Case Profile Series on
Land Trusts as Climate Change Solution Providers

Water Funds:
Conserving Green Infrastructure for Source Water Protection[1]

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INTERNATIONAL LAND CONSERVATION NETWORK

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The International Land Conservation Network, founded in 2014 as a program of the Lincoln Institute of Land Policy, connects civic and private organizations and people, across boundaries and around the world, to accelerate the protection and strengthen the management of land and natural resources. www.landconservationnetwork.org.

Cover photo of Crested Roses in the Páramo de Guerrero of Colombia, courtesy of Friedrich Kircher, Wikimedia Commons

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CASE OVERVIEW FOR EDUCATORS

Topic: Green Infrastructure

Subtopics: Municipal water management, water treatment, Nature-based solutions, Water Funds, Conservation Financing, water security

Timeframe: 2000-2022

Primary Learning Goals: (1) Better understand how water funds can direct financing from downstream users to upstream productive landscapes.

Secondary Learning Goals: (1) Develop insights into how land management can contribute towards water quality for municipalities. (2) Explore how large-scale cross sectoral partnerships form and operate successfully. (3) Gain an understanding of the large networks of public, private, and industry partners that can make such projects successful in multiple dimensions.

Primary Audiences: (1) Municipal planners and resource managers, (2) Conservation organizations and landowners, (3) Public decision-makers and regulators, (4) Staff, directors and supporters of NGOs, community organizations, (5) climate policy analysts and advocates, and (6) interested members of the general public.

Prerequisite Knowledge: General knowledge regarding climate change and the conservation of land and biodiversity

Summary: This paper explores the application of water funds as a tool for moving financing towards upstream conservation and land management projects that can result in maintenance or improvement of water quality. In particular, this paper explores 2 cases of water funds: one operating in Quito, Ecuador beginning in 2000, and another in which began developing in Cucuta, Colombia in 2016. The paper assists municipal planners and resource managers, conservation organizations and landowners, and policy advocates in understanding the development and impact that water funds can have on urban infrastructure as well as wider conservation goals. These two projects demonstrate how the concept could be applied in other contexts and watersheds in South America and globally.

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Introduction

Water Security: A Global Challenge

No issue illustrates the interlinkages between cities and rural communities, industry and agriculture, developed and developing countries, and our natural and built environments more than water. The World Economic Forum identifies water crises—defined as "a significant decline in the available quality and quantity of fresh water resulting in harmful effects on human health and/or economic activity"—as the risk of greatest concern to the global economy over the next 10 years.[2] The Organization for Economic Cooperation and Development estimates that global water requirements are predicted to be pushed 40 percent beyond sustainable water supplies by 2030.[3] At a global level, more than 50 percent of the world's cities and 75 percent of all irrigated farms are experiencing water shortages on a recurring basis.[4] At the same time, water pollution is a growing challenge across developed and developing countries alike; since 1960, the use of nitrogen and phosphorus in fertilizers has grown by as much as nine times, with consequences for both freshwater and coastal marine systems.[5]

Protecting Water at its Source

More than $90 billion is invested annually in water supply infrastructure, but only a small portion of this is currently dedicated to protecting water at its source.[6]

In order to meet current demands for clean, reliable water, water utilities usually employ one or more of the following options:

- New water sources: transport water via interbasin transfer from a source further away and/or tap groundwater sources;
- Advanced water treatment system: treat polluted water to a usable standard;
- Demand reduction strategies: promote strategies to reduce water demand and water use; and/or
- Improve landscape management and wastewater treatment: maintain or improve the quality and reliability of water coming into intake point(s). This fourth option is commonly referred to as Source Water Protection.

Traditional urban water management systems, with their focus on built solutions—aqueducts, pipes and drains—can have a devastating effect on the rivers, floodplains and wetlands that provide people with water and create habitat for wildlife. These "business as usual" solutions are also expensive, degrade over time and will likely be insufficient to deal with the pressures of global urbanization and climate change. The result: an unreliable water system that does not meet the needs of people or nature.

Natural infrastructure can and must complement gray infrastructure, which by itself will not be a financially or environmentally sustainable water security solution for much of the world. Instead

of incurring annual expenses for filters, energy to remove sediments, chemicals to purify water or new treatment plants (gray infrastructure), the experiences of cities and communities from Monterey, California to Nairobi, Kenya suggest that investing in watershed management (green infrastructure) for source water protection is more cost-effective, efficient, and beneficial.

