, 2013). Additionally, the Colombian Pacific ZEPAs give exclusive use rights to local communities in the first eight nautical miles to prevent industrial fleets from extracting the resource (mainly shrimp, but also mackerel and tuna).

The shift from community participation to local governance is increasingly being applied in SSF; however, the success of CBFM programs is by no means guaranteed and many of them have struggled (Pomeroy, Katon, and Harkes, 2001). The impact of CBFM programs depends ultimately on an array of ecological, economic, and social factors, but quality information and lack of a standardized set of indicators usually prevent multidimensional evaluation and meta-analysis (Chu et al., 2017). Consequently, a case-by-case approach and context-dependent results have become an acceptable manner to provide evidence of the effectiveness of management reforms on the global level (Hilborn et al., 2004). Evidence in Chile and Mexico shows that territorial use privileges programs have contributed to a recovery in fish stocks, leading to increased public and private economic benefits (Grafton et al., 2008). However, effectiveness of such programs in achieving economic and biological sustainability has been uneven (Techeira, 2012; Villaseñor-Derbez et al., 2019). Santos and Schiavetti (2014) reported that the effectiveness of territorial communal rights programs appears to be improving in Brazil. The environmental dimension of the program obtained the most strongly positive assessment, followed by the social dimension. In the Colombian Pacific, there is evidence that CBFM programs contributed to the improvement in the environmental performance of shrimp fisheries through increases in stock size and selectivity. Additionally, resource rents are partially restored, with positive impacts reverberating through the supply chain (Marco, Valderrama, and Rueda, 2020).

Successful CBFM programs not only provide incentives for management innovation and stewardship, they also contribute to increasing fisher income and social standing (Romero et al., 2016). For example, the Colombian ZEPAs triggered agreements between artisanal fishers and the private sector to harvest fish selectively, respect the minimum fish size, and manage the supply chain, which improved fisher income. When fisheries become more profitable, the fishers can afford better education and health insurance coverage for their families. A community that is successfully using its economic resources can go one step beyond resource dependence in the next generation. Given that management reforms are designed to protect the lifestyle of fishing communities, CBFM programs seek to promote alternative sources of income within adjacent fishing areas (e.g., ecotourism activities). Even if extra income opportunities do not reach all users, they contribute to reducing fishing pressure (Lopes, Silvano, and Begossi, 2011) and the risks of fishing (Santos and Schiavetti, 2014), an activity that incorporates many uncertainties due to price, revenue, and landings instability. High volatility usually diminishes the welfare that accrues to the community. Income diversification is especially relevant in non-specialty fisheries or when fishing communities are characterized by low fishing infrastructure and income. In that case, the fishing community will be among the groups that face the greatest amount of social exclusion (Béné, 2003). CBFM programs may also contribute to strengthening social capital, which promotes trust and cooperation among fishers and in the whole community.

There is no recipe for implementing CBFM programs. Given the wide variety of social, economic, ecological, and governance challenges, programs must be flexible to respond to changing priorities as local fishery contexts vary and additional information becomes available. As mentioned above, the design of CBFMs is typically site-specific; however, for a CBFM to be successful, legal and regulatory frameworks need to correctly identify communities that will be involved, allocate rights, delimit exploitation areas, and provide management information. Hilborn (2007) asserted that decentralized local fisheries management still depends on well-functioning national agencies for recognition and support. In addition, cross-scale linkages with higher levels of governance are necessary to maintain management efforts at the local level (Cudney-Bueno and Basurto, 2009).

A recent worldwide study of more than 130 fisheries managed using the CBFM approach found that optimal conditions for deployment are strong local leadership, social cohesion, and secure property rights (Gutiérrez et al., 2011; Levine and Richmond, 2014). In line with these arguments, the LAC experience shows that communities that wish to take more responsibility for fisheries management usually need long-term support and guidance from partner agencies in order to succeed at setting priorities and achieving the CBFM objectives. Support becomes more effective if the program manager collects data on which to evaluate fishery changes, either retrospectively or prospectively (Zeller, Froese, and Pauly, 2005). Successful programs benefit from improvements in the capacity of the fisheries to gather information and integrate it into policy-making (Marco et al., 2020). Iterative learning based on data collection and analysis can facilitate cooperation among fishery managers (Kaplan and McCay, 2004) and offers a cost-effective way to tackle climate change by capturing the wealth of knowledge that fishery actors (e.g., fishers and scientists) have on dealing with climate variability and change (Reid, 2016). In LAC, the CBFM approach has contributed to mainstreaming equality and gender equity. In 2017, the LAC Parliament created the world's first model law on SSF (PARLATINO, 2017), which served as an example for countries to strengthen gender equity. The model states that LAC will gender mainstream all of their policies regarding SSF, with special attention to women's tenure rights, education, and participation in the food system of fisheries.

Within a country, the potential to scale up CBFM programs is determined by at least the following three conditions (Graham, Charles, and Bull, 2006). First, political scaling-up since CBFM programs need the national fisheries administration to provide political recognition of the value of SSF to biodiversity, poverty alleviation, and food security, and a long-term commitment to supporting the fishery sector. Second, functional scaling-up since CBFM programs need fishing communities and partner agencies to expand the number and type of activities into a coordinated program with a shared vision of fisheries management. Third, organizational scaling-up since CBFM programs need to adapt on a case-by-case approach; networking among different regional experiences might contribute to successful implementation of new CBFM programs. Scaling-up CBFM programs can be a daunting process in regions with long coastlines or a large number of islands. Under certain circumstances, CBFM programs seem to be rather opportunistic, and thus expanding them too quickly can be counterproductive, especially when resources are limited.

Graham et al. (2006) recommended implementing fisheries management plans before developing too many CBFM programs because the process of strategic planning contributes to the survival of CBFM programs. Many fisheries management reforms tend to impose strong reductions in current fishing pressure in the hope of obtaining rapid improvements in environmental performance. Depending on the fishery context, however, strict conservation measures may impose short-term economic losses that are politically infeasible or socially unacceptable. Asche et al. (2018) found that economic profit and resource conservation reinforce one another but only with management that limits entry. This result aligns with the idea that rights-based management and secure use rights contribute to increased long-term economic sustainability. Moreover, the authors argued that sustainability may be compromised as a result of a specific institutional design or potential conflicts between rights-based fisheries management and social objectives. Costello et al. (2016) showed that the greatest economic benefits may come more from improving institutions than from improving environmental performance. Ensuring long-term economic benefits through strategic planning and institutions is key as such benefits can help offset many of the short-term necessary costs and potential conflicts associated with profound reforms to fisheries management.

By a way of conclusion, the architecture for mainstreaming biodiversity in LAC-SSF is now more complete, with successful CBFM programs having increased in number and scope. Over the past few decades, the increased attention paid to CBFM as a local, decentralized, bottom-up SSF governance approach has been fueled by the perceived poor performance of top-down, hierarchical governance approaches. Although more research is needed, a growing body of empirical evidence shows that, depending on local fisheries contexts, CBFM can provide more direct (environmental or social) and indirect (climate change adaptation or gender mainstreaming) benefits than top-down alternatives. The acceptance and proliferation of CBFM programs across the LAC region is attributed, at least in part, to the flexibility with which they can be designed and implemented. Gutiérrez et al. (2011) stated that CBFM is the "only realistic solution for the majority of the world's fisheries." However, the local fishery context and differences in policy design play an important role in success. Day (2008) recognized that changes in fishery management require a length of time before they become effective. For example, Villaseñor et al. (2019) found that the effectiveness of the above mentioned CBFM programs in Mexico was related to the length of the program being implemented. Even those CBFM programs that did not reach their objectives should be looked at with a sense of accomplishment. All these programs produced important insights for the future of fisheries management and made a substantial contribution to mainstreaming biodiversity and natural capital concerns into community and local development plans.

2.6 The Path toward Natural Capital and Ecosystem Accounting

Over the past decade, NCEA has gained relevance as a mechanism to inform decision-making and the formulation of public policy in LAC countries. Natural capital represents an average of 18 percent of the total wealth of the LAC region compared to the world average of 9 percent (Lange, Wodon, and Carey, 2018). Acknowledging the relevance of accounting for the share of natural resources as part of overall wealth, LAC offers insightful examples of countries that have successfully institutionalized environmental accounting. These experiences resulted from technical support offered by international organizations to national statistics offices, central banks, ministries of environment and natural resources, NGOs, and academia. Furthermore, LAC countries that have successfully mainstreamed NCEA within public policies have trustworthy mechanisms to systematically compile and share relevant data. Despite the challenges associated with operationalizing these accounting systems, governments in the region have already started to realize that NCEA can provide important decision-making tools to be used outside the realm of environmental issues. This section compiles some of the most relevant experiences of NCEA implementation in LAC, emphasizing its status, use in decision-making, and institutional features for its deployment.

The System of Environmental Economic Accounting–Central Framework (SEEA–CF) is the international statistical standard adopted by countries to account for the stocks, and changes in stocks, of their environmental assets such as water, energy, and forests. The compilation of tables and accounts proposed in this framework allows stakeholders to better comprehend the interaction between the environment and the economy, specifically the extraction of these assets from the environment, their use within the economy, and their return to the environment as emissions and waste. The SEEA–CF is complemented by the System of Environmental Economic Accounting–Experimental Ecosystem Accounting (SEEA–EEA), which considers the interaction of ecosystem assets with the economy and wider society within a specific spatial area. These accounts, together with the System of National Accounts 2008, allow stakeholders to answer relevant questions concerning biodiversity—the status and trends, synergies and trade-offs, and policy responses (Ruijs and Vardon, 2018)—constituting a basic building block for mainstreaming biodiversity and natural capital into public policies and strategies. The combination of approaches of the SEEA–CF (e.g., through information on environmental protection expenditures) and the SEEA–EEA (e.g., through ecosystem extent and condition indicators, and supply and use of ecosystems services) allows an integrated and consistent assessment of the relationship between biodiversity, economy, and well-being.

According to the Global Assessment of Environmental–Economic Accounting and Supporting Statistics 2017, nine LAC countries had a SEEA–CF program in place (53 percent of responses to the assessment are from LAC countries) and two countries stated that they were planning to start or had started a program (UNCEEA, 2018). Comparing LAC to other geographical regions, Europe and North America had a larger percentage of responding countries with an established program (88 percent), while Africa had a lower percentage (36 percent). Yet, over the past few years, several international initiatives have emerged that have modified this trend in Af-

rica.[18] Moreover, five LAC countries have published SEEA–EEA accounts (Hein et al., 2020), representing 20 percent of countries that have either published or compiled ecosystem accounts.

In general, all LAC countries that have compiled NCEA processes have, at a certain point of their development, received support from international organizations and countries advanced in environmental accounting. Mexico stands out because it started its NCEA process around the same time as other pioneer countries, such as The Netherlands and Australia. In 1991, Mexico was the first LAC country to publish environmental accounts as a result of a pilot study in joint collaboration with the World Bank and the United Nations Statistics Division (Van Tongeren and Schweinfest, 1991).

