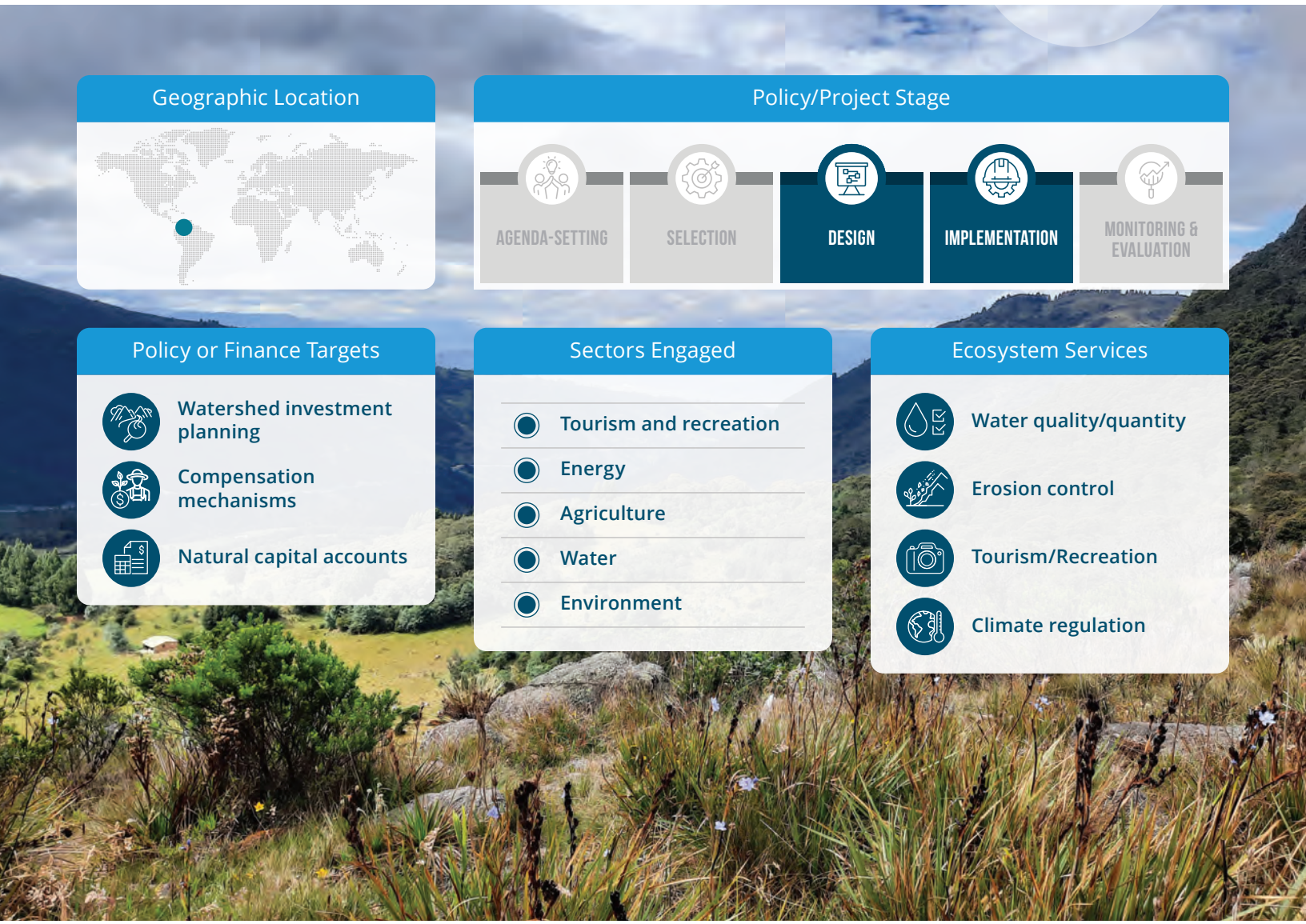
Mainstreaming Nature in
Policy and Investment Decisions

Advancing Ecosystem Accounting for Financing Protected Areas

Colombia Case Study



Geographic Location

Policy/Project Stage

- AGENDA-SETTING
- SELECTION
- **DESIGN**
- **IMPLEMENTATION**
- MONITORING & EVALUATION

Policy or Finance Targets

- Watershed investment planning
- Compensation mechanisms
- Natural capital accounts