Healthy source watersheds are vital natural infrastructure for nearly all cities around the world. They collect, store and filter water and provide benefits for biodiversity conservation, climate change adaptation and mitigation, food security, and human health and well-being. Today, an estimated 1.7 billion people living in the world's largest cities depend on water flowing from source watersheds sometimes located hundreds, if not thousands, of kilometers away. By 2050, those urban source watersheds will be tapped by up to two-thirds of the global population though they represent one-third of the Earth's land surface. A study by The Nature Conservancy estimates that source watersheds for the world's cities cover more than 37% of the world's ice-free land. [7]

Current and potential urban source watersheds

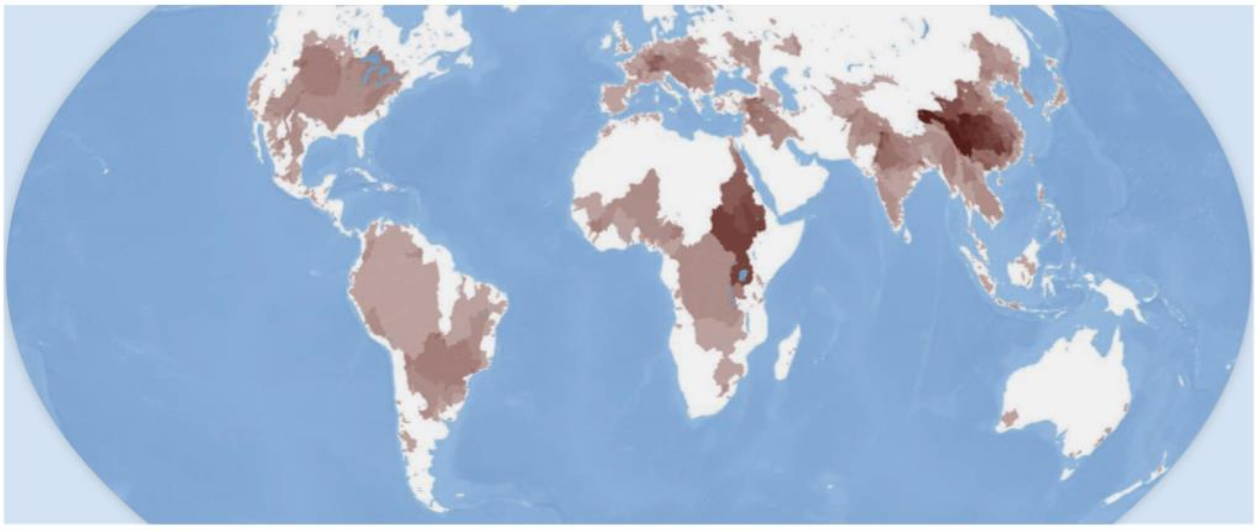


Figure 1.3. Watershed areas that currently or could potentially provide surface water supply to cities with populations greater than 100,000 people. Darker colors indicate overlapping watershed areas, where multiple withdrawal points collect surface runoff from the same upstream land areas. (Source: The Nature Conservancy)

To realize the full value of green infrastructure, it is important to move beyond a "one activity for one purpose" mindset. By "stacking" the benefits that natural solutions for source watershed protection provide, the financial case is strong for investing in natural solutions alongside gray infrastructure. In fact, one in six cities could recoup the costs through savings in annual water treatment costs alone. For utilities, local leaders, industries and policymakers, this requires looking beyond jurisdictional boundaries to form new partnerships and action plans. Working with partners, the Conservancy is developing sophisticated financial tools that gather investments from water users and direct the funding toward conservation of key lands upstream that filter and regulate water supply. At the same time, co-benefits, such as habitat for native plants and wildlife, avoided emissions, and positive human health outcomes, are preserved.

Capturing the Value of Source Watersheds Through Water Funds

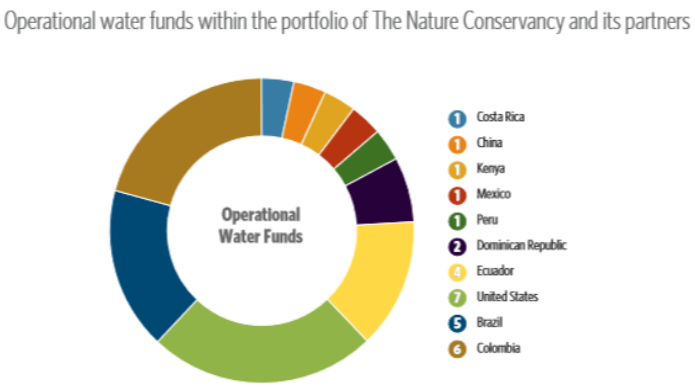
The water security benefits and co-benefits of source water protection are not being captured systematically today. Despite overwhelming benefits to cities, most exert little influence over how sources are managed. The barriers to implementation generally fall into three main areas:

- There is often a mismatch between the jurisdictions of the problem owners and problem solvers. Urban water users, such as municipalities, urban water managers or industries, have limited jurisdiction and cannot easily reach beyond those jurisdictional borders. Rural land stewards are making decisions that affect urban users but have little to no incentive to reduce their impacts;

- Knowledge transfer is lacking on how investments in source water protection can achieve specific water security outcomes or other benefits; and

- Replicable mechanisms that allow for a diversity of funding flows, based both on a supportive policy environment and on specific financial structures, are lacking.

