10. Ecosystem accounting for water and biodiversity policies: Experience from a pilot project in Peru

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Summary

This chapter describes the piloting of Ecosystem Accounting in San Martin, Peru and its potential to inform national, regional and international policy commitments. This was done in accordance to Peruvian national and regional frameworks for natural resources management, and international frameworks such as the 2030 Agenda for Sustainable Development (Sustainable Development Goals, SDGs) and Strategic Plan for Biodiversity 2011-2020 (Aichi Biodiversity Targets). We argue here that Ecosystem Accounting – by incorporating nature into frameworks that government use for development planning – can be of great relevance in informing long-term sustainability goals. In this chapter, we focus on water resource management and conservation of biodiversity, two key priority policies for Peru, which have been the focus of numerous initiatives and efforts, and the basis for a green growth development strategy both at national and sub-national levels.

We provide examples of how Ecosystem Accounting-generated indicators – ranging from the spatial distribution of ecosystem types over a given accounting period of time (*extent accounts*), complemented by indicators that inform characteristics and health of the ecosystems (*condition accounts*), and the flow of benefits to beneficiaries and/or economic sectors, both in biophysical and monetary terms (*ecosystem services supply and use accounts*) – can be critically important in conservation and sustainable use of water and biodiversity management. These indicators can be used, for example to: (i) identify the ecosystem sources of water-related benefits; (ii) show changes in these benefits associated with ecosystems' degradation; and (iii) to monitor water use by different beneficiaries, thereby helping to address equity issues associated with access to resources or impacts from degradation. As for biodiversity, accounting-derived indicators can be used for regularly monitoring the status and trends of threatened and endangered species, as well as for the conservation, restoration and sustainable use of ecosystems. All of these are reflected in SDGs and Aichi Biodiversity goals and targets, and are described in Table 10.1.

10.1 Introduction

Peru's economy has experienced significant growth over the last decade and the country has also made significant headway in poverty alleviation measures (IBRD 2017). To ensure continuous growth and shared prosperity, governmental policies ought to prevent and respond to the risks of current development patterns, such as those associated with natural resources use and climate change (ibid). The recognition of the interaction between economic growth and nature is an important step toward that goal, and one embraced by the Peruvian Government, as evidenced by numerous policies and commitments. For example, Peru has recently adhered to the OECD's Declaration of Green Growth (OECD. 2017) by promoting green growth through investment and the sustainable use of natural resources. Peru is also committed to incorporating information on natural capital into development

planning, having recognized the strong potential for significant ecological and socio-economic benefits from doing so (PLANAA PERÚ 2011).

In this chapter, we describe a Natural Capital Accounting pilot project that was implemented at the sub-national level through the Ecosystem Values and Accounting (EVA) project, a partnership between Conservation International, the Government of Peru (GoP), the World Bank Wealth Accounting and Valuation of Ecosystem Services (WAVES), and many others. The EVA project was an effort to demonstrate the value of incorporating ecological-economic information into standard economic statistics through Ecosystem Accounting, following the System of Environmental Economic Accounting (SEEA) – Experimental Ecosystem Accounting (UN et al. 2014). Ecosystem accounts developed for the project included extent, condition, ecosystem services supply and use, as well as thematic accounts – such as biodiversity, carbon, and water. The results were published in Conservation International et al. (2016).

The choice to pilot Ecosystem Accounting in San Martin was inspired by the regional government's innovative green growth policies developed to address sustainable development in the face of high levels of threats to ecosystems and biodiversity. San Martin has been experiencing high rates of deforestation, mostly concentrated in the Amazon region where 30% of the original forest cover has been lost primarily by unsustainable logging and agriculture conversion. Most importantly, the selection of the pilot region reflects both national and sub-national government alignment on the importance of building a more sustainable and greener economy.

The Ecosystem Accounting pilot in San Martin is an experiment testing various methodological approaches, as well as a demonstration at a sub-national scale to derive lessons for what would be required for application at the national level. It is also a real-world application of accounting information and statistics to address regional environmental and conservation policies. Considering that international commitments such as the SDGs, Aichi Targets and United Nations Framework Convention on Climate Change (UNFCCC) are reflected in national and sub-national policy priorities, Ecosystem Accounting is also a way of pragmatically meeting information commitments through a harmonized information system. While acknowledging that natural capital accounting (NCA) can contribute in a great many ways in policy discussions, we focus this paper on two important regional priorities: (a) water resource management; and (b) conservation and sustainable use of biodiversity. We first discuss the key benefits of NCA in national and regional decision-making process, and then address specific linkages of Ecosystem Accounting to policies for water and biodiversity conservation and sustainable use.