Sectors Engaged

- Tourism and recreation
- Energy
- Agriculture
- Water
- Environment

Ecosystem Services

- Water quality/quantity
- Erosion control
- Tourism/Recreation
- Climate regulation

natural capital PROJECT

Departamento Nacional de Planeación

gef

IDB

This document outlines the activities and results of the Colombian pilot project under a Regional Technical Cooperation (TC), **"Transforming Policy and Investment through Mainstreaming Rapid Approaches for Natural Capital Assessment and Accounting."**[1] This TC was funded by the Global Environmental Facility (GEF), implemented by the Inter-American Development Bank (IDB), and executed by Stanford University. The main beneficiaries and co-designers of this TC are the Colombian Ministry of Environment and Sustainable Development, the National Department of Statistics (DANE), the National Planning Department (DNP), and the technical work was led by the Stanford-based Natural Capital Project (NatCap). This work also received funding from the Gordon and Betty Moore Foundation.

This pilot project in Colombia is also part of the People, Planet, Prosperity (3Ps) project,[2] **a collaboration amongst NatCap, IDB, the Asian Development Bank, and the World Bank on pilots in 16 countries to scale up the use of natural capital approaches around the world.**

Summary

The main objective of this pilot project was to advance the design of financing mechanisms to strengthen Colombia's national system of protected areas (known as SINAP), as outlined in Colombia's **National Biodiversity Strategy and Action Plan** (NBSAP).[3] The project developed an economic valuation of the flows of ecosystem services — nature's benefits to people — from protected areas in the Northeastern Andes region to priority economic sectors (sanitation, energy, agriculture, tourism, and forestry) of several municipalities in Colombia (Tunja, Sogamoso, and Duitama). The team used the methodological and conceptual standards of the United Nations' System of Environmental Economic Accounting-Ecosystem Accounting (SEEA-EA)[4] to develop a replicable and scalable approach to valuing ecosystem services. This valuation provides a key input for equitable compensation and financing mechanisms, such as payments to rural land stewards or entities responsible for managing protected areas, to help them maintain the ecosystem services in support of the economic activities and population centers that rely on them.

Natural capital approaches (including natural capital assessments and accounting) make explicit nature's benefits to people (ecosystem services) so they can be incorporated into decisions and can motivate investments in ecosystems, improving the well-being of both people and nature.

Background

Colombia, one of the most biodiverse countries on the planet, has for decades been advancing policies and strengthening its knowledge, institutions, and governance to integrate nature into development decisions. A pioneer in the Latin American region, it has led the implementation of integrated economic and environmental accounting frameworks that incorporate the benefits that nature provides to society into decision-making.[5] Colombia has accomplished this by supporting the adoption of various mechanisms and instruments for regional planning as well as incentives such as payments for environmental services and environmental rates.

1 **Transforming Policy and Investment through Mainstreaming Rapid Approaches for Natural Capital Assessment and Accounting**, Inter-American Development Bank, 2024.

2 **People, Planet & Prosperity: Mainstreaming Nature in Policy and Investment Decisions (Global), Natural Capital Project**, Stanford University, 2025.

3 **Biodiversity Action Plan 2030, Government of Colombia.**

4 **System of Environmental Economic Accounting, United Nations.**

5 See Ministerio de Ambiente y Desarrollo Sostenible, Programa de las Naciones Unidas para el Desarrollo. 2014. **Quinto Informe Nacional de Biodiversidad de Colombia ante el Convenio de Diversidad Biológica**. Bogotá, D.C., Colombia. p. 101

Despite this progress, however, Colombia's 2021 assessment of biodiversity and ecosystem services showed declines. In response, in 2024, Colombia presented its most recent NBSAP to protect biodiversity by 2030 under the Kunming-Montreal Global Biodiversity Framework. In it, Colombia made it a key priority to define pathways for transformational changes in the social, economic, and cultural trends that affect biodiversity and the flows of nature's benefits to people, while also mitigating and adapting to climate change.