Colombia's first foray into environmental accounting was also early in the 1990s, with the creation of the pilot project of integrated-environmental economic accounting for Colombia (known as COLSCEA, its acronym in Spanish). Yet, unlike Mexico, Colombia received international support at a later stage of the accounting process (2011) from the Wealth Accounting and Valuation of Ecosystem Services (WAVES) initiative (Carvajal, 2017). WAVES is a partnership of the World Bank with its implementing countries created to promote sustainable development by ensuring that natural resources are mainstreamed in development planning and national accounts.[19] Colombia was selected as one of the first core countries supported by WAVES to compile and institutionalize NCEA.[20] This assistance was oriented toward closing the gap between compiling the accounts and using them in public policy. Costa Rica and Guatemala were also part of the WAVES initiative, but cooperation was mainly directed toward technically elaborating the accounts because of these countries' lack of expertise in environmental accounting.

Another variant in implementing NCEA countries is associated with the institutional setting in which the accounts are embedded. In LAC countries, most environmental accounts are compiled by national statistic offices, central banks, or by their ministry of the environment (or its equivalent). While some of these institutions have more expertise in calculating statistics and coordinating with informants, others have more detailed knowledge of the natural resource at stake, and others may be more efficient at facilitating communication with policymakers to ensure the accounts are used.

Environmental accounting, as proposed in the SEEA–CF, is designed to be implemented on a national scale. The framework was developed to be consistent with the definitions and classifications of the System of National Accounts, which has a national scope. Yet, pilot studies of environmental and ecosystem accounts have been developed on a smaller scale because biophysical and monetary information was available with the required level of detail. Ecosystem accounts included in the SEEA–EEA can be implemented on smaller scales (e.g., by ecosystem type or administrative unit) because of their spatial nature (Hein et al., 2020). In LAC countries, the scale of implementation is predominantly national, but countries such as Colombia, Costa Rica, Guatemala, and Peru have published environmental and ecosystem accounts on a subnational

[18] See Jansen (2018) for examples of initiatives encouraging NCEA in African countries.

[19] The initiative has focused on developing accounts for middle-income and data poor countries. Since its launch in 2010, WAVES has assisted more than 16 countries around the world in mainstreaming NCEA.

[20] The other four countries of the first stage were Botswana, Costa Rica, Madagascar, and the Philippines.

scale. LAC countries' experiences establishing environmental accounts following the SEEA–CF facilitates the ecosystem accounting process because there is already a foundation of key principles and scope of methodology. Further, there is knowledge of the role and engagement of the different stakeholders (e.g., public sector, corporations, and academia) in natural resource governance.

The stakeholders involved in calculating and implementing the accounts tend to vary among LAC countries. As suggested before, many of the environmental accounting processes in the region have resulted from technical support offered by international organizations such as the Economic Commission for Latin America and the Caribbean (ECLAC), the Inter-American Development Bank (IDB), the United Nations Statistics Division, the World Bank, and countries well advanced in NCEA.[21] The most common actors within countries are national statistics offices, central banks, and ministries of environment and natural resources.[22] Local governments mainly act as information providers. In terms of the private sector, there are ongoing efforts globally to promote public–private coalitions to better manage and account for natural resources (WAVES, n.d.; Natural Capital Coalition, n.d.).

A mechanism that has proved successful in some LAC countries is an inter-institutional committee or body to define the guidelines to implement the accounts. The purpose of these committees is to ensure a space for dialog and discussion between the institution(s) in charge of the technical compilation of the accounts (e.g., statistical offices and central banks), and their main users for policy analysis (e.g., government offices) and policymakers (e.g., ministers). This collaboration facilitates access to information for policymakers looking to make timely and transparent decisions related to natural capital. This type of arrangement, represented in the National Council of Environmental Accounts (CNCA, its acronym in Spanish), has proven effective for Costa Rica.[23]

The resulting statistics and indicators are effective for informing immediate national issues, as well as long-term development strategies and solutions for structural problems. In Costa Rica, the role of the Ministry of Finance in the CNCA ensures that environmental indicators are derived from the NCEA to evaluate environmental protection expenditures and to design policies aligned with sustainable development. Following the same approach, Costa Rica used the results of CO_2 emissions associated with energy use derived from the 2011–16 Energy Accounts as inputs to project CO_2 emissions to be included in the National Development and Public Investment Plan 2019–22 (MIDEPLAN, 2018a).

In Colombia, natural capital accounts supported two of the country's policy priorities. First, the information from the timber account made it possible to calculate the cost of fires caused by the 2015 El Niño, which was estimated at around US$170 million. Second, in the con-

[21] See Carvajal (2019) for examples.

[22] However, there are also examples of LAC countries in which the compilation of environmental accounts was conducted by an NGO (e.g., Conservation International in Peru) or through an academic initiative (e.g., the Institute of Agriculture, Natural Resources, and Environment in Guatemala).

[23] https://www.wavespartnership.org/en/costa-rica-1

text of the peace agreements, thanks to available data from the forest accounts it was possible to estimate the avoided costs of net forest loss by reducing deforestation (WAVES, 2016a).

Moreover, NCEA has been useful in generating information to assess and model the impacts of climate change, particularly through energy and land-use accounts. NCEA can provide data to determine the relationship between a country's use of its natural resources and its level of greenhouse gas emissions, shedding light on potential economic activities where stricter adaptation measures should be implemented to reduce the impact of climate change on biodiversity. The Integrated Economic-Environmental Modeling platform developed by the IDB is an example of using environmental and ecosystem accounts to generate indicators associated with environmental quality, wealth, and potential risks related to climate change, in addition to quantifying conventional indicators such as GDP, income, and employment. Colombia, Costa Rica, and Guatemala are examples of LAC countries whose natural capital accounts have been used as inputs for this model (Banerjee, 2017a, 2017b; Banerjee et al., 2016).

Furthermore, key results of Guatemala's ecosystem accounts were used as inputs for modeling tools to evaluate climate change scenarios based on the country's Climate Change Strategy. The prospective analysis resulting from the baseline data showed the country's vulnerability to precipitation decline, leading to drastic conversion of ecosystems and extinction of species (Global Program on Sustainability, 2020).

The environmental accounts can also be used to effectively monitor the indicators for the SDGs from the 2030 Agenda for Sustainable Development. Environmental accounts are useful for developing combined indicators that evaluate the use of natural resources in physical terms and their relationship with economic and social variables (e.g., resource intensity indicators).[24] The calculation of NCEA has already assisted some LAC countries in developing consistent and coherent indicators associated with the SDGs (Banco Central de Costa Rica, 2018; Bann, 2019; WAVES, 2020). Ecosystem extent and condition accounts[25] are other examples of NCEA that can be used as inputs for national biodiversity strategies and as instruments to monitor progress toward achieving the Aichi Targets as well as their compilation and use. This is the main objective of the current process of revising the SEEA–EEA, which was officially launched in March 2018 and is expected to be submitted for adoption by the United Nations Statistics Division in March 2021.

NCEA as proposed in the SEEA framework aims to describe the interaction between the economy and the environment in a statistical, comprehensive way that can be used for policymaking. There are no quantitative indicators or evaluation mechanisms to value the effectiveness of the environmental accounting process in LAC countries. However, Bass et al. (2017) proposed 10 principles to assess if natural capital accounting is suitable for policy purposes. These living principles—in the sense that they are meant to be reviewed on a regular basis—are grouped on

[24] Resource intensity indicators (e.g., water intensity) show the amount of a natural resource (in physical terms) that is required to generate a defined unit of gross value added. When evaluated over time (and by economic activity if the information allows it), it is possible to observe the relative economic efficiency of the resource's use at stake.

[25] Ecosystem extent and condition accounts are two ways in which the state of ecosystem assets can be measured in physical terms. See Chapter IV of UNCEEA (2018).

four characteristics that NCEA should have to inform good policy: comprehensiveness, purposefulness, trustworthiness, and mainstreaming.

Improving institutional integration of NCEA into public policy processes is a key component to enhance their effectiveness. This integration goes hand-in-hand with an implicit commitment of the implementing countries to ensure their natural capital and ecosystem accounts are compiled and updated. Chile, Colombia, Costa Rica, and Mexico are examples of LAC countries where the implementation of NCEA has resulted in a high level of institutionalization (Carvajal, 2017).

Chile developed a National Plan of Environmental Accounts to guarantee the integration of economic-environmental information with the design and execution of the country's public policies, and also to have an accountability mechanism to assess the impact of natural resource use on economic development (Chile Ministry of the Environment, 2016). Costa Rica, on the other hand, formalized the process of environmental accounting by creating an environmental statistics unit at the Central Bank of Costa Rica (Carvajal, 2017). By institutionalizing this process, Costa Rica is committed to regularly updating and improving its environmental accounts. As a result, government initiatives, such as the National Development and Public Investment Plan, and the scenario developed for the Decarbonization Plan rely on the information periodically derived from the environmental accounts.

To ensure data quality, the main sources of information used to compile the environmental and ecosystem accounts should be official, trustworthy, accessible, timely, and complete.[26] Also, the SEEA framework contributes to statistical production by identifying information gaps that need to be addressed. Continuous dialog and clear communication between NCEA compilers and information providers improve the consistency and precision of the accounts for the long term. As for ecosystem accounts, using a rigorous spatial approach is fundamental for their development. For them to be replicable on a national scale, geospatial information is required to account for the ecosystem assets and services at stake. Moreover, the accounting framework proposed by the SEEA–EEA allows transactions in ecosystem services to be registered in monetary terms through the ecosystem service supply and use accounts. With this information, it is possible to assess the economic significance of ecosystem services with respect to the users and location of the services at stake, thereby becoming a useful tool to value "nature's contributions to people," as proposed by IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) (Pascual et al., 2017).

In terms of the scale of compilation of NCEA, some LAC countries have developed environmental accounts at national and subnational levels. For example, Colombia compiled local water accounts for Lake Tota, the largest lake in Colombia, which provides drinking water to more than 250,000 people of the Boyacá department and whose watershed supports the production of 60 percent of the spring onions produced in the country (WAVES, 2016b). In Costa Rica, the Public Service Company of Heredia (ESPH, its acronym in Spanish), which is in charge of providing drinking water to 5 percent of the country's population, prepared a water account at the company level to show the usefulness of water accounting for decision-making related to business strategies

[26] See Vardon et al. (2018) for more dimensions of data quality.

(Banco Central de Costa Rica and ESPH, 2016). Both Colombia and Costa Rica also have water accounts at the national level. Biophysical and monetary information regarding the supply and use of natural resources needs to be available at the desired scale of study. Moreover, as partner countries in the Natural Capital Accounting and Valuation of Ecosystem Services (NCAVES) project, Brazil and Mexico are working to mainstream biodiversity and ecosystems at the subnational planning level.[27] One of the project's aims is to find the common ground between business accounting and the SEEA–EEA framework in a way that both the public and private sectors can be aligned to bring benefits when collecting and using statistics and data for NCEA. In Mexico, institutional arrangements in place to develop EEA include the private sector as a key stakeholder.

The long-term sustainability of NCEA programs depends on the particular conditions of each country, such as the credibility of the institutions involved in the accounting process, the availability of information in a timely and recurring manner, and the priorities of the policy agenda. However, for environmental accounting to be mainstreamed within policy formulation, and to secure its financing, it needs to be institutionalized within government agencies. This facilitates the timeliness and continuity of the process in the long run. Ideally, these funds would be used to finance personnel in charge of compiling the environmental accounts and to improve the technical and institutional capacities to implement NCEA (e.g., by means of training programs and update workshops).