Water funds, which enable downstream water users to jointly fund upstream land conservation and restoration, are one successful mechanism for securing improved water quality and in some cases more reliable flows. The Nature Conservancy is developing a set of replicable financial and governance mechanisms that help downstream water users work with upstream communities to protect water supplies at their source through land management and restoration. Together with its partners, The Nature Conservancy has helped create 29 operating water funds in ten countries across Latin America, North America and East Africa; 30 more are currently in design.[8]



Water Funds: An Overview

Water funds are a finance and governance mechanism that links downstream water users to upstream land stewards around a common goal of sustainable watershed management. They provide an institutional platform through which the downstream beneficiaries of clean water pay for investments upstream that are needed to "secure" this resource –in terms of both quality and quantity into the future. These upstream investments pay for a various conservation actions that provide a secure source of clean water, such as restoring forests and native vegetation adjacent to streams or reducing water extractions, thereby avoiding expensive future treatment costs. Water Funds can be established in different ways:

- with public or private resources that are "capitalized" over time, as with an endowment, for example;
- from fees that downstream beneficiaries pay on a regular basis, e.g., each person living in the city pays a small amount as part of their monthly water bill;
- or some combination of these.

As a permanent governance, investment and source water protection implementation mechanism, water funds provide the framework for collective action, connecting land stewards in rural areas and water users in urban areas to share in the value of healthy watersheds. Water funds for source water protection are explicitly designed to address trust and engagement, effectiveness and efficiency.[9, 10] They come in a variety of forms and can be adapted to the local socio-cultural, political, economic and environmental context, but they share four primary organizational components:

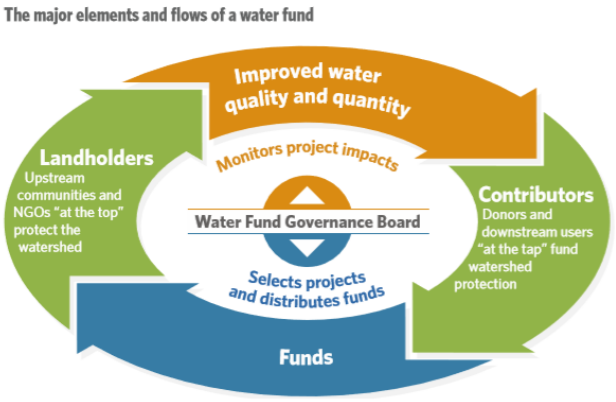
1. First, water funds are a governance mechanism for building trust and engagement among multiple watershed stakeholders for transparent project planning and decision-making. This governance process is partly characterized by **a multi-stakeholder board or a project management unit** composed of water users and, sometimes, other watershed actors, including upstream communities.

2. Second, given the need to meet multiple stakeholder goals in a transparent way, water funds have also been characterized by **efforts to include science and local knowledge in water fund planning and prioritization**.[11, 12]

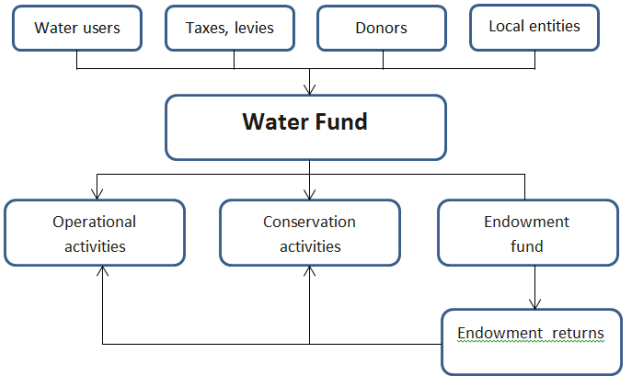
3. In addition, water funds are a **funding vehicle** where multiple stakeholders—including water users, government agencies and nongovernmental organizations (NGOs)—come together to provide long-term resources for source water protection.

4. Finally, there is a **watershed conservation program**, which facilitates the implementation of activities on the ground.[13]

Water funds have also been referred to as "collective action funds," characterized by their pooling of "resources from multiple water users (and sometimes NGOs or government acting in the public interest) to financially incentivize coordinated interventions across a landscape."[14] A water fund's success fundamentally depends on this pooled downstream support, but also on the pooled support and engagement of local land stewards who feel that they benefit from water fund activities in a meaningful way. Water funds can create a virtuous cycle whereby well-designed, equitable programs provide opportunities and support for land stewards who then manage their land in a way that provides watershed services important for their own communities as well as for downstream water users. Recognizing the benefits of watershed services, downstream users provide political and economic support that ensures continued benefits to all actors in the landscape.