A central government policy for achieving Colombia's objectives is the "Consolidation of the National System of Protected Areas of Colombia," referred to as CONPES 4050.[6] This policy aims to establish mechanisms that bring in strategic economic sectors (agriculture, energy, tourism, and forestry) and high-income municipalities into financing nature protection efforts, internalizing the investments required for more equitable and sustainable biodiversity management. To achieve this objective, Colombia sought to quantify the contributions of protected areas to strategic economic sectors and use the results to design the compensation mechanisms.

As a parallel effort, through the 2021 Climate Action Law, Colombia established a comprehensive framework to address the challenges of climate change mitigation and adaptation.[7] A key action within this framework is the implementation of the SEEA-EA, which aims to systematically measure the interactions between society and nature and integrate these metrics into the national accounts system. CONPES 4050 and the climate law present a unique opportunity to align inter-institutional efforts and coordinate progress in both implementing biodiversity measurement frameworks and using this data to design, execute effective policies, and track progress.

This project evaluated the ecosystem services provided by Colombia's system of protected areas in the Northeastern Andes, to three higher-income, higher-population municipalities, Tunja, Sogamoso, and Duitama (i.e., providing biophysical metrics). It also quantified these contributions of nature to people as a percentage of GDP and municipal revenue. The analysis highlighted the benefits natural ecosystems and protected areas provide to local economies, and advanced the use of SEEA-EA in Colombia to support the design of compensation mechanisms for stewardship of these areas.

Key Outcomes

Natural capital assessment & economic valuation: This project linked the economic and social well-being of three higher-income, higher-population municipalities with several key ecosystem services provided by Colombia's system of protected areas. The natural capital assessment revealed that flows of ecosystem services from protected areas represent a significant economic value to the focal municipalities (and in reality are likely greater, since the analysis included a limited number of services). In Duitama, the assessed values represented 3.84% of the total municipal GDP in 2023. In Sogamoso, the economic value of the services equals 2.53%, and in Tunja, 1.0% of the municipal GDP. These results provide key information to support the design and implementation of economic instruments such as payments for ecosystem services and environmental water fees.

6 Consejo Nacional de Política Económica y Social (CONPES). Departamento Nacional de Planeación. Política para la Consolidación del Sistema Nacional de Áreas Protegidas - SINAP. 2021.

7 Ley de Acción Climática de Colombia. 2169 de 2021

Supporting natural capital accounting in Colombia: This project developed a series of novel workflows for characterizing and valuing ecosystem services flows in a way that aligns with both SEEA-EA principles and standards, and decision-making in the Colombian context — integrating local data, biophysical models, and economic valuation techniques to implement Accounts 3 and 4 of the SEEA-EA.[8] Aligning with SEEA-EA provides additional legitimacy and relevancy to the results of the analyses, for use in compensation mechanisms, strategic planning, and furthering Colombia's implementation of the SEEA-EA.

Integrating into financial compensation mechanisms: Using information from this work, the Colombian National Planning Department has evaluated the fiscal and economic costs associated with nature protection within SINAP, as a further step toward creating sustainable funding mechanisms that connect ecosystem service providers and beneficiaries. DNP is now prioritizing financial instruments and mechanisms that can incorporate natural capital valuation results within their design and operation, and identifying financial, institutional, and regulatory bottlenecks for implementing these proposals.

Natural Capital Approaches

Sub-national natural capital assessment of ecosystem services from the system of protected areas to three municipalities: The team engaged with representatives from national parks, sanitation, energy, agriculture, and environmental sectors, as well as municipal authorities from Tunja and Duitama, to gain a deeper understanding of the regional ecosystem services and help validate results. Ecosystem services to the focal municipalities originate across a wide region, thus the biophysical modeling combines municipalities, nearby protected areas, watersheds, and other regional jurisdictional boundaries.

Based on input from sector and municipal leaders, the team identified a subset of priority ecosystem services for modeling: water supply, global climate regulation, soil and sediment retention, water purification, water flow regulation, and recreation-related services. The team used NatCap's open-source modeling tool, InVEST®, to assess the supply, use, and value of each service for each of the municipalities.

