

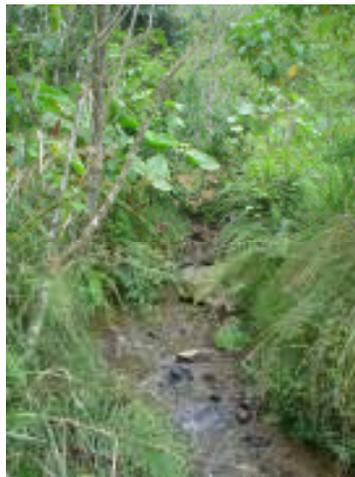
## Linking People and Nature through Watershed Conservation in the East Cauca Valley, Colombia

**Author:** Rebecca L Goldman, Silvia Benitez, Alejandro Calvache, Sarah Davidson, Driss Ennaanay, Emily McKenzie, Heather Tallis

**Short title:** Water Funds for conservation of ecosystem services in watersheds, Colombia

**Key Message:** Water funds link water users to nature - the source of all clean water upon which they depend. Users have an incentive to find the lowest cost option for maintaining access to a clean, regular water supply. In the Andean region, natural ecosystems provide these services at a low cost. Hence, investing in nature conservation makes economic sense. One such investment – water funds – are proliferating in the Andes. Water funds are long-term trust funds that involve a public-private partnership of water users who determine how to invest financial interest in conservation activities in priority areas. InVEST, an ecosystem service mapping and modelling tool, was used in the East Cauca Valley Water Fund in Colombia to help direct the fund's conservation investments towards areas with the highest potential for reducing sedimentation and maintaining water yield. With quantitative estimates of ecosystem service returns, it was possible to identify the most efficient investment portfolio for each watershed in the fund.

**Suggested citation:** TEEBcase by Rebecca L Goldman, Silvia Benitez, Alejandro Calvache, Sarah Davidson, Driss Ennaanay, Emily McKenzie, Heather Tallis (2010) Water Funds for conservation of ecosystem services in watersheds, Colombia, available at: [TEEBweb.org](http://TEEBweb.org).



Picture 1: (Left) Benefits of fencing; Picture 2 (Centre): Riparian Buffer; Picture 3 (Right): Children residing in the East Cauca Valley

## **What is the problem?**

The Northern Andes region faces three critical problems: 1) natural ecosystems – the key hydrologic regulators of the region – are threatened by conversion to crop and ranch land; 2) ranchers and farmers depend on the land for their livelihoods making it unjust, inequitable, and unsustainable to stop their land usage; and 3) growing population and demand for water. Coupled with unpredictable impacts of climate change, there is a threat to the long term availability of natural resources.

The watersheds of Northern Andean region are characterized by a mix of high altitude grasslands (páramo) and forests which provide valuable water services: flow regulation (Buytaert et al. 2007) and improved water quality through decreased sedimentation (White et al. 2009), among others. The demand for a clean and regular supply of water by downstream users – namely citizens, water utilities, hydropower companies, agriculture companies, and beer and water bottling companies – is ever-increasing. Coupled with unpredictable impacts of climate change on rainfall and temperature, regular access to clean water is a growing concern. Natural areas that are important for biodiversity conservation and water regulation are often officially protected. However, the budget of the Ministry of Environment in this region is insufficient for effective management of protected areas and buffer zones, where most of the pressures of land use change exist.

The main threat to the páramo and forests is conversion to crop and ranch land by relatively poor families living in the watershed, upstream from the main water users. Preventing access to the natural ecosystems would unjustly harm their livelihoods. However, allowing continued conversion increases the likelihood of ecosystem degradation and threatens access to ecosystem services for these same people, as well as downstream users and beneficiaries.

## **What is done to solve it and what is the role of local policy?**

The Nature Conservancy (TNC), with many partners, has launched an effort to provide a sustainable funding source for conservation and protection of natural ecosystems in order to provide valuable ecosystem services while maintaining or enhancing the livelihoods of watershed communities. These projects are called water funds, and the first was launched in Quito, Ecuador in the late 1990s, led by TNC in close collaboration with Fundación Antisana who together approached the city's mayor (see Arias et al. TEEB D2 case study). Now, with 13 water funds in some stage of development in the Northern Andes region, TNC is developing a step-by-step methodology for how to create a water fund (see Ramos et al. *forthcoming*).

In a water fund, water users voluntarily put money into a trust fund; the users and other key stakeholders in the watershed form a public-private partnership to make decisions on how to spend interest, and in some cases a portion of the trust itself, to finance conservation activities in the watershed (see Goldman et al. 2010). These user group public-private partnerships include public agencies such as water utilities and hydropower companies and sometimes representatives from the National Park agencies and/or regional environmental authorities. Private companies can include water bottling companies or beer companies, among others. Different non-government organizations are also members.