NCA and policy and decision making at national and regional levels

There is an increasing recognition that NCA, broadly speaking, ought to shift away from a supply-side and toward a demand-side, decision-centered approach (Bass et al. 2017). We argue that for that to become a reality, there needs to be an understanding of how public policies, incentives and/or investments lead to on the ground changes, and most importantly, how and what kind of information generated by accounts can facilitate this process. In Peru, environmental governance is decentralized, with the national government providing a policy framework to regulate private and public activities, while the regions work toward implementing policies, often through projects developing the enabling conditions and incentives to stimulate local economies.

At the national level, the overarching policy framework for environmental management is the National Environmental Plan (PLANAA for its acronym in Spanish). This presents the vision for key environmental issues up to 2021 (PLANAA PERÚ. 2011). The latest National Agenda for Environmental Action, also called Agenda Ambiental (Agenda Ambiente Perú 2015-2016), provides a road map for coherently addressing short-term national priorities with respect to biodiversity, climate change, water resources and environmental quality and, broadly speaking, for environmental governance and international

commitments (MINAM. 2014). At the regional level, the Agenda Ambiental Regional San Martin (Agenda Ambiental Regional 2014-2015) sets short-term strategic actions and goals for the region, based on priorities that are well-aligned with the national level policy, though addressing specific regional environmental management and sustainability issues (ARA-SM. 2014)

Ecosystem Accounting in Water Resources Management

Peru has significant surface water resources, though they are unevenly distributed across the country (Kuroiwa 2009) (Figure 10.1). Indeed, 30% of surface water resources are located in arid, semi-arid and sub-humid areas, while about 80% of the population is situated on the arid coast, the semi-arid and sub-humid highlands dry places where economic activities associated with agricultural, industrial and mining are concentrated (ibid). Peru's freshwater ecosystems not only support great biodiversity (Olson and Dinerstein.1998) but provide urban and rural communities with essential services, including fish, water for drinking and irrigation, and moderation of floods and droughts (Kvist and Nebel. 2001). Artisanal fisheries are critical to rural economies, providing food security and livelihoods. Recent studies in the Peruvian Amazon have shown that fisheries provide a safety net for rural households when faced with environmental disasters, such as floods or fires (Coomes. 2010).

Though water is relatively abundant in San Martin, it is also recognized as a critical resource for many economic activities and settlements. A key policy challenge in that sense includes the protection of mountain ecosystems and highlands (headwaters of various water bodies that supply production lands agricultural services and water supply). A recent study commissioned by Conservation International in the Mishquiyacu, Rumiyacu and Almendra watersheds, source of water for the capital city of Moyobamba, found 174 bird species, 13 of which were migratory species and two endemic species to Peru (Ayapi and Ruiz. 2014). These watersheds have been deforested and degraded to the point that water provision in Moyobamba has become erratic during the dry season. A water payment for ecosystem services has been set up in these watersheds with the Moyobamba water provision company. However, the fee collected in the water bill for the recovery efforts, about US$ 0.3 per month per household, is insufficient and needs to be reconsidered.

One important and nascent initiative by the national government is the "Water Factories" (Fábricas de Agua, in Spanish), which seeks to address the degradation of high Andean ecosystems, the headwaters of many of Peruvian rivers (MINAM. 2017). The ultimate goal is to promote investment in the conservation, restoration and sustainable use of the freshwater ecosystems that provide water-related ecosystem services – water provisioning and water filtration. The Water Factories initiative relies on regulatory, economic and technical instruments including public investments in biodiversity conservation and ecosystem services programs, compensation incentives for ecosystem services (MERESE in Spanish). The Water Factories initiative seeks to identify and promote other existing financing mechanisms through, for example, private and cooperation funds, public treasury, corporate social responsibility or other contributions.

Figure 10.1 Hydrographic Map of Peru

Another relevant initiative, the "Incubator for Ecosystem Services Retribution Mechanisms," was implemented as a partnership between government and non-government organizations in Peru (MINAM et al. 2012). At the national scale, the Incubator sought development of tools and guidelines including rapid hydrological assessment for investments, whereas, at the local scale (e.g. in Alto Mayo watersheds in San Martin) it supported the developments of frameworks to assess cost-effectiveness of alternative watershed protection investments (ibid).