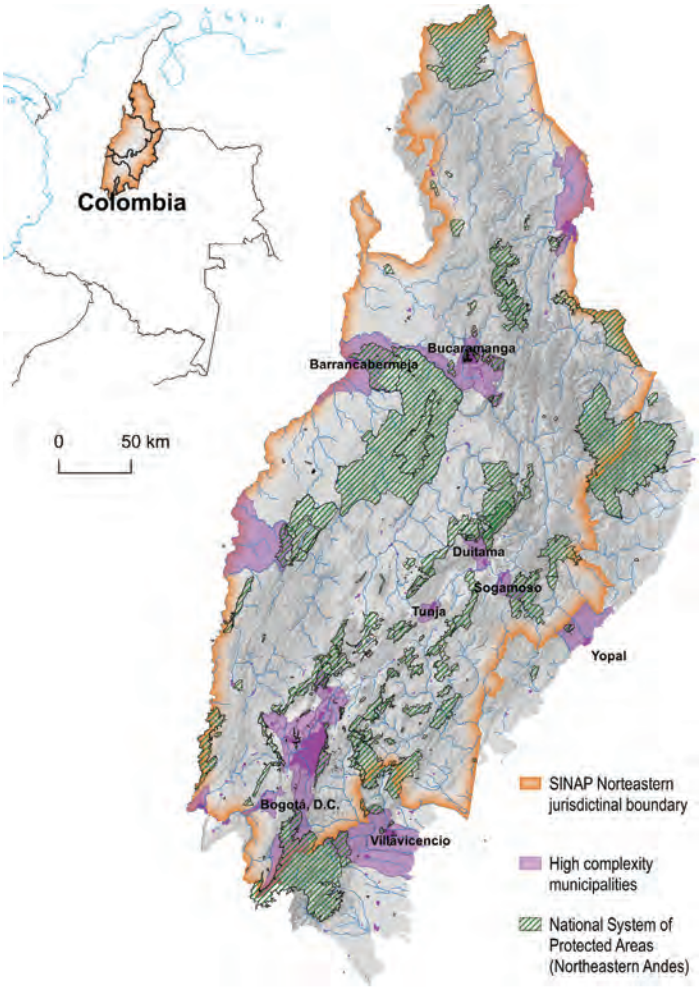


Figure 1: Protected areas and municipalities of high complexity that are located in the jurisdiction of the Northeastern Andes, and the biophysical boundary that contains the protected areas that benefit the municipalities of Tunja, Duitama, and Sogamoso.

8 Ecosystem services flow accounts (physical and monetary) record the supply of ecosystem services by ecosystem assets and the use of those services by economic units, including households (see System of Environmental Accounting, United Nations, for more information). Account 3 refers to flows of ecosystem services in physical units, and Account 4 in monetary units.

The natural capital assessment revealed that flows of ecosystem services from protected areas represent a significant economic value to the focal municipalities. In Duitama, the assessed values represented 3.84% of the total municipal GDP in 2023. In Sogamoso, the economic value of the services equals 2.53%, and in Tunja, 1.0% of the municipal GDP.

The significance of these contributions is further demonstrated by comparing ecosystem service values to municipal revenues. In Tunja, the total value of ecosystem services related to maintaining a stable water supply in 2022 was equivalent to 10.93% of total municipal revenue (i.e., total revenue brought in from national and local sources) and 22.94% of local tax revenue. In Duitama, stable water supply services represented 29.69% of total revenue and a substantial 111.57% of local tax revenue, indicating the financial importance of this service for the municipality. For Sogamoso, water supply services comprised 27.45% of total revenue and 88.34% of local tax revenue.

Similarly, the nutrient retention service also demonstrates the scope of the economic benefits provided by these ecosystems. Combined nitrogen, phosphorus, and sediment removal from water sources in Duitama is equivalent to 23.16% of total revenue and 87.05% of local tax revenue. In Tunja, these ecosystem services contributed a value equivalent to 1.25% of total revenue and 2.62% of local tax revenue, and in Sogamoso, they constituted a value equivalent to 13.43% of total revenue and 43.21% of local tax revenue.

The economic dependency of sectors in high-complexity municipalities on services provided by protected areas highlights the need for innovative financing schemes to secure ecosystem benefits. These schemes can compensate municipalities and communities that provide these services through land and water stewardship, while strengthening management of the protected areas.

Table 1: Summary of results of the selected ecosystem service valuation for the municipalities of Tunja, Duitama, and Sogamoso. Figures in millions of Colombian pesos per year ($COP/yr, as of 2022).