By connecting downstream and upstream communities, water funds can be seen as promoting a more systemic approach to watershed management that involves, connects and gives voice to a broad range of stakeholders.[15] The water fund model is not one-size-fits-all. Each water fund needs to be tailored to the local socio-cultural, ecological and economic context.[16] In practice, water funds display a wide diversity of funding, governance and implementation strategies related to the objectives of organizing and mobilizing resources and supporting watershed protection.[17, 18]



TNC 2011

Examples of governance, funding and implementation models for water funds

Governance models	Funding models/sources	Implementation models/strategies
• Multi-stakeholder governance board or project management unit (mix of public, private, multi-lateral and civil society institutions and, in some cases, representation by upstream water providers)	• Voluntary contributions by board/project management unit members	• Payment for ecosystem services
• Project management unit composed of watershed committee, public agencies and civil society	• Donations outside board	• In-kind contributions for habitat conservation/restoration (e.g., home gardens, inputs for alternative income generating activities, materials for improved agricultural productivity)
• Board of people elected by various watershed stakeholders	• Watershed committees required by law to invest fees from large water users in watershed health	• Protected area creation
• Three-way agreement among municipalities, water providers and facilitating NGO, day-to-day management by independent water user associations in each municipality	• Legal regulations create conditions for establishment of PES schemes through public resources	• Land purchases
• Umbrella organization among municipalities	• Municipal block grants	• Easements
• Government agency in charge with no board, but many partners	• Municipal taxes and water user fees	• Forest certification
	• Water companies apply a water tariff that includes the costs of watershed conservation	• Social marketing/education
	• Percentage of water company income established by municipal ordinance	• Direct investment in agricultural practices that reduce sediment or nutrient run-off, such as buffer strips, terracing, cover crops, etc.
	• Water companies (utilities) invest part of general budget	• Direct investment in restoration of ecosystems, like wetlands, grasslands and forests to improve watershed health
	• Environmental compensation/offsets	• Public land management practices, such as fire management or enforcement infrastructure
	• Interest generated by endowment	• Targeted investments to reduce the impact of other sources of water impairment, like road surfaces

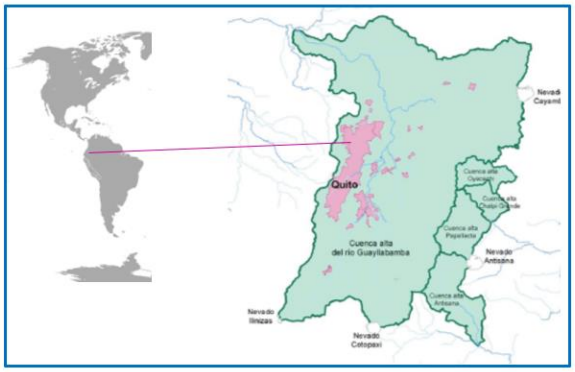
A key element of this bridging process is bringing together financial, political and social capital in the form of a multi-stakeholder board or project management unit. These decision-making bodies include diverse watershed actors who decide what, where and how to invest resources. The composition and decision-making structure of these boards vary based on the local context, but water funds to-date have successfully engaged a wide range of actors. NGOs, water utilities, municipal governments, national water authorities, private companies and hydropower are the most commonly represented. Some of the most successful water funds in terms of number of participants and land area influenced have included local communities on the governance boards, demonstrating the value of including these voices from both an equity and an effectiveness standpoint.[19]

To date, the water fund model has proliferated in Latin America, where growing water demand and water stress intersect with increasing pollution and development. In 2011, an agreement between the Inter-American Development Bank, FEMSA Foundation, the Global Environment Facility, the International Climate Initiative, and The Nature Conservancy created the Latin American Water Funds Partnership to contribute to water security in Latin America and the Caribbean through the creation and expansion of Water Funds. The public-private partnership, which could benefit as many as fifty million people, is working to protect three million hectares of watershed across Latin America. Two cases from this partnership follow: the first, from the oldest Water Fund in Latin America (Quito, Ecuador) and the second an emerging Fund which aims to replicate and build upon the model (Cucuta, Colombia).

Case Study: FONAG and the Quito Water Fund[20]

The Nature Conservancy's water funds effort began in Quito, Ecuador in 2000. In the late 1990s, the Metropolitan District of Quito had estimated that 80% of the city's water supply originated from protected areas within its watershed: the Ecological Reserve Antisana, the Cayambe Coca National Park, and Cotopaxi National Park. These protected areas were facing multiple threats related to land use change, including livestock grazing, detrimental agricultural practices, road construction, and insufficient financing for management and monitoring.

In response to growing water demands and concern over watershed degradation, the municipality of Quito, the water company of Quito and The Nature Conservancy structured, over the course of two years, the Fund for the Protection of Water (FONAG) as a private trust with a US$21,000 endowment. As of 2018, FONAG's endowment has grown to US$18.7 million, which generates an annual operating budget of US$2 million which support the implementation of FONAG's annual plan. The largest source of funding (87 percent) comes from Quito's water company, which by a municipal ordinance is required to contribute two percent of the water company's annual budget; nine percent of FONAG's funding comes from Quito's electric utility.



FONAG works to mobilize critical watershed actors to exercise their civic responsibility related to water resources. The multi-stakeholder Board of Directors of the Trust—composed of 6 public, private and NGO watershed actors—provides a mechanism for joint investment in watershed protection, including supporting the communities that live there. These board members – The Quito water company, The Nature Conservancy, Quito Power Company, National Brewery, Consortium CAMAREN, and The Tesalia Springs Company - each contribute to the trust fund every year as well as meet to approve the budget for FONAG each year. FONAG uses the interest money from this trust fund, along with donations, to finance their project initiatives. Even though FONAG's trust fund is private, since 95% of their funding comes from public entities – like the Quito water utility – they are managed publicly and funds within the trust must be invested in public investments.