Information generated through *ecosystem extent and ecosystem services supply and use accounts* in San Martin (Conservation International et al. 2016) provides vital information for broad water management issues, and for the Water Factory and Incubator initiatives, in particular. For example, we estimated that total water use in the region between 2009 and 2013 ranged between 4.70 and 6.71 million m^3/year, most of which was extracted by the agriculture sector (70%) followed by non-consumptive use by the energy sector (23%) and public sector (5%). Our findings also show that (natural) terrestrial ecosystems contributed the most to water provisioning, with the highest contribution from Humid Montane Forest (84%). Although water use in the region is increasing by 3.3% per year to meet the growing demand, there is only a 2.5% average increase per year in the contribution from natural terrestrial ecosystems (Conservation International et al. 2016). In monetary value, the water provisioning ecosystem service contributed by natural ecosystems was estimated between 24 – 26 million PEN (Sol) for the region in that period (ibid).

These results quantify the role of natural ecosystems in providing water for different beneficiaries. In San Martin watershed services are used by different sectors, such as households, municipal water suppliers, agriculture and commercial uses. Any degradation of ecosystems that leads to changes in quality and quantity of water supply will affect all these users, but our results suggest that impact would fall disproportionately on rural households. The accounts demonstrate how such integrated information can help assess policies that promote a fair and equitable sharing of benefits which requires promulgation of legislative frameworks backed up by adequate information about who benefits and by how much (see Table 10.1). Indeed, the water-related ecosystem services supply and use accounts are specifically designed to address some of those challenges and applications, by measuring: (i) in physical terms, how water flow is regulated through inter-ecosystem processes; and (ii) in economic terms, how water contributes to different sectors of economy as both direct use value (e.g. household consumption) and inputs to downstream production (e.g. irrigation of rice paddy).

Ecosystem accounting and biodiversity conservation and sustainable use

Peru stands out as one of the most biologically diverse countries on Earth and has been designated as one of the 17 megadiverse countries (Mittermeier et al. 1998). It hosts 84 of the 104 life zones of the planet, from the staggering heights of its mountain peaks to its 72 million hectares of forests to the depths of the Pacific Ocean off its shores. Threats to biodiversity are tightly linked to anthropogenic disturbances, such as those associated with deforestation, illegal mining, extraction and illegal trade of species, flora, fauna and biological resources, among others. Furthermore, Peru's vast numbers of endemic species, given their small range and restricted requirements, are particularly threatened by climate change (Larsen. 2012). The biggest conservation challenge is the reduction of deforestation, estimated at 150,000 ha^{-1} $year^{-1}$ (1990-2000). Around 70% of this deforestation is caused by smallholder farmers (< 5 ha) migrating from depressed areas in the Andean region (ENBCC 2016).

San Martin is not only a region of high biodiversity but also as a region where ecosystems are highly threatened. In a study about the distribution of endemic species in the Andes of Peru and Bolivia, researchers concluded that San Martin has critical areas of importance due to the irreplaceability of a large quantity of micro-endemic species (Young. 2007). Furthermore, the high susceptibility of montane and premontane forests to climate change and land use change require urgent actions to promote their conservation, not only because of its high biodiversity value but also because of the critical water provisioning, food security and climate regulation services they provide for human well-being (Ecobona 2009).

"Ecosystem extent accounts" in San Martin recorded the area of the distribution of various ecosystem types over the chosen accounting periods and were complemented by "*ecosystem condition account"* that recorded biodiversity as a characteristic of different ecosystem types. *"Biodiversity accounts"* in San

Martin measured biodiversity in various ways, including species richness, independent of different ecosystem types. These accounts demonstrated that species richness was reduced by 0.3% between 2009 and 2013 in different ecosystems. Habitat important for threatened species (including for example the Critically Endangered Yellow-tailed Woolly Monkey) has been reduced by 17% compared to its original extent, although some important habitat areas showed much greater loss. From 2009 to 2013 an average of 2.9% of habitat for threatened species was lost (UNEP-WCMC, 2016).

These types of accounting information not only contribute to national/regional biodiversity action plans, but also help meet international reporting commitments. For example, such measurements, when consistently and repeatedly measured, can be used for regularly monitoring the status and trends of threatened and endangered species. This also enables appropriate legislative and policy measures to be implemented in Peru. SDGs call for conservation, restoration and sustainable use of ecosystems and ecosystem services (Target 15.1), which requires identification, delineation and measurement of areas which are to be conserved and protected. This was an important application of the *ecosystem extent accounts*. In addition, the identification of degraded areas in the *ecosystem condition accounts* suggests were restoration activities are needed. The SDGs also call for the conservation of critical mountain ecosystems that provide benefits to downstream populations (Target 15.4). In the San Martin region our study showed that, in 2013, about 67% ecosystems are classified as mountain ecosystems of different elevation range. The *ecosystem services supply and use* accounts measured both in monetary and biophysical terms the ecosystem services provided by the mountain ecosystems. This information could lead to identification and protection of the most valuable, in terms of ecosystem services, mountain ecosystems in the high and mid-Andes.