Some LAC countries have public resources assigned to develop environmental statistics. Mexico and Colombia have compiled environmental accounts since the 1990s. More recently, countries such as Costa Rica, Chile, and Brazil have incorporated their programs on environmental statistics as part of their institutional work (Carvajal, 2017). Regardless of the institutional setting in which NCEA are produced, the compilation of accounts should be independent of the country's political context.

Finally, creating official commissions and intergovernmental bodies to define the use and scope of the NCEA ensures that statistics are considered key inputs to legislation and public policy and their analysis. This mechanism needs to be paired with strong institutional commitment and political willingness from the stakeholders involved in implementing the accounts.

In conclusion, economic progress at the expense of natural resources and resulting degradation needs to be accounted for to have an integrated perspective on the overall net outcomes faced by LAC countries. Detailed information about the state and quality of natural capital available in the LAC region is relevant to measure the impacts of green growth strategies and development policies (Carvajal, 2019).

LAC countries that have successfully mainstreamed national capital and biodiversity accounting within public policies are those where statistics are compiled following a continuous and reliable process. The trustworthiness of the institution(s) in charge of the compilation process is key for optimal cooperation from the sources of information and to regularly improve the available data. Compiling environmental accounts as suggested by the SEEA framework allows hybrid indicators to be calculated, combining environmental and economic information, as well

[27] See SEEA (n.d.) for more information about the NCAVES project.

as biophysical and monetary information. Using these indicators as inputs and measures in government plans and legislation facilitates the formulation of integral, evidence-based development strategies.

2.7 Ecosystem-Based Adaptation in Agricultural Landscapes

EBA in agricultural systems is defined as "agricultural management practices which use or take advantage of biodiversity or ecosystem services or processes (either at the plot, farm, or landscape level) to help increase the ability of crops or livestock to adapt to climate change and variability" (Vignola et al., 2015). EBA interventions have great potential to address climate change and biodiversity loss, but they are often overlooked. One of the main limitations to accurately assessing the extent of EBA across LAC is that implementing these practices is not explicitly referred to as EBA. Explicit EBA interventions have mainly been promoted by international organizations, including NGOs and funding agencies, with different levels of participation by central governments. Current efforts focus on mainstreaming EBA into public policy instruments, such as Nationally Determined Contributions, Nationally Appropriate Mitigation Actions (NAMAs), National Adaptation Plans, and other policy mechanisms that aim to promote adaptation, mitigation, biodiversity conservation, and overall ecosystem resilience. This section highlights the knowledge gaps that hinder successful scalability of EBA and its systematic integration into agricultural policies. Examples of policies implementing this approach (or similar ones) in LAC are presented. The conclusion provides some considerations to realize the potential to mainstream and replicate EBA practices on various scales.

In the LAC region, the expanding agricultural sector continues to be the main driver of deforestation, degradation, and land-use change (FAO, 2018), with agricultural lands currently covering 38 percent (9.5 percent for crops and 28.5 percent for pasture) of LAC territory (OECD/FAO, 2019). Further, there is an estimated 650 million hectares of deforested and degraded lands (WRI, 2016). Current projections indicate an 18 percent growth rate in LAC's population between 2019 and 2050 (UN, 2019), highlighting the need to increase food production to satisfy future demand. However, climate change threatens the capacity of agricultural systems to fulfill these urgent necessities (Hannah et al., 2017). Climate change also poses a threat to the region's rural communities, with rising temperatures, changing rainfall patterns, and more frequent extreme weather events significantly reducing crop yields, creating new pest outbreaks, increasing soil erosion, damaging farm infrastructure, and threatening farmer food security and livelihoods (Alpízar et al., 2017b; Harvey et al., 2017). Furthermore, climate change jeopardizes the region's food security, as estimates indicate that nearly 15 million smallholder farmers in the LAC region (OECD/FAO, 2019) contribute to the region's food production, with smallholder and family farmers being particularly vulnerable to these climate change impacts due to their low adaptive capacity (Bouroncle et al., 2017; Holland et al., 2017; Simoes et al., 2010).

EBA is one potential solution to help farmers adapt to climate change. EBA refers to "the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change" (CBD, 2009). While EBA is more commonly thought of as applying to forests or other intact ecosystems (Scarano, 2017), it can also be applied in agricultural systems and landscapes (Vignola et al., 2015). EBA in agricultural systems includes management practices that use or take advantage of biodiversity or ecosystem services or processes (Vignola et al., 2015). It can include actions to conserve existing natural ecosystems, to restore degraded natural ecosystems or degraded agricultural lands (through natural re-

generation, forest restoration, or improved fallows), and to sustainably manage crops and livestock. It can include actions at the plot or farm level, as well as at the larger landscape level (Harvey et al., 2017). Examples of agricultural practices that can be considered EBA include managing trees in agroforestry or silvopastoral systems to protect crops or livestock from high temperatures or extreme weather events; using cover crops to help conserve soil structure, humidity, and nutrients; or conserving riparian vegetation in farms to ensure water can be provided under changing climatic conditions (Vignola et al., 2015).

Implementing EBA practices is a critical element of mainstreaming biodiversity and natural capital into the agricultural sector and more broadly the rural development agendas of LAC countries. Furthermore, scaling-up EBA offers powerful synergies and complementarities between mainstreaming biodiversity and climate policy because EBA is part of the National Adaptation Plans and NAMAs of several LAC countries. EBA can also contribute to countries' efforts to achieve land degradation neutrality under the United Nations Convention to Combat Desertification, biodiversity targets of the United Nations Convention on Biological Diversity, and the SDGs. In addition, EBA can contribute to achieving domestic commitments to the Bonn Challenge, which aims to restore 20 million hectares of degraded land in the LAC region by 2020.[28]

At the landscape level, implementing EBA practices such as agroforestry systems (e.g., live fences, windbreaks, and shade trees) can provide important co-benefits, such as biodiversity conservation. These positive externalities are derived particularly from providing or increasing habitat and enhancing or restoring landscape connectivity (Estrada-Carmona et al., 2019; Schroth et al., 2004). Habitat and connectivity support gene flow, reducing local extinction risks and supporting delivery of critical ecosystem services to food production, such as pollination and pest control (Chain-Guadarrama et al., 2019; Martínez-Salinas et al., 2016). EBA practices benefit people by reducing their vulnerability to extreme weather events (e.g., storms and flooding), serving as a source of products and services for local livelihoods, and maintaining ecosystem services that underpin agricultural production (Doswald et al., 2014; Jat et al., 2016; Rosa-Schleich et al., 2019). Many EBA practices have been used for decades in LAC as part of sustainable land management, agroecological approaches, agroforestry initiatives, restoration initiatives, and watershed management, and as an integral part of a wide variety of efforts to conserve biodiversity. Nowadays, these practices have grown in importance because of their ability to enhance the adaptation and resilience of agricultural systems and human communities to climate change. However, the frequency of EBA implementation varies across crops. For example, agroforestry systems are commonly implemented in pastures, coffee, and cacao (e.g., live fences and shade trees) but are far less common in annual crops or extensive monocultures (e.g., palm oil, sugarcane, and pineapple).

In many cases, EBA practices in the sense of the definition of Vignola et al. (2015) are being promoted not as EBA per se, but as part of larger initiatives focused on landscape restoration, resilience to climate change, or sustainable production. EBA has been incorporated into diverse policy instruments and other initiatives on multiple scales across LAC, though in many cases these practices are not specifically called EBA. Most of these instruments relate to national

[28] For more information, see https://www.wri.org/our-work/project/initiative-20x20.

and subnational efforts to encourage sustainable agriculture, and frequently particular agricultural practices are promoted but not necessarily addressed as EBA or even justified based on their adaptation benefits. For instance, for a long time agroforestry systems have been promoted across agriculture-dominated landscapes in LAC through a wide variety of initiatives (Current, Lutz, and Scherr, 1995). In particular, agroforestry systems have been promoted in the coffee sector to enhance the habitat for biodiversity, to sustain coffee productivity over time, and to reduce the impact of pests and diseases due to climate variability (Chain-Guadarrama et al., 2019). As such these systems are also an important element in coffee certification schemes (Rueda, Thomas, and Lambin, 2015).

Current efforts to incorporate EBA into policy mechanisms involve its inclusion in the NAMA plans, Nationally Determined Contributions, National Adaptation Plans, and forest landscape restoration plans. Although in LAC most NAMA efforts have focused on the transport and energy sectors, several countries (Honduras, Nicaragua, Costa Rica, Dominican Republic, and Colombia) have incorporated (or are incorporating) agroforestry systems as an important element of their coffee and livestock NAMAs. Mexico has also included agroforestry systems within its 2019–24 National Development Plan as a fundamental piece of its "*Sembrando Vida*" program. This program explicitly promotes agroforestry systems with monetary incentives and technical assistance to increase tree cover. Although promoting agroforestry systems is without question a step forward, the Mexican National Development Plan does not mention the relationship between these practices and adaptation nor does it depict these efforts as an adaptation strategy or even address these interventions as EBA. Finally, as part of the Bonn Challenge (i.e., the 20x20 Initiative), many LAC countries are implementing a variety of approaches to restore degraded forest lands, including managing them mainly through silviculture and natural regeneration, and improving agricultural lands mainly through agroforestry systems. El Salvador has reported that 17 percent of its national restoration initiatives are being conducted within PAs and are thus directly contributing to biodiversity conservation (Dave et al., 2018).

In the case of the Nationally Determined Contributions, this CBD led framework sets out high-level objectives and a vision to address adaptation goals, which for some LAC countries include EBA. For instance, Mexico, Guatemala, El Salvador, Honduras, and Costa Rica all include commitments based on using biodiversity and ecosystem services (i.e., EBA) in their Nationally Determined Contributions, but only Mexico and Costa Rica explicitly refer to these efforts as EBA. These five Mesoamerican countries all include EBA commitments in their Nationally Determined Contributions into two broad categories: (i) enabling conditions (67 percent of commitments) and (ii) actions on the ground (33 percent of commitments). The latter mostly focus on promoting sustainable production practices and natural infrastructure (Luna and Martínez, 2019). Brazil, on the other hand, already has in place a variety of national and subnational policies that have the potential to propel EBA implementation, including its Nationally Determined Contribution, which focuses on two main components—sustainable energy and sustainable land use—the latter including the goal of restoring over 25 million hectares of degraded lands (Scarano, 2017). Implementing EBA within this CBD strategic framework may be embedded in National Adaptation Plans, which usually requires coordination between the ministries of environment and agriculture, and the ministries of economy or finance to ensure public investment.