FONAG conducts source water protection through a variety of mechanisms. Given the great importance of the páramo (high elevation Andean grasslands) to Quito's water supply, FONAG focuses much of its efforts in maintaining or improving the integrity and function of this ecosystem. This strategy is seen as the most effective way to maintain or improve water quality and base flow at EPMAPS intake points, avoiding the need to build more infrastructure for water supply for Quito. FONAG has four conservation and watershed management programs to achieve these objectives: a) protection of key páramo areas from grazing and burning through

park guard surveillance; b) restoration of degraded areas through riparian fencing, passive restoration of páramo areas through cattle and fire exclusion, and active restoration through replanting of páramo plant species; c) environmental education; and d) hydrologic data management.

Since its inception, FONAG has worked to protect and/or restore more than 40,000 hectares of páramos and Andean forests through a variety of strategies, including directly owning and managing 19,870 hectares, restoring 15,374 hectares of land, and securing conservation agreements on 6,593 hectares of land in addition to working with more than 350 local families on recovering local water sources. FONAG has identified 236,600 hectares in Quito's source watershed that are considered priority areas, of which 81,500 hectares are within protected areas. FONAG's objective is to conduct, over the next 60 years, conservation action on the remaining 155,100 hectares of unprotected land in the watershed. As a result of its work over the past 19 years, FONAG has secured water quality and quantity for Quito's population of more than 1.5 million people.[21]

FONAG has also established a rigorous hydrologic monitoring program to communicate and improve outcomes of investments in collaboration with several academic institutions. While FONAG has been successful in obtaining funding and implementing watershed conservation, questions remain as to whether FONAG's activities are achieving stated ecosystem service goals.

To answer this, monitoring and impact evaluation is now a key priority for FONAG. In collaboration with TNC and the University of San Francisco, FONAG has developed a monitoring program to evaluate the impacts of páramo protection and restoration on ecosystem integrity (defined as an ecosystem structure similar to areas with little human disturbance), water quality, and flow (Encalada et al 2014 a, b). Monitoring has been implemented through partnerships with FONAG park guards and field technicians. Monitoring results will be used to inform adaptive management – including the type of management to pursue, on what scale, and where - as well as to report measures of success. The approach followed provides information on short-term results (regarding the implementation of interventions and potential changes in threats), and longer-term impacts (in terms of the ecosystem integrity and water quality).

Specifically, in accordance with FONAG's strategic plan 2020, monitoring was designed to answer the following questions:

- Are FONAG's activities resulting in a reduction in the prevalence or intensity of critical threats present in the water supply areas (e.g. burning, cattle)?

- Are FONAG's activities resulting in a maintenance and increase of natural cover and connectivity? Are FONAG's activities improving terrestrial and aquatic ecosystem integrity?

- Are FONAG's activities resulting in an increase (or maintenance) of water retention capacity in targeted areas, observed through an increase (or maintenance) in base flow?

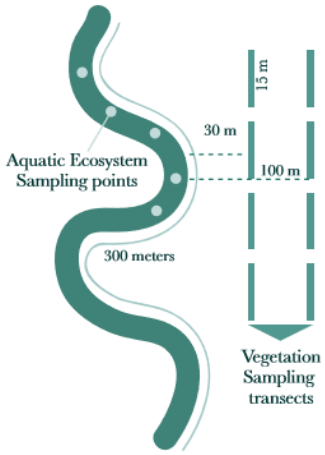
• Are FONAG's activities resulting in a reduction of bacteria; an improvement (or maintenance) of water quality parameters; and an increase (or maintenance) of nutrient retention capacity of the basins, resulting in reduction of nutrient concentrations?

The proposed goals and indicators in the 2020 plan are as follows:

Indicator Macro	Indicator Specific	Goal	Baseline 2014
Water quality regulation	Dissolved oxygen Ph Conductivity Temperature Nitrogen and sulphur Coliforms Aquatic invertebrates	By 2022 water quality of rivers within priority areas will comply with the Water Quality Index for high montane Andean rivers.	Current study in Antisana, Cotopaxi and Cerro Puntas developed by Universidad San Francisco de Quito.
Water quantity regulation	Base-flow behavior of watersheds of hydrologic importance for FONAG.	By 2022 achieve stable flows in hydrologically important areas for FONAG.	Water balance reports of FONAG hydrologically important areas.

Monitoring design and implementation was carried out in a series of steps. The first step was a diagnostic designed to: 1) create a baseline by characterizing the current state of selected study areas in terms of water quality and terrestrial and freshwater ecosystem integrity and 2) use this information to develop long-term program goals and indicators to track through time. Paired microwatersheds (including control microwatersheds where FONAG is not working and intervention microwatersheds where FONAG is working) were selected in each study area.