Ongoing biodiversity-related initiatives focus on better identification of the values of biodiversity and ecosystem services, and also on business opportunities such as bio-commerce. These efforts are strongly based on the Government of Peru's recognition that biodiversity is an important resource for both rural and indigenous communities, whose livelihoods and economic opportunities associated with conservation and sustainable use of biodiversity are limited. Indeed, MINAM is working with partners on: (i) business plans for numerous natural products (e.g., cocoa, chestnut, textiles, ornamental flowers, gamitana, ecotourism, etc.); (ii) development of value-chain for products extracted around protected areas (ASBYSE Project); and (iii) bio-commerce of native potatoes by indigenous communities (PRODERN Project). The ultimate goal is innovation and generation of products and processes that add value to biodiversity.

Table 10.1 An illustrative example of the cross-linkages between SDGs (UN n.d.) and Aichi Targets (CBD et al. n.d.) with San Martin regional priorities and how Ecosystem Accounting contributes to resource management, monitoring and achieving those commitments

	Water resources management	Biodiversity conservation and sustainable use
SDG	• **Target 15.1**: **Conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services** ○ "Extent accounts" and "condition accounts" as implemented in San Martin can help to identify and delineate areas targeted for conservation, and for restoration of degraded areas. • **Target 15.4 Conservation of mountain ecosystems, including their biodiversity to provide benefits which are essential for sustainable development** ○ "Extent accounts" as implemented in San Martin can help the identification of different classes of mountain ecosystems.	• **Goal 1: End poverty in all its forms everywhere** • **Goal 2**: **End hunger, achieve food security and improved nutrition and promote sustainable agriculture** ○ "Ecosystem supply and use" as implemented in in San Martin can show the relevance of better resource management for numerous benefits, including food security and nutrition. • **Target 15.6: Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed** ○ "Ecosystem services supply and use" as implemented in San Martin can facilitate implementation of policies toward equitable sharing of benefits from biodiversity.
Aichi targets	• **Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity** ○ "Ecosystem extent and condition accounts," in addition to "biodiversity accounts" as implemented in San Martin can be used for monitoring the status and trends of threatened and endangered species. • **Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.** ○ Ecosystem extent and condition accounts", in addition to "biodiversity accounts", as implemented in San Martin can inform the development of appropriate legislative and policy measures and serve as a tool to monitor its implementation over time. • **Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society** ○ **Target 1, 2 & 6:** "Ecosystem supply and use accounts", as implemented in San Martin can be used as an incentive for a systematic measurement and monitoring of biodiversity - and benefits nature provides, facilitating reporting and accomplishment of these targets.	• **Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.** ○ "Ecosystem extent", "condition accounts" and "ecosystem supply and use accounts", in addition to "biodiversity accounts", as implemented in San Martin can demonstrate the importance of nature to livelihoods and the economy, increasing awareness and support for more sustainable management uses of ecosystems and biodiversity. • **Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.** ○ "Ecosystem extent and condition accounts", in addition to "biodiversity accounts", as implemented in Peru, can be critically relevant for the incorporation of biodiversity values into national official statistics, and for their use on policy, planning, management and reporting. • **Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services** ○ Ecosystem extent, condition accounts and ecosystem supply and use accounts", in addition to "biodiversity accounts", as implemented in San Martin, can help the identification of critically important biodiversity as well of its numerous benefits to a range of beneficiaries, allowing understanding of distribution of benefits (and costs).

Note: The connections between the Aichi Targets and the System of Environmental and Economic accounts were mapped in Vardon et al (2016).

10.2 Conclusion

In this chapter we summarized how natural capital accounting, and Ecosystem Accounting in particular, contributes to regional and national policy processes in San Martin, Peru. Specific examples from water resources management and biodiversity conservation perspectives are provided. Sectorial and cross-sectorial policy and development-decision processes can take advantage of recent science, statistics and information to ensure their success and maximize impacts. Ecosystem Accounting not only provides spatially explicit information and data, it also provides an opportunity to understand conservation and development interventions, particularly as it relates to changes and trade-offs in the provision of benefits, equity issues on the distribution of benefits (and costs).

Our experience with ecosystem accounting in San Martin helps to illustrate the utility of ecosystem accounting for more holistic management of natural resources, facilitating the identification of ecosystems regulating flows, enabling improved monitoring of benefits over time, ultimately allowing for more efficient implementation of policies, as well as compliance with international commitments such as SDGs and Aichi targets.

Despite all the promises of accounts, to fully exploit their potential it is important for ecosystem accounts to be integrated into national information systems and repeatedly measured like many other statistical measurements and census. Nature is the starting point of prosperity and human well-being; therefore, it is important that it is considered and reflected in development decisions.

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