Across LAC countries, mainstreaming EBA into national planning processes on climate and development has been promoted and supported by international organizations and donors. For instance, since 2008, Germany's International Climate Initiative of the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety has been financing climate and biodiversity projects, including EBA. This initiative plays a pivotal role in Germany's climate financing and funding commitments for the Convention on Biological Diversity.[29] Most of these projects specifically aim to generate evidence and promote changes that support including EBA in Nationally Determined Contributions, National Adaptation Plans, NAMAs, and other planning efforts focused on climate, development, and biodiversity conservation (e.g., Mexico's National Biodiversity Strategy) by working in close collaboration with government agencies. During the past decade in particular, the United Nations Food and Agriculture Organization (FAO) has spearheaded important efforts to bring attention to the critical climate adaptation needs within the Central American Dry Corridor. This attention led in 2017 to the establishment of a program dedicated to strengthening resilience to climate change in this corridor and the Dominican Republic, a joint effort by the Central American Integration System (SICA from the Spanish acronym), the Central American Bank for Economic Integration, the FAO, and the United Nations Environment Programme. The program is currently seeking funding from the Green Climate Fund to develop EBA to increase climate resilience. Efforts are supported by government entities from Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, and Dominican Republic. Furthermore, it is important to bring attention to the role of the Green Climate Fund in financing the promotion and implementation of EBA, with six adaptation projects currently being implemented in LAC, four of which focus on ecosystems and ecosystem services. The six projects represent an investment of over US$200 million that will impact more than 10 LAC countries.

The private sector also plays an important role in promoting EBA. For instance, certification mechanisms have for a long time promoted EBA across a variety of crops, from biodiversity friendly to organic schemes, the latter with important co-benefits to human health. In countries like Brazil, Chile, and Peru there are community-based programs where farmers are responsible for verifying each other's practices without the intervention of a third-party (e.g., Participatory Guarantee Systems). This practice helps avoid certification costs while still guaranteeing that production systems adhere to a certain set of rules (FiBL and IFOAM, 2020). International NGOs, and to a lesser extent national NGOs, are also key actors and the ones mostly responsible for implementing research and/or development projects involving EBA promotion, with most of these projects implemented in collaboration with government institutions, such as the ministries of agriculture and environment (Vázquez Vela, 2018). However, it is important to stress that many of the organizations promoting EBA are promoting them under the umbrellas of sustaina-

[29] Examples include the Ecosystem-Based Adaptation for Smallholder Subsistence and Coffee Farming Communities in Central America project implemented by Conservation International, the Tropical Agricultural Research and Higher Education Center, and the French Agricultural Center for International Development in Guatemala, Honduras, and Costa Rica; the Mainstreaming Biodiversity into the Mexican Agricultural Sector project implemented by GIZ in collaboration with the Federal Agriculture and Rural Development Secretariat of Mexico; and the Adaptation, Vulnerability, and Ecosystem project implemented by IUCN in Mexico, Guatemala, El Salvador, Costa Rica, and Panama.

ble agriculture or best management practices or even climate mitigation practices, rather than EBA. This is also true for government policies and highlights the need to adapt farm-program incentives in order to mainstream EBA and biodiversity conservation into agricultural lands (Ogg, 2020).

The amount of available information pertaining to the direct financial and environmental benefits of implementing EBA varies for different practices. For instance, there is plenty of evidence indicating that agroforestry systems can be profitable under a wide variety of conditions (Current et al., 1995; Lyngbaek and Muschler, 2001; Martinelli et al., 2019), but profitability depends on the stability of input prices, farmer's agricultural knowledge, and access to markets and financial mechanisms, among other factors (Tremblay et al., 2015). There is also evidence that silvopastoral interventions allow farmers to cope with environmental stressors. For example, trees on farms help provide fodder to sustain animals during a drought and regulate microclimatic conditions contributing to animal comfort, thus increasing meat and/or milk production (Cubbage et al., 2012). More than a decade ago, the Regional Integrated Silvopastoral Ecosystem Management project supported by the GEF and the World Bank promoted silvopastoral practices (i.e., EBA practices such as reintroducing trees and shrubs into permanent pastures) to foster biodiversity conservation and productivity in livestock systems in Nicaragua, Costa Rica, and Colombia. Many of these practices persist in these landscapes, suggesting that farmers continue to perceive benefits, particularly because of improved rangeland productivity (Garbach, Lubell, and DeClerck, 2012). Similar efforts have been widely promoted in Colombia where intensive silvopastoral systems have been proposed as a strategy to restore large areas of degraded pastures, particularly due to their contributions to climate change mitigation and adaptation as well as to biodiversity conservation (Murgueitio et al., 2011, 2014).

Integrating EBA is usually considered a more cost-effective approach to climate change adaptation than approaches that rely on technical solutions, such as infrastructure or applying additional inputs (Emerton, 2017; Reid et al., 2019). However, there are also differences in costs of implementation. For example, research from Brazil shows that EBA in the form of restoration is cheaper when focusing on natural and assisted regeneration strategies instead of tree planting and direct seeding (Brancalion et al., 2019). EBA is linked to a series of economic benefits, such as avoided costs, income smoothing, increases in land value, sustainability of livelihoods, and new market opportunities (Reid et al., 2019; Vignola et al., 2015). However, evidence of EBA effectiveness needs to be strengthened since most projects lack enough robust information to assess their effectiveness over time (e.g., measurements of the ecosystem services provided, appropriate baselines, and measures of the adaptation benefits), which in turn hinders the capacity to conduct such analyses (Emerton, 2017). To improve our understanding of the effectiveness of EBA, we need better information about the EBA practices being implemented (e.g., geographic location, area covered, associated with which crops, and implementation and management requirements), whether they have been implemented with specific adaptation objectives, and their impacts on multiple dimensions (e.g., social, ecological, and economic).

The human health co-benefits of EBA are also important. For instance, reducing the frequency of chemical fertilizer applications combined with using integrated pest management programs and the overall shift to organic agriculture reduce farmer exposure to unhealthy and some-

times highly toxic substances (Bacon et al., 2012; Pavlidis and Tsihrintzis, 2018; Rosa-Schleich et al., 2019). Due to the direct and indirect effects on human health, there is a great opportunity to work in collaboration with ministries of health to promote these practices. In addition, EBA could help reduce the risk of disasters caused by climate hazards (e.g., risks due to drought, flooding, hurricanes, and landslides). For example, conserving and restoring forests and natural ecosystems on steep slopes or along floodplains can help mitigate the impacts of flooding or destruction of cropland and farming communities. Finally, EBA plays an important role in maintaining and/or improving habitat for biodiversity, thus securing critical ecosystem services for farmers and downstream communities (Doswald et al., 2014; Reid et al., 2019).

EBA practices in agriculture show great potential for scalability across and within LAC countries. However, this potential depends on enabling or facilitating conditions. Promoting EBA should be accompanied by other mechanisms that can foster long-term adoption, such as access to capacity building (i.e., for farmers and policymakers), support for agricultural extension programs, and EBA knowledge hubs and/or learning communities (i.e., facilitate farmer-to-farmer exchange of experiences and lessons learned) (Vignola et al., 2015; Harvey et al., 2017). In addition, EBA practices should be incorporated into existing financing mechanisms. For instance, some PES programs in LAC (e.g., Costa Rica's National PES) currently promote implementing EBA in the form of agroforestry systems to support biodiversity and provide ecosystem services. Other mechanisms include micro-credit programs for small-scale agriculture, CTFs, forest landscape restoration, watershed management initiatives, and public–private partnerships to fund conservation in agricultural landscapes. Strengthening the evidence on the effectiveness of EBA in delivering ecological and socioeconomic outcomes would help foster their wider implementation and long-term adoption (Lee et al., 2014; Scarano, 2017).

Finally, to mainstream EBA into climate change, development, and disaster risk national plans, better coordination of agricultural and climate change policies is needed. Coordination would foster the synergies between on-farm productivity and global climatic goals. In other words, a transformative change in current policies (including on-the-ground coordination of adaptation) and mitigation interventions are both needed to promote sustainable agriculture (Harvey et al., 2014; Ojea, 2015; Vignola et al., 2015). Governments in LAC must prioritize the implementation of EBA as an important component of climate change adaptation in agriculture given the diverse associated co-benefits and the opportunity to achieve multiple goals (e.g., adaptation, biodiversity conservation, and diversity of income sources). EBA should be part of a larger adaptation strategy that also includes conventional adaptation practices, such as drought-tolerant crop varieties, better water management, farm insurance, alert systems, and other technological measures (Harvey et al., 2014; Cohen-Shacham et al., 2019). Strong climate change policies are needed to foster EBA implementation, as well as political and legal support for these practices. Including these practices in programs that support sustainable agriculture is a most needed strategy since EBA by itself is not enough. Rather, EBA should be part of a suite of adaptation options and must be recognized as a crucial element within agricultural adaptation strategies, including alliances with parallel processes promoting similar approaches. For instance, the Regional Strategy for Climate Change of the SICA makes explicit the regional linkages with the most recent international guidance on climate change and development (Paris Agreement and SDGs). In 2017, the ministries of agriculture of the SICA agreed to use the Cli-

mate-Smart Agriculture approach as a tool to reduce climate-related risks in the agriculture sector. As a result, the Climate-Smart Agriculture Strategy for 2018–30 was deployed. This strategy was supported by a SICA technical group that comprises regional institutes and research centers.[30]

To conclude, it is important to highlight that EBA is critical to help countries meet their climate goals, to foster conserving biodiversity and providing ecosystem services in agriculture-dominated landscapes, and to help rural communities adapt to climate change. Based on LAC experiences, we know that EBA practices commonly used by farmers show a lot of potential for scalability. However, this will only happen if programs promoting EBA enhance its ability to demonstrate the multiple benefits associated with these practices, if government structures facilitate farmer access to financial mechanisms, if local capacity is strengthened, and if EBA is actively promoted as an adaptation strategy. Additionally, it is crucial to map the extent of EBA interventions (percent of land covered) and to analyze its impacts compared to other policies that simultaneously promote adaptation and biodiversity conservation in agricultural lands.

LAC countries have already incorporated EBA-like practices in many national and regional efforts to promote sustainable agriculture. However, in many cases the relationship between the agricultural practices being promoted and their adaptation benefits is not clearly established. In addition, in preparing this report we noted the insufficient information on the extent of EBA practices implemented in the region, making it difficult to know how widespread its use is and for what types of crop systems it is mainly implemented. We know EBA has great potential; however, for instance, we do not have data on how many hectares are affected by practices that can be considered EBA or whether these practices were established with clear adaptation objectives.

For EBA to become the norm within the agriculture sector it is necessary to foster a cross-sectoral effort designed to highlight the economic, environmental, and social benefits associated with implementing these practices. EBA should be systematically integrated into agricultural policies, not just for adaptation, but also for sustainable production, restoration of degraded land, sustainable development initiatives, sustainable agriculture initiatives, and watershed management initiatives, among others. It is an approach that cuts across different disciplines and sectors.

A takeaway is that EBA is often overlooked as an adaptation strategy, with governments and donors preferring to invest in technological/conventional solutions (e.g., plant breeding, new varieties, more inputs, farm insurance, changes in crops, and adoption of irrigation technologies), rather than realizing that they can take advantage of the biodiversity and ecosystem services already available within agricultural landscapes. EBA must be acknowledged by governments as a vital element of adaptation strategies and as a critical complement to technological adaptation approaches. Finally, to effectively mainstream EBA across landscapes and scales, it is necessary

[30] Including the Inter-American Institute for Cooperation on Agriculture, the Tropical Agricultural Research and Higher Education Center, ECLAC, the International Center for Tropical Agriculture, and the CGIAR Research Program on Climate Change.

to strengthen the current body of evidence demonstrating the effectiveness of these practices in delivering adaptation benefits in the short, medium, and long term.