Control and impact microwatersheds were selected to represent conditions as similar as possible with the exception of the existence or not of FONAG activities. The specific design for each study site is shown below. Five water quality samples were collected at 20 meter intervals along a section of 100 meters within each microwatershed. In addition, a 300 x 10 m riparian area along the stream was sampled every 15 meters (n=20 samples), to assess vegetation cover type, number of vegetation strata and predominant vegetation species. Finally, four 15 meter transects were established 30 meters and 100 meters from the stream (8 total) to assess species richness, functional diversity, and vegetation cover in the surrounding terrestrial areas.



Ecosystem	Type	Indicator
Aquatic	Physical	• pH • Dissolved oxygen concentration • Temperature • Conductivity • Stream flow • Geomorphological characteristics (meanders, pools, etc.) • Light density • Riverine vegetation cover • Stream substrate composition • Total water solids (dissolved, volatiles, total)
	Chemical	• Sulfates • Ammonium • Nitrate • Nitrite • Phosphate
	Biological	• Macro-invertebrate community composition and structure • Total coliforms • Escherichia coli • Chlorophyll • Ecological Quality Ratio Index - calculated based on the Andean Biotic Index that measures tolerance levels of macro-invertebrates to pollution levels in streams (Ríos-Touma, 2014).
Terrestrial	Biological	• Vegetation cover • Percentage of bare ground • Density and richness of species • Life-form diversity

Results of the diagnostic showed contrasting results for the aquatic and terrestrial ecosystem integrity in the three study sites. In general, the quality of most of the aquatic ecosystems was characterized as “moderate”, with no consistent differences between the FONAG intervention and the control microwatersheds (Figure 4). Furthermore, the diagnostic revealed a great level of variance, which suggests that effective monitoring will be possible only after a solid baseline has been established for critical indicators, especially those related to the physical-chemical characteristics of the water in these streams. Some water quality indicators showed better conditions in streams managed by FONAG than the control streams (see below), but this was not statistically significant.

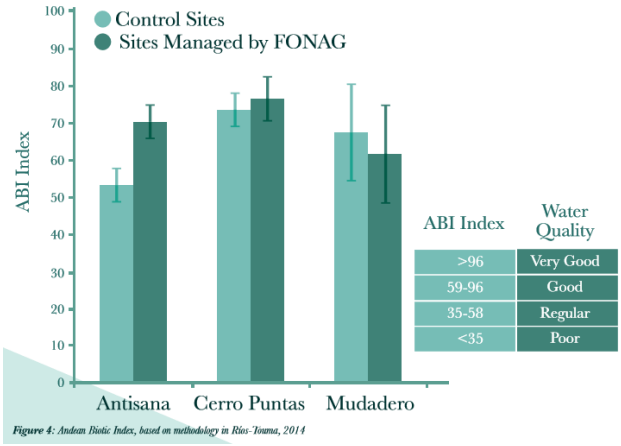


Figure 4: Andean Biotic Index, based on methodology in Rios-Touma, 2014

For terrestrial ecosystems, however, the diagnostic revealed consistent differences between FONAG and control sites. Specifically, FONAG sites showed significantly lower amounts of bare ground, and higher coverage and representation of shrubs.

These consistent differences across the three sites strongly suggest that the vegetation of the FONAG sites is starting to recover after the significant reduction in grazing and burning pressure that has resulted from the intervention of the Water Fund. From this perspective, it can be inferred that future years of continued management will bring not only a further recovery of the terrestrial ecosystems, but also an improved status of the ecological integrity of the aquatic environments that drain these landscapes. Such potential changes can only be assessed through a consistent monitoring system directly incorporated into the management activities of the Fund.

Case Study: Alianza BioCuenca and the Emerging Cucuta Water Fund

The BioCuenca Alliance was formed in June 2016 to protect the basins of the Zulia and Pamplonita rivers which supply the city of Cucuta, Colombia. Its governance includes the Water Supply and Sanitation company of Cúcuta, the Regional Autonomous Corporation of the North East Border region, the Mayor´s office of Cúcuta, the Government of Norte de Santander, the Ministry of Environment and Sustainable Development, Bavaria S.A., GIZ (German Development Cooperation) and the Chamber of Commerce of Cúcuta.

The Alliance focuses on the protection of the 150,000 hectare Santurban Páramo in the Norte de Santander region, which supplies the headwaters of these rivers in addition to the rivers Suratá, Tona and Frío, that together provide water to more than 2.2 million people living in the region's economic hub of Cúcuta. The Santurban Páramo is considered one of the most emblematic páramos in Colombia and has critical value as a natural reserve for water replenishment, storage, purification, and regulation system.

The Santurbán highlands support the livelihoods of several municipalities through farming, livestock, open cast mining and electricity production. Within the Santurbán region, 95% of the inhabitants live from traditional forms of agriculture and artisanal mining. The ecological integrity of the Santurbán páramo and the sustenance of its inhabitants is under serious threat from being permanently damaged. In addition, climate change will aggravate current water stress: climate scenarios predict high levels of water stress for the area by 2050. The Alianza BioCuenca is based on the successful water fund model adopted by other Colombian cities but goes beyond this concept as it aims to be a platform of cooperation and collaboration between the private sector and individuals.