The conservation activities take various forms. For example, to help protect natural ecosystems and associated ecosystem services, water funds hire, train, and pay salaries of community-based park guards. To improve and secure water service provision and biodiversity from

working landscapes in the watershed, water funds help land managers implement best management practices, such as fencing riparian areas and re-vegetating the landscape. Water funds include a mechanism for compensating people for their investment by reducing current production costs (e.g. building a community milk bottling plant to cut out the middle man) or supplying or subsidizing products families would otherwise have to purchase (e.g. giving families seeds and training to grow commonly consumed vegetables).

### **What was achieved?**

In the East Cauca Valley of Colombia, TNC and Asocaña, an association of sugar cane producers who provided most of the funding, led to the creation of a water fund, called Fondo de Agua por la Vida y la Sostenibilidad (FAVS) – Water Fund for Life and Sustainability. Asocaña relies on a regular supply of clean water for sugar cane production. The capital fund is currently worth USD 1.8 million. Several other groups, including community-based grassroots organizations, the regional environmental authority, and a peace and social justice organization also participate in the fund. Nine watersheds feed the valley. The goals of this water fund are to secure biodiversity and water-related service benefits, particularly reduction in sedimentation and maintenance of regular water flows. Activities carried out through investments by the fund include conserving at least 125,000 hectares of the natural ecosystems and improving management of the landscape. These activities will benefit 920,000 people downstream and sugar cane production, an important industry for the Colombian economy.

In order to 1) identify priority areas for FAVS investment, 2) establish quantitative ecosystem service goals, and 3) develop a portfolio of the most efficient activities, TNC and partners used a watershed scoring process and a modeling tool called InVEST (Integrated Valuation of Ecosystem Services and Trade-offs), developed by the Natural Capital Project (Tallis et al. 2010). First, a conservation activity (restoration, reforestation, fencing or silvopastoral practices) was assigned to each part of the landscape based on the behavior of landowners in the region and successful investments by early members of the water fund over the last 20 years. These assignments implicitly considered factors such as opportunity costs and land owners' willingness to change activities. For example, no water fund investments and associated conservation activities were assumed to occur in sugar cane growing areas because the opportunity costs are too high. The landscape was ranked to highlight the places where possible conservation investments were likely to yield the greatest improvement in water yield and erosion control. Factors included in the ranking were those known to affect the hydrological response of the services, such as slope, soil depth, distance to stream or water body, aspect, elevation and precipitation. Data from historic conservation investments in each watershed were used to estimate how much the proposed conservation activity in each location would cost. Combining the landscape ranking and cost information enabled selection of the highest ranked locations for each activity, tallying costs until the target budget level was met. The resulting selected activities across the landscape formed the water fund investment portfolio. This process was repeated for five budgets, ranging from the level of investment currently committed by the fund (USD\$10 million) to a doubling of that investment (USD\$20 million).

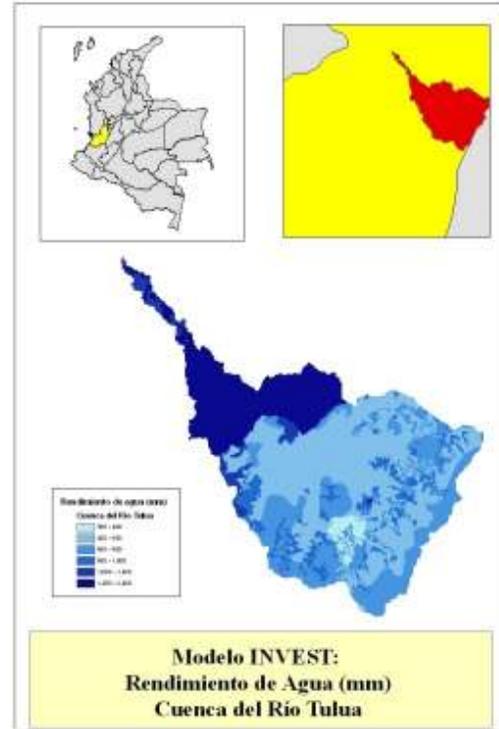
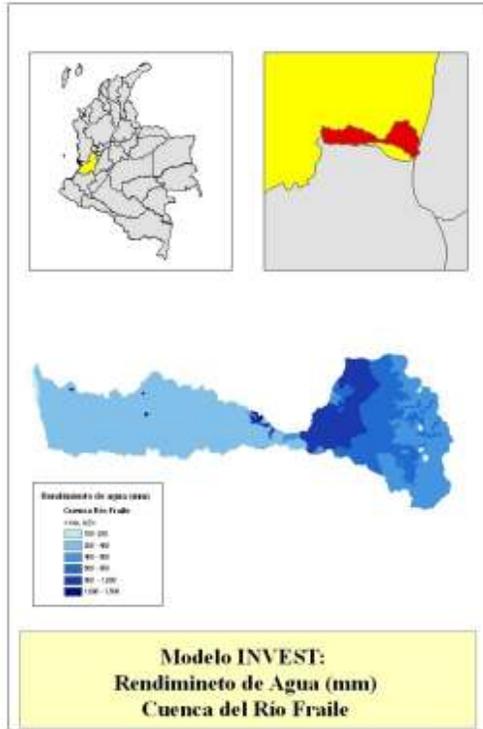
With this set of investment portfolios as scenarios for future management, InVEST was used to estimate the ecosystem service returns from each. InVEST quantifies, maps and values ecosystem services under current and possible future conditions. The models currently included in this free software tool estimate habitat quality, and the biophysical level and economic value of carbon storage and sequestration, annual water yield for hydropower (and other uses), avoided sedimentation, water purification (for nutrients), crop pollination, timber production and open access harvest (of non-timber forest products and other natural products).