3 RECOMMENDATIONS FOR POLICYMAKERS

In the past two decades, there has been a paradigm shift in the approach to characterizing and proposing solutions to the most pressing environmental problems. Society's multiple objectives (e.g., reduced poverty and economic growth, increased equity and inclusiveness) are perceived as strongly complementary to protecting and sustaining nature and the services derived from healthy ecosystems. Natural capital and biodiversity help reduce poverty, increase economic growth, and increase equity and inclusiveness. Moreover, long lasting success in raising human well-being can only be achieved if nature is sustainably managed. An example of this paradigm shift is the United Nations' SDGs, which are a mix of environmental, social, and economic objectives. This shift must be followed by concrete actions, policies, and institutions that integrate and embed natural capital and biodiversity values into strategies and practices of public and private actors as a matter of day-to-day decision-making. The operative term to describe that process is mainstreaming biodiversity.

In this report, two types of mainstreaming are easily identified: policy tools and actions.

Policy tools drive the mainstreaming of natural capital and biodiversity in and of themselves. Examples from this report include natural capital and ecosystem accounting, nature-based solutions for infrastructure, ecosystem-based adaptation of agriculture, and community-based fishery management (CBFM). In LAC, CBFM programs demonstrate key elements and successes related to mainstreaming biodiversity and natural capital. These programs require coordination with local communities and their varied list of priorities, and coordination between environmental agencies (e.g., ministries of environment and resource management agencies) and non-environmental agencies (e.g., ministries of interior, development, or agriculture, and Afro-American and indigenous rights groups).

Actions have evolved from some of the policies described in this report, becoming true tools for mainstreaming natural capital and biodiversity after experience and evidence showed that long-term success and financial support requires the involvement of communities, indigenous populations, private companies, and non-environmental government institutions. Examples include protected areas and payment for ecosystem services.

This report is a synthetic overview of some of the most important policy tools and approaches that have been used in the past two decades in the LAC region to mainstream biodiversity and natural capital into public plans and strategies. The analysis of those policies allows us to draw two key lessons and make a series of policy recommendations regarding the enabling conditions for mainstreaming natural capital and biodiversity into public policy.

3.1 Two Key Lessons

The first lesson is inevitably related to the role of governments. Historically, the responsibility for providing public goods related to protecting and managing nature lay with local or central governments, and frequently with authorities specifically tasked with environmental concerns. Mainstreaming natural capital and biodiversity into day-to-day activities inevitably leads to a much more shared responsibility, in which private firms, communities, and consumers, to name a

few relevant stakeholders, are not passive recipients of government policies, but rather are central players in constructing and governing public goods.

Having said that, all of the tools described in this report share a common feature: strong endorsement and support from governments. At the very least, this support includes providing a legal framework, political enabling conditions, and a mix of complementary policies. Examples include elimination of perverse incentives (e.g., subsidies for extensive agriculture) and land-use policies that support protected areas and schemes to pay for ecosystem services. In some cases, governments took a leading role in launching the policy tool itself. Examples include nature-based solutions for infrastructure and natural capital and ecosystem accounting.

Importantly, private sector participation has been more prominent when complementary policies create sustained demand for ecosystem services, such as caps on carbon emissions or requirements to offset biodiversity. Similarly, increased adoption of ecosystem-based adaptation in agriculture is highly related to the prominent role it has in the Nationally Determined Contributions and National Adaptation Plans of LAC countries. Nationally Determined Contributions and their respective adaptation plans not only raises the level of importance of the tool, but it also forces the ministries of environment, agriculture, and finance to be involved and to coordinate.

Finally, the pivotal role of government institutions in supporting natural capital and biodiversity is not circumscribed by environmental authorities. On the contrary, the role of central banks, agriculture ministers, and infrastructure ministries was key to several of the policies in this report. Appendix 2 shows Colombia's experience with mainstreaming biodiversity, an interesting blueprint for the ambitious overhaul of government institutions needed in the context of strong complementarity between economic growth and natural capital.

The second lesson relates to the long-term sustainability of the policies themselves. Although some of the policy tools described in this report have a long history, none of them can take their survival for granted. On the contrary, the lessons derived from policy tools with a longer history (e.g., protected areas) are evidence of the constant challenges they face. These challenges are political, financial, and technical, and solving the financial and technical challenges is typically the only functioning strategy to deal with the political challenges.

Financial challenges have always been at the center of natural resource management, irrespective of whether the policy tool requires public funds or is in the hands of private investors or donors. Innovation is the key to success. Protected areas, payment for ecosystem services, community-based fishing management, and conservation trust funds all relied on local and national government budgets and international assistance to begin, but quickly opted to diversify their financial bases through innovative financial tools, such as schemes to match funding, market access, and public–private partnerships. For nature-based solutions, the funding for natural capital is inherent to the design of the infrastructure project, but even in that case, innovation in project finance is needed to ensure that biodiversity considerations are not dropped for the sake of cheaper projects.

Technical challenges are equally important. All of the policy tools described in this report have required fine tuning. Successful policies constantly gather information and use it to adapt. Protected areas provide a powerful example. The criteria to establish new protected areas and define their level of protection is evolving beyond purely biodiversity conservation to include protecting key ecosystem services (e.g., providing water). Doing so fosters the interest of local

governments and populations, thereby increasing the capacity of the protected area to deliver on biodiversity goals. Similarly, successful community-based fishery management programs are flexible and can respond to changing priorities as local fishery contexts change and additional information becomes available.

3.2 Key Enabling Conditions

The comparative analysis of the policy tools described in this report also allowed us to identify key enabling conditions that facilitate mainstreaming natural capital and biodiversity into public policy. The policy instruments described in this report benefited from the following enabling conditions:

- **Strong institutions:** A basic fabric of legal and financial practices and functional supporting institutions (e.g., banking, auditing, and contracting) is required. In particular, multiple stakeholders need to share responsibilities and roles, which inevitably creates the need for innovation in the institutional and legal framework.
- **Policy mix:** Policy instruments do not operate in a vacuum, and their success depends heavily on their interaction with existing policies. The design and operationalization of new policy instruments must consider the mix of policies, avoiding undesirable interactions and encouraging positive ones.
- **Clear demand:** Successful policy tools are a reaction to clear demand for ecosystem services (e.g., community-based fishery management as a response to diminishing fish stocks). Effective communication of the benefits is needed to secure social acceptability in the long term.
- **Third-party brokers:** The policies described in this report all benefited, at one point or another, from the active engagement of third-party brokers. This role is played, for example, by the IDB in the context of nature-based infrastructure in Andros Island, Bahamas, by conservation NGOs for environmental trust funds and community-based fishery management, and by the World Bank for natural capital and ecosystem accounting and payments for ecosystem services.
- **Evidence-based design and implementation:** The design and implementation of successful policy tools to mainstream biodiversity should be based on information and the best scientific evidence available at the time. Still, implementing a policy should not be deferred if not all of the information is available at the onset of the process or if scientific evidence is weak. The key to success is an embedded system that systematically gathers evidence of the tool's impact. Successful policies are those that are constantly being adjusted and fine-tuned based on evidence (e.g., improved targeting in paying for ecosystem services and adjusted fishing efforts in community-based fisheries). Although there are significant technical and financial challenges to evaluating the impact of the policy tools described in this document, the need to ensure that policies deliver on their promises is key to their survival, particularly in a context of increasingly scarce funds, time, and political capital.
- **Technical and financial sophistication:** Managing and conserving natural capital and biodiversity needs to evolve to become more technically and financially sophisticated, thereby attracting a larger and more varied pool of donors and producing more effective

investments in conservation. This is particularly important in selecting monitoring, reporting, and verification tools, and choosing indicators of success. Successful mainstreaming tools can track performance and show outcomes for a broad audience that goes well beyond environmentally motivated actors; skeptics should be the target audience. A good example is nature-based infrastructure. A major part of using nature-based infrastructure is the ability to demonstrate, in a standard cost–benefit analysis, its cost effectiveness compared to gray infrastructure.

- **Governance for inclusiveness:** Policies to mainstream biodiversity include a broader range of stakeholders than traditional tools. Moreover, multiple stakeholders from multiple sectors have a larger investment in the policy tools. To be successful, these policies must specifically address the issue of governance, how to secure accountability and ownership and, more generally, how to build social capital, trust, and cooperation among the stakeholders.

In this document we have reported on 10 instances where LAC is succeeding in implementing policies to mainstream biodiversity and natural capital. Although the process is far from complete, progress is being made and key lessons can be drawn from the experiences. For each policy tool, we have distilled evidence from multiple locations, countries, or approaches. As a result, we strongly believe that this description and the key enabling conditions identified herein are relevant and applicable not only within LAC but well beyond its borders. LAC is heterogeneous enough to provide a good testing ground for alternative policy designs, and our hope is that other initiatives worldwide can benefit from the accumulated experience. After all, in many instances, the outcome of local efforts to protect and sustainably use biodiversity and natural capital is determined at the planetary level, and LAC's accumulated experience should be an input to global solutions.

4 APPENDICES

4.1 Case Study: Payments for Ecosystem Services in Costa Rica

Costa Rica has a long-standing tradition of innovation in policy instruments for managing the environment. This country is globally recognized as one of the pioneers implementing PES, which it has done since 1997 (Pattanayak et al., 2010; Porras et al., 2013). This scheme was deployed as part of an innovative blend of economic and regulatory instruments to manage the environment. It provides a valuable source of inspiration for other countries that are looking for effective ways to preserve and regenerate ecosystems, and as such, the Costa Rican experience with PES carries significant potential for South–South learning. In fact, the Costa Rican case has inspired other countries to develop national programs, such as Mexico and Ecuador (FONAFIFO, CONAFOR, and Ministry of Environment, 2012) and likely at least a few local examples around the world (Porras et al., 2008). Nevertheless, replication should take into account the enabling conditions for PES deployment in Costa Rica, as described below.

Costa Rica's success with PES is the result of decades of experimentation, learning, and adaptation (Kim et al., 2016). From its inception well into maturity, the Costa Rican PES program enjoyed a set of very country-specific, idiosyncratic enabling conditions generated by the national government and by a global trend to increase the role of markets in conserving and managing nature. To a great extent, the PES program in Costa Rica needs to be understood as part of a mix of complementary policies and laws devised by the central government to decisively protect the environment. The objective of this section is to highlight the achievements and challenges of the PES program in Costa Rica, but also to provide a precautionary list of the country-specific conditions that favored its development.