Service	Tunja	Duitama	Sogamoso
Nitrogen retention	328	10,337	7,100
Phosphorus retention	347	29,076	22,812
Sediment retention	3,846	7,497	—
Low flow maintenance	39,523	60,125	61,153
Visitation	782	1,381	1,643
Total	**44,827**	**108,416**	**92,709**
Municipal GDP	4,489,000	2,827,000	3,670,000
% of municipal GDP	1.00%	3.84%	2.53%

Table 2: Comparison of the selected ecosystem service valuation and the total municipal income and local tax revenue for the municipalities of Tunja, Duitama, and Sogamoso. Figures in million COP $/yr as of 2022.

			Water quantity			Water quality				
				Ecosystem services proportion (%)					Ecosystem services proportion (%)	
Municipality	Total Municipal Revenue 2022	Local tax Revenue 2022	Water supply / low flows maintenance	Municipal Revenue	Local Tax Revenue	Nitrogen Removal	Phosphorus Removal	Sediment Retention	Municipal Revenue	Local Tax Revenue
Tunja	$361,504	$172,304	$39,523.29	10.9%	22.9%	$328	$347	$3,846	1.3%	2.6%
Duitama	$202,530	$53,891	$60,124.78	29.7%	111.6%	$10,337	$29,076	$7,497	23.2%	87.0%
Sogamoso	$222,749	$69,224	$61,153.48	27.5%	88.3%	$7,100	$22,812	NA	13.4%	43.2%

Supporting natural capital accounting in Colombia: The team integrated local data, biophysical models, and economic valuation techniques to create ecosystem service flow accounts in line with the SEEA-EA, contributing to the pilot's legitimacy and replicability. This work supports the implementation of the SEEA-EA in Colombia, led by the Colombian National Administrative Department of Statistics. Notably, the team established a methodology to define and model ecosystem accounting baselines for several water-related ecosystem services in the Colombian context. Baselines are an important part of the SEEA-EA framework, as they provide reference values against which to compare changes in the provision of ecosystem services over time.

Designing compensation mechanisms: The analysis of ecosystem service values highlights the connections between protected areas, natural ecosystems, and specific beneficiaries in the evaluated municipalities. By providing an understanding and quantification of where and how much ecosystems contribute to specific beneficiaries and sectors in high-complexity municipalities, this analysis can guide the advancement of policies and investments directed at securing and enhancing the protected areas where those benefits originate. DNP is currently adopting this information to prioritize and incorporate natural capital valuation approaches in the design of financial instruments.

Capacity Development

The adoption of SEEA-EA in national accounts systems is a long-term effort that requires fostering interdisciplinary and inter-institutional cooperation and the strengthening of technical capacity for its effective implementation. In this project, our approach to capacity development was to serve as a bridge between policymakers — in this case, the DNP, data providers, DANE, and societal actors. The project fostered a series of technical discussions with entities relevant to the adoption of the SEEA-EA to co-develop specific methodological advances. By adhering to SEEA-EA principles, while bringing in the users' perspectives (i.e., focusing on CONPES and sectors in Tunja, Duitama, and Sogamoso that benefit from protected natural areas), the team developed important insights and shared understanding across the institutions involved in the effort.

This work helped advance the implementation of SEEA-EA in Colombia through the development of key processes and recommendations for engagement to help in identifying potential beneficiaries, methods for validating ecosystem services, valuation methods, and documented logical chains including ecosystems, drivers, metrics, users, and beneficiaries. These advances are relevant for inclusion in future curricula at local universities and across the international natural capital accounting community of practice to promote adoption of these approaches.

Lessons Learned

1

Coordination Across Sectors and Government: Natural capital assessments and accounting rely on information from the people and groups who use and benefit from the ecosystem services being analyzed. Conducting accurate and credible evaluations requires the participation of the economic sectors that benefit from these services, as well as national institutions that produce and manage environmental and economic information.

Much of what is needed to apply the SEEA-EA already exists within Colombian institutions, including information, knowledge, and engagement with potential beneficiaries. Therefore, additional capacity development should focus on the coordination of the various entities that make up the Colombian Environmental Information System (SIAC).