The design and operationalization of the Alianza BioCuenca was fully supported by Good Stuff International LAC under a contract with the German development agency GIZ. The government of the Norte de Santander department contributes roughly US$260,000 USD annually to the Fund and is matched by the mayoralty of the city of Cúcuta. Currently, the Fund has leveraged resources of approximately $429,687.

Currently, the strategic plan of the Alliance focuses on the areas of Páramo and High Andean Forest in the Santurbán Paramo region, with the goal of conserving approximately 16,000 hectares, to protect and ensure the production of clean water for approximately 140,000 people.[22]

Conserving Global Green Infrastructure: The Future of Water Funds

In its 2014 survey of investment in watershed services programs, Forest Trends found that over the previous two years, water funds ("collective action funds") were the fastest growing type of program in terms of number of programs, making up one of every three new programs.[23] In its 2016 survey, Forest Trends documented 95 active, pilot and in-development water funds around the world, with a proliferation in Asia and North America, where previously most had been concentrated in Latin America.[24] Those 95 programs represented a total investment of over US$563.9 million and covered nearly 9 million hectares.

Opportunities

- Source water protection has broad geographic relevance for reducing land-based sources of nonpoint pollution.
- Four out of five cities can reduce sediment or nutrient pollution by a meaningful amount through three representative practices: forest protection, pastureland reforestation and agricultural best management practices.
- More than half of the world's urban populations could benefit from improved water security as a result of natural infrastructure.
- An increase of US$42-$48 billion annually would be required to achieve an additional 10 percent of sediment and nutrient reductions in 90 percent of our source watersheds. For half of cities, all annual source water protection activity costs could be just US$2 or less per person.
- As the number of water funds in Latin America and North America increase, TNC is partnering to establish and explore water funds in Africa and China.

Challenges

- Changing the way water institutions think and operate takes time and negotiation.
- There remain gaps in knowledge and understanding of the implementation and full range of benefits of nature-based solutions.
- The infancy of comparable cost calculations between natural-based solutions and gray infrastructure.
- High transaction costs.
- The length of time it takes some nature-based solutions to demonstrate their full benefits.

- The success of water funds rests in large part on developing an evidence-based culture that evaluates and demonstrates success around the right metrics.

- Well-designed hydrological monitoring programs should be implemented at the first stages in order to set baselines and improve prioritization tools.

- Social monitoring programs can be used to avoid unintended negative impacts and risks and ensure that the water fund provides the best possible outcomes for upstream communities.

- Community-based monitoring, informed by local knowledge and observation, also contributes in major ways to understanding the social and biophysical impacts of water fund activities.

The opportunity to use water funds as a way to help cost-effectively secure water, mitigate and respond to climate change, protect biodiversity, and support human health and well-being is immense. In fact, the global value of this opportunity, and the consequences if we fail to act, are too massive to ignore. However, it will take the combined efforts of many different actors working in collaboration to carry out this vision of a water-secure world through source water protection over coming decades.

About the Authors

Chandni Navalkha is Associate Director of Sustainably Managed Land and Water Resources and works on projects to advance and accelerate the enduring protection of land and water resources worldwide. Prior to joining the Lincoln Institute, Chandni was a fellow with the Sri Lanka Program for Forest Conservation, conducting research on the impacts of conservation on local livelihoods near the Sinharaja World Heritage Site. Chandni has worked for organizations in North America, Latin America, and South Asia supporting urban, peri-urban, and rural communities involved in voluntary land and resource conservation, and earlier in her career worked in change management for private and public sector organizations as a consultant with Accenture. She holds a Master's in Environmental Science from the Yale School of Forestry and Environmental Studies and a dual B.A. in English and economics from Cornell University.

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Appendix 1: Study Group Questions

One of the several uses of this case profile is in an academic setting. Following are several questions that an instructor can pose to their study group to engage participants in the details of the narrative.

1. Is this a novel initiative? How have the protagonists adapted the potential of marketing Nature-based solutions to the two different watersheds and municipalities?

2. Is the solution profiled in this case measurably effective and strategically significant for the practice of land and biodiversity conservation and climate change adaptation and mitigation? Why and why not?

3. Is the solution emerging from this case transferable to other jurisdictions and will it endure?

4. Is this a large landscape solution that crosses sectors and political jurisdictions? Who are the key players from various sectors essential to the success of this initiative? What are the key technologies and organizational methodologies?

5. If you were a key participant in one of the profiled water fund projects, what would be your priorities for action in the next year? Over the next ten years?

References

Abell, R., et al. 2017. Beyond the Source: The Environmental, Economic and Community Benefits of Source Water Protection. The Nature Conservancy, Arlington, VA, USA.

"Alianza BioCuenca." Alianza BioCuenca. https://www.alianzabiocuenca.org/.