Historically, the creation of PES in Costa Rica was preceded by a series of legal amendments that resulted in a cohesive legal framework that facilitated the creation of the program. The foundations of PES can be traced back to the ratification of several international conventions (e.g., Rio Declaration on the Environment and Development[31], and the CBD of 1993) that, in turn, shaped the amendment of Article No. 50 of the Political Constitution of Costa Rica that "guarantees citizens a healthy and ecologically balanced environment." In 1996, *Forestry Law No. 7575* prohibited land-use change to protect standing forests (think "stick") and at the same time was an innovator in LAC with the creation of a national-level PES program (think "carrot") (Porras et al., 2013; Kim et al., 2016).[32] This program is a market-oriented instrument that provides private landowners financial compensation for a bundle of ecosystem services defined in Law 7575 as mitigation of greenhouse gas emissions; protection of biodiversity for its conserva-

[31] The Rio Declaration on the Environment and Development, see https://www.jus.uio.no/lm/environmental.development.rio.declaration.1992/portrait.a4.pdf

[32] Other supplementary legal instruments in Costa Rica include the *Public Services Regulatory Authority Law*, *Soil Conservation Law*, and *Biodiversity Law*.

tion and sustainable use; water protection for urban, rural, and hydroelectric use; and scenic natural beauty for tourism and scientific purposes.[33]

The National Fund for Forestry Financing (FONANIFO, for its Spanish acronym), which was created under Law 7575, is the entity that leads the financial and operational aspects of the PES. This government body, under the supervision of the Ministry of Environment, has a board of directors composed of two representatives of the private forestry sector and three representatives from the public sector (Kim et al., 2016). Since its inception, FONAFIFO has spent roughly US$400 million on efforts toward reducing deforestation. The finance structure is dominated by the income coming from a 3.5 percent share of the national fossil fuel tax, which represents nearly 80 percent of its total budget in the recent decade (Kim et al., 2016). Remarkably, the legal framework has not been static in relation to funding sources. It has also allowed the establishment of bilateral agreements for voluntary contributions from hydropower and local companies, as well as external donations and debt with international financial organizations. In relation to the latter sources, these have been important in making funds available to protect key biological corridors (e.g., Mesoamerican Biological Corridor in Costa Rica).

Up to 2018, FONAFIFO signed 17,776 individual contracts with landowners, enrolling around 1,134,072 hectares into the program. Most of these contracts (approximately 90 percent) are under the forest protection modality, followed by contracts on reforestation and forest management (FONAFIFO, 2020). In addition, roughly 7,504,836 trees have been planted in agroforestry or silvopastoral systems. Approximately 15,000 families have received payments from the program, including payments for over 162,111 hectares of indigenous territories that have received PES (FONAFIFO, 2020). In over 20 years of operation, only 2 percent of the PES contracts have been breached (Kim et al., 2016).

Since its inception, the PES program has progressively incorporated social objectives by including indigenous communities and rural holdings with only land possession titles (rather than formal land titles), including (in 2004) criteria favoring lands located in municipalities with a lower social development index,[34] and adding small-scale agriculture through agroforestry systems[35] to promote rural development (Kim et al., 2016).

In terms of the direct impact of the PES program on the targeted ecosystem services and biodiversity, there is no adequate monitoring framework and not enough data for a proper assessment. Furthermore, obtaining a credible counterfactual scenario is very difficult, especially since those enrolled in the program come from very different social, economic, and biophysical circumstances than non-enrolled lands and may be differentially affected by other policy measures or broader economic factors, including parallel programs or pre-existing incentives

[33] For more information see http://www.fonafifo.go.cr/es/.

[34] This index encompasses the following indicators: economic, electoral participation, health, education, and security (MIDEPLAN, 2018b).

[35] Including agroforestry systems as eligible land use within the PES program is also a key step in recognizing their role in mitigating greenhouse gases and protecting biodiversity. The aim of defining a maximum number of trees per landowner (3,500 trees) was to increase the participation of small farms. In addition, FONAFIFO explicitly favors the participation of indigenous communities and farmer cooperatives within this category of payments.

(Pagiola, 2008). Despite these limitations, rigorous impact evaluations for the Costa Rican PES scheme were carried out nearly a decade after the program's implementation (Arriagada et al., 2008, 2009; Pattanayak et al., 2010; Pfaff et al., 2009; Robalino et al., 2008). Most of these assessments focused on the effect of the PES program (i.e., the carrot, given that the land-use change prohibition applies to the whole country and hence cannot be evaluated) on land-use outcomes, rather than biodiversity or ecosystem services per se. Generally, impact evaluations demonstrate that the PES program, given that a land-use change prohibition is in place, has had only a small impact on reducing deforestation in Costa Rica.[36] Figure 1 shows that the implementation of PES coincided with other policies and external factors affecting deforestation.

It is important to emphasize that there is a mix of policies (including PES) and external factors that have influenced Costa Rica's success in achieving high forest cover nowadays. Once known for having a deforestation rate of 6 percent (one of the world's highest), Costa Rica now has more than doubled its forest cover (from 20 percent in 1996 to 54 percent in 2015). Figure 1 illustrates some of the many factors influencing deforestation rates in Costa Rica.

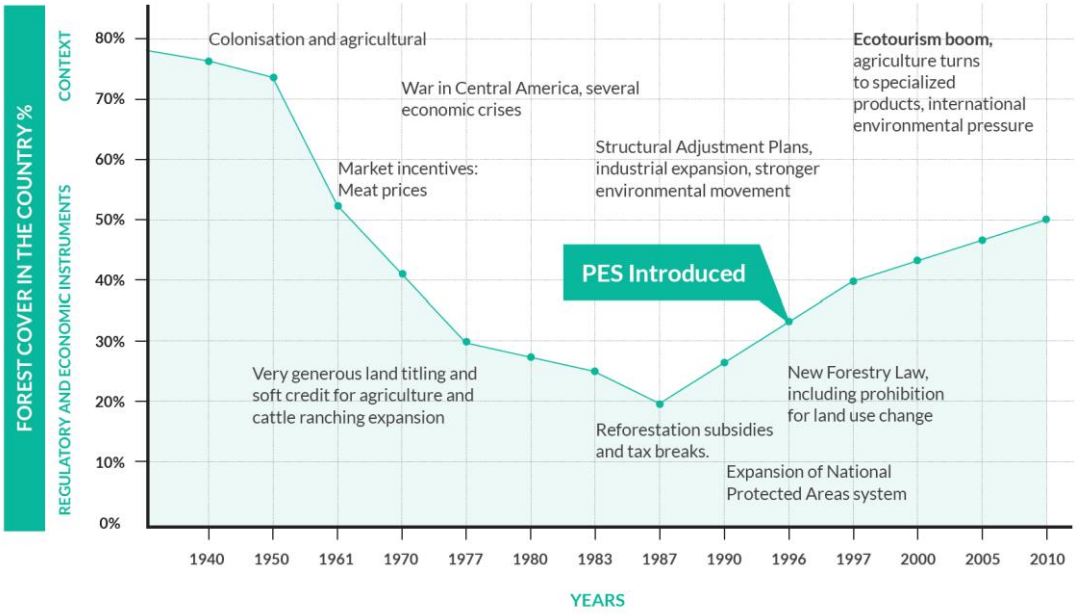

Figure 1. Evolution of Forest Cover and PES (Kim et al., 2016).

Before the 1980s, the most important negative driver of forest loss was high international meat prices generating strong incentives for land conversion, which was also favored by Costa Rica government policies facilitating credit for extensive cattle herds and providing land titling to those who cleared the forest for agricultural purposes. Interestingly, in the late 1980s, both in-

[36] These studies have not distinguished between forest types and their biodiversity conservation value (Porras et al., 2013). Additionally, even though most participants renewed their contracts voluntarily, the PES does not seem to support significant improvements in household assets or self-reported improvement in quality of life (Arriagada et al., 2015).

centives started to vanish and the government started promoting green legislation, including soft loans for forestry projects and direct subsidies for reforestation, management, and protection of natural forest. The enactment of Law 7575 in 1996 marked two fundamental changes: prohibiting land-use change and creating the PES program. Furthermore, conserving forests and other ecosystems has been promoted by the development of a strong nature-based tourism industry and the consolidation of the National System on Protected Areas (roughly 30 percent of the country is under some category of protected areas) over the past decades. This historical evolution suggests the importance of considering PES as part of a larger blend of policies and incentives aligned toward restoring and protecting key ecosystems.

On top of the positive mix of factors already described that favor PES in Costa Rica, it is also important to stress that the country's political and social stability has enabled the continuity of the program. In addition, the government has been promoting the development of a cross-sectoral agenda that fosters the coordination of actions among forestry, agriculture, and development sectors. Moreover, land tenure is well defined and supported by national legislation, which is a key prerequisite for establishing a contractual relationship between landowners and FONAFIFO.

In terms of non-environmental outcomes of the PES program, it is important to stress that at the outset of the program, socioeconomic outcomes were not a primary target. Still, the relevance of these has been gradually increasing. The socioeconomic effects of the Costa Rican PES program have also been the subject of impact evaluation studies (Arriagada et al., 2015; Robalino et al., 2014; Robalino and Pfaff, 2013). The general conclusion is that the scheme has not had substantial impacts, negative or positive, on poverty at a national level. This result, although disappointing at first sight, can actually be seen in a very positive light. Since 1996, Costa Rica has invested heavily in supporting the absolute protection of forests. This has been achieved without increasing poverty rates. In addition, Robalino and Pfaff (2013) noted that there were no negative effects on employment. The insignificant effects of the PES program on socioeconomic variables might be partly explained by a selection bias on the part of the beneficiaries, who are usually economically and educationally better-off than the non-recipients.

Overall, Costa Rica has the potential to achieve a more ambitious PES agenda, leading toward consolidating the program fully into the mainstream economy. Currently, one of the biggest challenges is securing long-term financial sustainability to meet increasing demand, since FONAFIFO's current budget accommodates only 42 percent of applicants and opportunity costs are generally increasing in areas where the forest is most at risk (i.e., urban areas and places where high-value export crops are produced), which reduces the competitiveness of PES (Kim et al., 2016; Porras et al., 2013; Porras and Chacón-Cascante, 2018). Furthermore, the strong policy promoted by the government on decarbonization also challenges the current high rate of dependency on tax revenue from fossil fuels.

To overcome these financial obstacles, a more comprehensive strategy for building a robust finance structure is needed, particularly including more participation from the private sector. Ultimately, this entails a fundamental change from donor-based to investor-based approaches to financing PES (Kim et al., 2016). In this sense, a foundational pillar for private investment is devising credible and measurable indicators to judge changes in ecosystem services resulting from

land-use changes and the role played by PES in securing desirable land-use changes. An investor-driven approach requires that those financing PES can more easily understand the characteristics of the ecosystem services acquired and their returns. Therefore, mechanisms to ensure measurable and verifiable financial and conservation impacts of PES, as well as transparent and credible trading and monitoring mechanisms, must be part of a stronger ecosystem marketing plan because private investors expect reliable, accountable, and science-based tools to support their transactions.

It is important to note that the success of the Costa Rican PES is not the result of chance. The government took decisive steps to create enabling conditions through complementary policies to protect the environment (e.g., legal prohibition on land-use change and a strengthened National Protected Areas System) and to promote green economic growth. This complementary blend of incentives seems to be key to Costa Rica's leading role in biodiversity conservation. Keeping this leadership role requires constant innovation and an adaptive management strategy that can adjust course based on carefully secured information, upcoming priorities (e.g., adaptation to climate change), and new financial challenges.

4.2 Case Study: Colombia's Mainstreaming of Biodiversity into Public Policy

Colombia is listed as one of the world's megadiverse countries, hosting nearly 10 percent of the planet's biodiversity (CBD, 2020). Recently, it has been promoting ambitious initiatives to mainstream biodiversity into public policies and private businesses that historically have been opposed to policies and programs for biodiversity conservation (BIOFIN, 2016). In fact, Colombia is now considered one of the world's leaders in experience with biodiversity mainstreaming projects (GEF, 2019). Much of the government effort aims to create a comprehensive policy framework that incentivizes the participation of a wide variety of actors, including associations of agricultural producers, local governments, the private sector, and indigenous communities.