In the FAVS water fund case, InVEST was used to assess two of the main services of interest to Asocaña: annual water yield and avoided sedimentation. With the quantitative estimates of ecosystem service returns, it was possible to identify the most efficient investment portfolio for each watershed in the fund. For example, the estimates show where in a sub-watershed the water fund should reforest or restore vegetation and where it would be more cost effective to fence off areas or engage in silvopastoral practice. Using these targeted activity maps, the water fund partnership can now evaluate where these practices are most feasible given the social context of communities living in the watersheds.

Both watershed communities and water fund decision-makers benefited from this prioritization exercise. Watershed communities benefit since practices are implemented where there are greater returns from the investments (such as availability of water on their own farm or ranch) with costs that can be readily offset. For the water fund decision making process, with nine watersheds as potential areas for investment and limited revenue for conservation practices, a cost-benefit assessment basing benefits on ecosystem services returns provides an efficient and effective way to target action.

The recommendations from this modeling exercise were based on current climate conditions, but it is well known that climate conditions are changing in the region and are likely to affect precipitation and temperature in ways that may change the effectiveness of these investment portfolios. To ensure that the water fund's investments are robust to climate change, new research is being done, in partnership with CIAT (International Center for Tropical Agriculture), using InVEST sedimentation and water yield models, FIESTA (Fog Interception of the Enhancement of Streamflow in Tropical Areas), and SWAT (Soil and Water Assessment Tool) to: 1) assess impacts from climate change on the provisions of these services as well as on biodiversity and crops, 2) determine if on-the-ground activities promoted by the water fund are adapted for these changes, and 3) design activities to promote resilient ecosystems that will continue to provide the benefits people will increasingly need as they adapt to climate change. These activities will be designed using stakeholder workshops.

**Figure:** InVEST modeled estimates of water yield in the East Cauca Valley



## Sources

Arias, V, Benitez, S, Goldman, R. PES : The Case of Quito, Ecuador. TEEB D2 Case Study.

Buytaert, W., Iñiguez, V., De Bièvre, B. 2007. The effects of afforestation and cultivation on water yield in the Andean páramo. *Forest Ecology and Management* 251: 22-30.

Goldman, R.L., Benitez, S., Calvache, A., and Ramos, A. 2010. Water funds: Protecting watersheds for nature and people. The Nature Conservancy, Arlington, Virginia.

Kareiva, PK, TH Ricketts, GC Daily, H Tallis, and S Polasky, Eds. Forthcoming. *The Theory & Practice of Ecosystem Service Valuation*. Oxford University Press, Oxford.

Natural Capital Project (2010) URL: <http://www.naturalcapitalproject.org/nasca.html> (accessed June 29, 2010).

Ramos, A., Benitez, S., Calvache, A. *Forthcoming*. Fondos de Agua: Conservando la Infraestructura Verde: Guía de diseño, creación y operación. The Nature Conservancy.

Tallis, H.T., T. Ricketts, E. Nelson, D. Ennaanay, S. Wolny, N. Olwero, K. Vigerstol, D. Pennington, G. Mendoza, J. Aukema, J. Foster, J. Forrest, D. Cameron, K. Arkema, E. Lonsdorf, and C. Kennedy. 2010. INVEST 1.004 beta User's Guide. The Natural Capital Project, Stanford University.

White, D., Rubiano, J., Andersson, M., Garcia, J., Saenz, L., Jarvis, A. 2009. Análisis de oportunidades de inversión en conservación por ahorros en tratamiento de aguas Sitio del estudio: El Páramo de Chingaza Colombia. CIAT, Colombia.

**Acknowledgement:** Marta Echavarría ([mechavarria@ecodecision.com.ec](mailto:mechavarria@ecodecision.com.ec)) for reviewing the case