Bennett, G. and Carroll, N. 2014. Gaining Depth: State of Watershed Investment 2014. Forest Trends, Washington, D.C., USA. Available from www.ecosystemmarketplace.com/reports/sowi2014.

Bennett, G. and Ruef, F. 2016. Alliances for Green Infrastructure: State of Watershed Investments 2016. Forest Trends, Washington, D.C., USA.

Bremer, L., Auerbach, D.A., Goldstein, J.H., et al., 2016. One Size Does Not Fit All: Diverse Approaches to Natural Infrastructure Investments within the Latin American Water Funds Partnership. Ecosystem Services 17: 217–236

Bremer et al. 2016a. Bridging Theory and Practice for Hydrological Monitoring in Water Funds. Latin American Water Funds Partnership and Stanford University. Available online at: https://naturalcapitalproject.stanford.edu/wp-content/uploads/2016/12/study-cases-monitoreo-hidrico-water-funds_1.pdf

Calvache, A., Benítez, S., and Ramos, A. 2012. Fondos de Agua: Conservando la Infraestructura Verde. Guía de Diseño, Creación y Operación. Alianza Latinoamericana de Fondos de Agua. The Nature Conservancy, Fundación FEMSA y Banco Interamericano de Desarrollo. Bogotá, Colombia. Available from http://www.fondosdeagua.org/sites/default/files/WATER%20FUNDS%20MANUAL-SPANISH%20VERSION.pdf (accessed September 2016). (In Spanish).

Climate & Development Knowledge Network (CDKN). 2016. Watershared: Adaptation, Mitigation, Watershed Protection and Economic Development in Latin America. Available from http://cdkn.org/wp-content/uploads/2016/06/CDKN-Bolivia-watershared.pdf (accessed October 2016).

Goldman-Benner, R.L., Benitez, S., Boucher, T., Calvache, A., Daily, G., Kareiva, P., Kroeger, T., and Ramos, A. 2012. Water Funds and Payments for Ecosystem Services: Practice Learns from Theory and Theory Can Learn from Practice. Oryx 46: 55-63.

Lorena Coronel T. 2019 Los Caminos de Agua FONAG: Trabajos y Aprendizaje. Fondo para la Protección del Agua, Quito, Ecuador. (In Spanish)

The Nature Conservancy. "Protecting Water at Its Source." The Nature Conservancy. https://s3.amazonaws.com/tnc-craft/library/water-funds-fact-sheet-1.pdf?mtime=20180219003723.

OECD. 2012. *OECD Environmental Outlook to 2050: The Consequences of Inaction*. https://doi.org/10.1787/9789264122246-en.

Paladines, R., Rodas, F., Romero, J., Swift, B., López, L., and Clark, M. 2015. The Regional Water Fund (FORAGUA): A Regional Program for the Sustainable Conservation of Watersheds and Biodiversity in Southern Ecuador. Available from http://www.watershedconnect.com/documents/files/the_regional_water_fund_foragua_a_regional_program_for_the_sustainable_conservation_of_watersheds_and_biodiversity_in_southern_ecuador.pdf

Richter, B. 2016. Water Share: Using Water Markets and Impact Investment to Drive Sustainability. The Nature Conservancy, Washington, D.C., USA.

Shah, T. 2016. Increasing Water Security: The Key to Implementing the Sustainable Development Goal. Global Water Partnership Technical Committee. Global Water Partnership, Stockholm, Sweden.

Sutton M.A., Bleeker A., Howard C.M., et al. 2013. Our Nutrient World: The Challenge to Produce More Food and Energy with Less Pollution. Global Overview of Nutrient Management. Centre for Ecology and Hydrology, on behalf of the Global Partnership on Nutrient Management and the International Nitrogen Initiative. Edinburgh, UK.

World Economic Forum (WEF). 2016. The Global Risks Report 2016, 11th Edition. World Economic Forum, Geneva, Switzerland.

Endnotes

[1] The material for this background paper, including figures and diagrams, is sourced in large part directly from the following publication of The Nature Conservancy: Abell, R., et al., 2017.
[2] World Economic Forum (WEF), 2016
[3] OECD, 2012.
[4] Richter, 2016.
[5] Sutton et al., 2013.
[6] The Nature Conservancy, "Protecting Water at Its Source."
[7] Abell et al., 2017.
[8] Abell et al., 2017.
[9] Bennett, 2014.
[10] Goldman-Benner et al., 2012.
[11] Climate & Development Knowledge Network (CDKN), 2016.
[12] Calvache et al., 2012.
[13] Bremer et al., 2016.
[14] Bennett, 2016.
[15] Abell, 2017.
[16] Shah, 2016.
[17] Climate & Development Knowledge Network (CDKN), 2016.
[18] Paladines et al., 2015.
[19] Bremer et al., 2016.
[20] The material for this case study is sourced in large part directly from the following publication of The Natural Capital Project: Bremer et al., 2016a.
[21] Lorena Coronel, 2019.
[22] Allianza Bicuenca, http://alianzabiocuenca.org/.
[23] Bennett, 2014.
[24] Bennett et al., 2016.