The process of biodiversity mainstreaming in Colombia is interesting because it shows a country-wide, systemic effort to generate a comprehensive policy framework to guide specific plans and government strategies to sustainably use biodiversity, while also promoting the active engagement of stakeholders at different levels. In this section, we describe the key building blocks of the process, starting at the national level and then describing efforts emerging at the local level, as well as the synergies between the two. The objective is to show the challenges and enabling conditions faced by Colombia in including natural capital in decision-making processes; this review could potentially serve as a roadmap for other countries.

On the national scale, an important milestone in this recent trend was the promulgation of the National Policy for the Integral Management of Biodiversity and its Ecosystem Services (PNGIBSE from the Spanish acronym) (Minambiente, 2012). This policy is innovative for various reasons: (i) it introduces a fundamental change in how biodiversity is framed as a strategic component of the country's competitiveness and development agenda; (ii) it requires the coordination of plans and strategies from the government, productive sectors, and civil society to minimize their impact on biodiversity and encourage sustainable use; and (iii) it specifically addresses major threats to biodiversity in Colombia, such as those resulting from extractive industries, land-use change, and ecosystem fragmentation.

To implement the PNGIBSE, the country used a participatory approach to create a Biodiversity Action Plan[37] and regional Biodiversity Action Plans. Both were aiming to guarantee inclusiveness in decision-making, but also synergies with regional instruments that regulate the use and management of biodiversity by different economic sectors (Minambiente, 2016). This policy framework offers several examples that serve to illustrate the direct and indirect effects of mainstreaming natural capital and biodiversity into public policy. For instance, the following are among the main actions and policies developed by the Colombian government:

- A national REDD+ strategy, conceived primarily as a tool to reduce deforestation and forest degradation, but with an important focus on the integral management of biodiversity, biodiversity-friendly agricultural and forestry products, traditional knowledge on biodiversity, and economic instruments (Minambiente and IDEAM, 2018).

[37] Strongly supported by the Colombian Entrepreneurial Council for Sustainable Development, which brings together the energy, mining, agro-industry, construction, and finance sectors.

- A National Carbon Tax created as part of Colombia's climate commitments to reduce its emissions (Minambiente, 2020). A fraction of this tax is used in conservation activities such as reducing deforestation, conserving key ecosystems, and strengthening the system of PAs (Minambiente, 2020).
- A PES program that favors public or private lands located in degraded strategic ecosystems or ecosystems at risk of degradation in post-conflict municipalities (Minambiente, 2018a). The program is financed with 1 percent of the current income of the territorial entities.
- A policy requesting environmental compensation for biodiversity loss. The Ministry of the Environment requests compensation for the impacts on biodiversity caused by projects or activities within the framework of environmental licenses, change of land-use, and forestry (Minambiente, 2018b). This tool establishes preservation and restoration actions so that there are no biodiversity losses in net terms.
- A natural capital ecosystem accounting system, implemented by Colombia as environmental satellite accounts and gradually leading to a system of environmental and economic accounts in the country (DANE, 2018). Some results have been used to calculate Colombia's peace dividend, to make adjustments to water prices, and to monitor indicators of the country's National Green Growth Policy (WAVES, 2020).
- A National Green Business Plan[38] and the National Program of Sustainable Biotrade, both of which seek to consolidate green businesses through certification schemes, organic production, and similar approaches to minimize negative impacts on biodiversity.

The Colombian government's ambition goes one step further. As a complement to PNGIBSE, the National Development Plan 2018–22 (DNP, 2018a) has fundamental elements that promote mainstreaming biodiversity. In particular, the Green Growth Policy starts from the Pact for Sustainability of the National Development Plan. This policy seeks to direct the national economy toward green growth, promoting the increase in the country's economic productivity, while ensuring the sustainable use of natural capital through a cross-sectoral approach to incorporating good agricultural practices, and developing a bioeconomy and green businesses (DNP, 2018a).

The above framework provides conditions that enable the development of specific instruments to directly or indirectly influence biodiversity conservation. Interestingly, many of these instruments are market-oriented. Table 1 (on the next page) presents a summary of these instruments.

In an impressive turn of events at the sectoral level, key actors in the country's private sector have been involved in initiatives to mainstream biodiversity through the national coffee, livestock, and palm oil federations. In the coffee sector, thanks to the catalytic role of the rural extensionist network of the National Federation of Coffee Growers (FNC), coffee producers successfully implemented friendly farming practices, including agroforestry and shaded cultivation, as well as a landscape approach that aims to improve biodiversity connectivity between forested

[38] In the period 2014–18, 21,053 greens jobs and roughly US$172 million were generated. Source: Colombian Ministry of Environment and Sustainable Development, cited by Mauricio Mira Pontón, presentation at Pre-COP25, Costa Rica 2019. Other examples include the 357 green businesses in sustainable agroecosystems and biotrade, verified by MinTIC (2018).

areas. As opposed to the traditional mono crop, input-intensive, and treeless model of coffee cultivation, this new approach triggered biodiversity-friendly cultivation of coffee that opens new market niches for certified coffee and participation in PES markets. Mainstreaming is also fostered through agreements with public and private partners that have contracted or co-financed FNC extension services.

Table 1. Main Economic Instruments Influencing Biodiversity Conservation in Colombia

Economic Instrument	**Target Outcomes**
Compensatory Tax Rate for Wildlife Hunting	Protect and renew wildlife
Water Use Tax Rate	Protect and renew water resources
Tax Rate for Contaminated Discharges	Decontaminate water bodies
Electrical Sector Transfers	Protect the environment and defend the river basin
Environmental levies on real estate (property tax)	Protect or restore the environment
Environmental tolls surcharge	Recover and conserve areas affected by national road construction
Forest Compensation Rate	Protect and renew resources
Carbon Tax	Generate revenue from the carbon content of all fossil fuels. Part of this revenue is used to finance biodiversity conservation
National tax on the consumption of plastic bags	Regulate use of plastic bags

Source: Green & Sustainable Business Office 2018—Ministry of Environment and Sustainable Development of Colombia. Cited by Mauricio Mira Pontón, presentation at PreCOP25, Costa Rica, 2019.

The National Cattle Ranching Association, in collaboration with other executing partners, promoted an important transformation in the country's livestock sector to adopt environmentally friendly silvopastoral production systems, improving the provision of environmental services and biological connectivity, particularly in the eastern savannahs and southern mountain valleys (GEF, 2019; World Bank, 2019). Improving environmental services has also been triggered by carbon sequestration payments for silvopastoral systems.

Finally, the National Federation of Palm Oil Producers (Fedepalma) has been part of the Roundtable on Sustainable Palm Oil since 2004. As part of this initiative, palm oil producers have begun to incorporate environmental planning and adopt sound agroecological practices to protect biodiversity and increase farm productivity (Fedepalma, 2016). Fedepalma, in collaboration with key partners in the value chain, has also promoted the development of environmental certification standards for palm oil production.

These examples show that the private sector is successfully scaling-out practices that promote biodiversity conservation, mostly by highlighting the role of improved agricultural practices in achieving environmental and productive benefits (win–win benefits) and by using highly trained extension agents. There are other examples of initiatives, with strong participation of municipal

governments, community councils, and other grass root organizations, that aim to minimize the negative impact of land-use change and illegal mining activities.[39] Despite these advances, there are still important challenges to minimizing the negative impact of mining and oil activities in Colombia.[40]

The participation of the private sector and civil society in general is fostered by other mechanisms as well, such as Natural Reserves of Civil Society (RNSC), intending to involve private landowners in conserving biodiversity in exchange for tax exemptions and participating in planning development programs (Parques Nacionales de Colombia, 2020a). Currently, there are 841 RNSCs that correspond to 171,435.41 hectares under protection (Parques Nacionales de Colombia, 2020b).

Last but not least, it is relevant to highlight the role of ethnic communities in conservation efforts. Collective land rights are legal figures by which the state recognizes land ownership on the part of the ethnic and rural communities of Colombia. These communities protect the natural resources in their territories through their own cultural identity, norms, and local institutional arrangements (Gómez et al., 2016). Empirical evidence shows that collective land titling is an effective alternative in reducing deforestation in Colombia (Vélez et al., 2020).

The mainstreaming biodiversity projects implemented in Colombia are likely to be scaled-out to other sectors in the country. Furthermore, these initiatives could be replicated in other countries, after properly accounting for local conditions. It is worth mentioning that projects and initiatives in Colombia have been facilitated by the enabling conditions created by PNGIBSE and connected policies, credible scientific research institutions providing data and technical support at different levels,[41] and the positive political and social environment, particularly associated with the Peace Agreement.[42] It is likely that, in the near future, successful experiences with biodiversity in the productive sectors will favor implementation of similar actions on other relevant sectors through a closer relationship between the national producer federations and the Ministry of Environment.

Broadly speaking, the economic and social impacts obtained from the impressive array of policies implemented in Colombia have not been systematically quantified in economic or ecological terms. Despite this limitation, some project indicators suggest important achievements in the area covered by and returns to farmers.[43] Clearly, in addition to potential contribution to im-

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39 For instance, the Forest Management and Sustainability in the Heart of Colombia's Amazon project (known as Corazón de la Amazonía) and conservation of biodiversity in landscapes influenced by mining in the Chocó Biogeographic Region, both supported by GEF.

40 Mining and oil represented 8 percent of Colombia's GDP in 2011 (BIOFIN, 2016).

41 Noteworthy are Instituto Amazónico de Investigaciones Científicas (http://www.sinchi.org.co) and Instituto Alexander von Humboldt (http://www.humboldt.org.co/es/).

42 After the Peace Agreement in 2016, tourist visits to Colombia's national parks increased up to 70 percent (PNNC, 2018, cited by Mauricio Mira Pontón, presentation at PreCOP25, Costa Rica, 2019).

43 The establishment of 31,000 hectares of certified coffee, 1,022 hectares under landscape management that contributes to the connectivity of 10,340 hectares of forest, and 9,475 tons of CO_2 captured and sold in 2014 in the PSA market (GEF, 2019). Conversion of 27,950 hectares into silvopastoral systems and 4,112 hectares into intensive silvopastoral systems, conservation of 18,238 hectares of forests, enrichment of 2,849 hectares of secondary forests, and increased productivity for farmers to US$523 hectares a year (World Bank, 2019). Other

proving biodiversity conservation, most policies influence mitigation of and adaptation to climate change, improvements in water availability, the productivity of farms, and more secure livelihoods for farmers and local communities. The creation of municipal forest reserves and PAs and other activities that aim to reduce water contamination caused by unlicensed gold mining and its effects have positive impacts on public health and social stability in some regions (GEF, 2019).

Colombia's mainstreaming of natural capital and biodiversity suggests the importance of a balance between conservation and production goals. This delicate equilibrium requires a blend of public policies defining long-term goals and strategies to sustainably use biodiversity by implementing legal tools and economic incentives, coupled with specific plans and actions to assure active involvement of sectoral associations of agricultural producers, local governments, the private sector, and indigenous communities.

projects managed to conserve 354,667 hectares of forests and 437 hectares of agroecosystems, generating a 53 percent increase in income from certified organic products (GEF, 2016).