2

Skills/Experience: Using natural capital approaches requires a broad set of technical and analytical skills. While institutions in Colombia have strong expertise, there may be opportunities to further enhance specific skills, particularly in building a shared understanding of ecosystem services and their contributions to local and regional economies. Additionally, strengthening knowledge of biophysical modeling tools, economic valuation methods for integrated environmental-economic assessments, and the collection and analysis of stakeholder surveys could further support effective decision-making. These challenges are compounded by limited time and budget. Building skills and experience requires dedicated funding and support to bridge the gaps in skills, data, and resources. This approach will help to ensure the successful integration of SEEA-EA methodologies into local decision-making processes.

3

Data: Comprehensive datasets, such as information on users, sectoral activity and value creation, ecosystem conditions, and service flows, are currently not readily available to municipalities or environmental agencies due to limited data infrastructure or fragmented information systems. Two aspects could facilitate future natural capital-based approaches: (1) identifying and standardizing datasets at the national, regional, and municipal levels to conduct ecosystem service assessment exercises, and (2) building inter-institutional partnerships to ensure the availability of such information in a timely manner.

Pathways for Mainstreaming

The biophysical analysis of ecosystem service supply developed in the present study covers an extensive area of the Northeastern Andes of Colombia and can readily be applied to other municipalities and other specific ecological and economic contexts, thereby broadening the impact and applicability of the findings. A modular approach can also enable the eventual design of larger-scale compensation mechanisms that explore coordination between municipalities to enhance the impact of biodiversity financing.

Close coordination between DANE, which is leading the adoption of ecosystem accounting under SEEA-EA at the national level, and DNP as well as other institutions that implement policy would enable the implementation of ecosystem accounting to support decision-making in Colombia.

The team convened for this pilot (comprised of government, research institutions, and other experts) serves as a useful model for further scaling the application of these approaches and iterating over time. As local capacity grows in government and local research institutions, lessons from implementing new policy and compensation schemes will emerge through tracking of natural capital accounts over time, and adaptation of policy and finance instruments can occur.

National and regional institutions can make important contributions to natural capital approaches in Colombia. The National Authority of Protected Areas (Parques Nacionales de Colombia), as the administrator of protected areas, is uniquely positioned to advance the valuation of cultural ecosystem services such as ecotourism and recreational activities. Civil society actors are also relevant for advancing these efforts. USOCHICAMOCHA, the association of water users of the Alto Chicamocha, which is a civil society entity and key water manager in Boyacá, already holds significant institutional capacity and data regarding water consumption in the agriculture sector, which provides a strong foundation for advancing the process of ecosystem service valuation and potentially implementing financial instruments to internalize environmental investments. Enhancing municipalities' capacity to collect and report information on agricultural production, water demand, and other ways they rely on ecosystem services would improve the comprehensiveness of ecosystem accounting efforts and support the design and monitoring of compensation mechanisms.

Encouraging interdepartmental coordination and fostering partnerships across groups such as USOCHICAMOCHA and the regional environmental authority, CORPOBOYACÁ, would help address information gaps and align efforts toward integrating ecosystem service values into municipal policies and planning frameworks.

Read more on the pilot project page: https://bit.ly/3PsColombia.

Contact NaturalCapitalProject@stanford.edu **for more information.**

DOI: 10.18235/0013736

Cover image credit: Jesse Goldstein/NatCap

PEOPLE PLANET PROSPERITY

For more information, please visit the **3Ps project page**: bit.ly/peopleplanetprosperity

The 3Ps project is is funded by the Global Environment Facility, the Gordon and Betty Moore Foundation, and the Global Partnership for Sustainable and Resilient Landscapes (PROGREEN), a World Bank Multi-Donor Trust Fund.

natural capital PROJECT

Departamento Nacional de Planeación

gef

IDB

Authors
Héctor Angarita
Jesse A. Goldstein
Lisa Mandle
Jaime Moreno Miranda
Orlando Vargas Rayo
Carolina Díaz Giraldo
Fabián Darío Villalba Pardo
Camilo Andrés Díaz Campos
Lina Barbosa

Edited by
Vanessa Callau
Elana Kimbrell
Duval Llaguno
Mary Ruckelshaus
Gregory Watson
Zoë Wilson

http://www.iadb.org