4.3 Case Study: Sustainable Infrastructure Framework on Andros Island, Bahamas

Engineering solutions (e.g., "hard" stabilization methods such as seawalls) have typically been used to protect shoreline against climatic events. However, in recent years, there has been a paradigm shift in coastal hazard and climate change planning toward nature-based approaches to protecting coastal communities and gray infrastructure (Arkema et al., 2017). Protecting and restoring coral reefs and other natural assets can be low cost, sustainable options for shoreline protection (Silver et al., 2019). Although awareness of the role that ecosystems play in shielding coastal communities from climatic events has recently increased significantly due to major catastrophic hurricanes (e.g., Katrina), the implementation of nature-based solutions (NBS) is still quite limited (Arkema et al., 2017). In addition, closing the gap in needed new infrastructure services (e.g., roads and water sewage systems) requires not only new investments but also a transformation in the way infrastructure is designed and operated in the context of climate change (IDB, 2018). Andros Island, Bahamas, is a notable positive exception in developing sustainable infrastructure services that incorporate natural capital.

The Government of The Bahamas is committed to implementing an NBS to minimize climate change vulnerability and to promote the sustainable development of Andros Island (Arkema et al., 2017; IDB, BRL Ingeniere, and Blue Engineering, 2017). The crux of this innovative approach is the creation of a national cross-sectoral planning framework and the development of a Sustainable Development Master Plan specifically tailored for Andros Island, driven by a stakeholder-led process, and informed by sound scientific advice. The lessons from this case are particularly useful for small island developing states aiming to develop similar processes, including natural capital as a key asset for sustainable development in the face of climate change. This section describes the main components of the Bahamian strategy to deploy a sustainable infrastructure[44] framework and concludes by enumerating key elements to replicate this initiative.

Andros Island[45] is the largest island in The Bahamas, yet one of the least developed. It has the third-largest barrier reef in the world and accommodates much of The Bahamas' commercial and sport-fishing industries, ecotourism, and agriculture. However, Andros Island lacks the essential infrastructure, social services, and educational opportunities to support sustainable development (Arkema et al., 2017). The island is often severely impacted by hurricanes and oth-

[44] Based on the Global Commission on the Economy and Climate and the UN Commission for Sustainable Development 2001 Framework for Sustainability, among other key global references, the IDB (2018) defines sustainable infrastructure as "infrastructure projects that are planned, designed, constructed, operated, and decommissioned in a manner to ensure economic and financial, social, environmental (including climate resilience), and institutional sustainability over the entire life cycle of the project."

[45] Andros Island covers 43 percent of The Bahamas' land mass and has 2 percent (7,490 persons) of the nation's total population (IDB, 2017). The unemployment rate on the island is 17 percent. Throughout the island, tourism generates US$44 million in direct revenues. Agriculture is prominent in the north, while commercial fishing is predominant in the south. The island has potable water supply issues, mainly on South Andros. Furthermore, natural disasters pose a threat to medical, educational, and transport services (maritime, land, and air).

er extreme climatic events, jeopardizing its civil infrastructures.[46] This risk is exacerbated by the low-lying character of the island and because most towns and villages are concentrated close to the shore. Furthermore, it is likely that all of the islands in The Bahamas will suffer significant economic losses from sea level rise, coastal flooding and erosion, mangrove retreat, decreased seagrass bed productivity, and saline intrusion (Simpson et al., 2012).

At the national level, the Bahamian government is creating an overarching framework for cross-sectoral planning to build resilience against climatic impacts. Thus far, the government has implemented an Integrated Coastal Zone Management (ICZM) program for the sustainable development of Andros Island. The ICZM aims to support climate preparedness by combining engineering solutions for gray infrastructure and innovative NBS. This effort includes protecting and restoring natural ecosystems (e.g., mangroves, coral reefs, and seagrass) and incentivizing the private sector[47] to consider investments in NBS. Additionally, the National Development Plan, Vision 2040, guides decision-making and investments in the economic, governance, social, and environmental dimensions of the nation over the next 20 years. As a complement, the government recently launched a National Policy for Adaptation to Climate Change, a National Energy Policy, and a National Maritime Policy (IDB et al., 2017).

Under the umbrella of the national planning described above, the Office of the Prime Minister, with support from the IDB, engaged in an innovative and participatory process to create the Sustainable Development Master Plan for Andros Island.[48] The Master Plan reshapes Andros into a nature-based economy and provides a roadmap for future development, balancing conservation and economic development (IDB et al., 2017). Some of the key features of the master plan are as follows:

- Bridging the historical gap in coordination of planning and development across sectors and government entities. The master plan aims to serve as a pilot project for translating national policies into an actionable plan for sustainable development.
- Identifying public and private investment opportunities, as well as recommendations for policy changes, that generate enabling conditions to guide sustainable development on Andros Island through three strategic time periods (up to 2020, up to 2030, and up to 2040).
- Conducting extensive public consultations to reflect the concerns and visions of all relevant stakeholders, such as scientists, government policymakers, the private sector, and civil society. These consultations revolved around the elements the stakeholders wanted to retain into the future for Andros and the importance of nature for achieving these goals. This participatory process identified nine elements as the most important issues to

[46] From 1990 to 2015, The Bahamas experienced 15 major hurricanes, affecting 27,000 citizens (IDB, 2017). In 2015, Hurricane Joaquin destroyed large segments of the country (including Andros), with total damage estimated at US$104.8 million. This vulnerability is exacerbated by inadequately designed infrastructure noncompliant with building codes (IDB, 2017). The recent Hurricane Dorian generated damages and losses equivalent to a quarter of the country's GDP (IDB, 2020).

[47] The private sector is mostly associated with nature-based tourism, which is the main source of income for the archipelago and which sustains the livelihoods of roughly 80 percent of the population.

[48] Also includes cooperation with the University of The Bahamas and The Bahamas Chamber of Commerce and Employers' Confederation (IDB et al., 2017).

be addressed by a multi-sectoral actionable plan for development: food and water security, connectivity and accessibility, education and capacity building, livelihoods and income equality, land tenure security, land-use planning and enforcement, health and well-being, strengthening local government, and climate change and coastal resilience.

- Using scientific advice to model sustainable development planning and reduce coastal risk.[49] The master plan is organized around four alternative scenarios. A scenario describes how Andros might look in the future given a particular suite of predictions of sea level rise and various types of investments in new civil infrastructure, alternative NBS for coastal protection (e.g., coral, mangrove, and seagrass), zoning guidelines, and tourism and fishing activities, among others. By clearly outlining a vision for the future, "scenarios play an important role in sharing information, illustrating a pathway to the future, comparing and evaluating options, and building consensus for a plan" (Natural Capital Project and The Nature Conservancy (2017).[50] Scenarios were presented as future storylines, along with detailed spatial data translating each storyline into different maps of a future Andros, all with the aim of facilitating participatory analysis and discussion. These scenarios were (IDB et al., 2017):
  - *Business as Usual* "represents a future similar to the current situation with little investment in new infrastructure, educational opportunities, or development."
  - *Conservation* "gives priority to ecosystem health and protection of habitats and species rather than economic development."
  - *Sustainable Prosperity* "blends human development and conservation goals by investing in critical infrastructure and education to achieve a nature-based economy that can be sustained over time."
  - *Intensive Development* "gives priority to major economic development rather than ecosystem health and protection of habitats and species."
- Following the participatory process to collectively identify and analyze critical issues. Consensus emerged across all relevant stakeholders that the most preferred scenario included a balance between conservation goals, investments in critical infrastructure, and education to ensure sustainable development (*Sustainable Prosperity* scenario).[51]

Supported by the national planning framework and having the conclusions of the Sustainable Development Master Plan as a guiding framework for implementation, the government, through the Ministry of Works and Urban Development, engaged in an ambitious program of climate-resilient coastal infrastructure, including specific activities for climate resilience on An-

[49] The Natural Capital Project at Stanford University provided scientific support by using open-source computer software to explore how the alternative future development scenarios might impact fishing, tourism, coastal protection, and other benefits that nature provides to people. Information from local stakeholders, policy documents, and the scientific literature complemented this effort. More details in Natural Capital Project and The Nature Conservancy (2017), Arkema et al. (2017), and IDB et al. (2017).

[50] Natural Capital Project and The Nature Conservancy (2017) provide further details on developing scenarios.

[51] The Sustainable Prosperity scenario would "produce a similar delivery of fishery and coastal protection services compared to the Conservation scenario, a higher delivery of services than the Business as Usual scenario, and lower the risk of coastal, marine, and freshwater degradation relative to Intensive Development" (Natural Capital Project and The Nature Conservancy, 2017).

dros Island. This program, which was supported by a loan of approximately US$25 million from the IDB, consisted of three components:

1. **Sustainable coastal protection infrastructure:** Applies the best scientific knowledge available to design and implement engineering solutions for shoreline stabilization and coastal flooding control in connection with reconstructing critical road infrastructure. The investment includes baseline studies (e.g., hydrodynamics and nearshore oceanography), improvements in gray infrastructure (e.g., new roads, seawalls, and drainage), and beach and shoreline enhancements (IDB, n.d., 2017). This component envisions investments in coastal protection infrastructure on four different islands in The Bahamas, including Andros.
2. **Natural infrastructure for hazard resilience on Andros:** Delivers priority investments in NBS as effective defensive measures for shoreline protection and sustainable development of the coast, taking into account the recommendations of the master plan. It focuses on conserving and restoring coastal natural habitat by replanting mangroves and seagrass, controlling invasive species (e.g., casuarina), and other approaches for flood and erosion control and related benefits like recreation and fisheries. Local participation and community engagement is encouraged for this component (IDB, n.d., 2017).
3. **Institutional strengthening for coastal risk management:** Recognizes that an enabling condition for success in the integrated management of the coast relates to stronger institutions. As such, the program aims to support the national ICZM governance and planning processes. Some of the main elements of this component include establishing a Coastal Protection Unit, facilitating inter-institutional coordination, improving specific regulatory instruments to implement ICZM (e.g., building codes), establishing and training to implement a web-based national coastal risk information and monitoring platform, and implementing a culturally appropriate and targeted communications strategy related to ICZM.

Several key lessons from Andros Island can be replicated in other parts of the archipelago and other countries, particularly small island developing states.

- A comprehensive participatory approach among policymakers, scientists, the private sector, and civil society legitimizes and enriches the planning process for NBS for infrastructure development.
- Measuring and comparing changes in the benefits of NBS across development scenarios helps all stakeholders identify shared goals and understand trade-offs.
- The lack of scientific inputs that justify the effectiveness of NBS are often cited as a major barrier to deploying public plans and policies based on natural capital (Firth, 2019). The Andros case suggests that, beyond generating and using scientific information and methods to overcome this challenge, it is important to find mechanisms to disseminate this information in a timely and accessible manner and to strengthen the capacities of the public and private sectors, and civil society in general, to use it as a key element for decision-making.

- A planning process should evaluate the impacts of proposed changes in economic, environmental, and social metrics, thus encouraging consideration of all three aspects in cross-sectoral planning.

The result is a concrete and practical perspective on the role of natural capital in actionable plans centered on the needs of people at the core of development strategies.

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