The Regional Water Fund (FORAGUA): A Regional Program for the Sustainable Conservation of Watersheds and Biodiversity in Southern Ecuador

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I. Executive Summary

The Regional Water Fund of Southern Ecuador (FORAGUA) represents a model of how municipalities of varying size and capacity can act together to form a single integrated water fund as a mechanism to manage water resources.

Water funds are mechanisms to finance the management of water catchment areas in order to ensure water quality as well as the retention capacity of mountain ecosystems. In doing so, they also conserve biodiversity and other environmental values of these mountain forests, linking water users to the ecosystems that provide the water they depend upon. This system implements a conservation program planned and funded with resources provided by citizens living within the watersheds, and in doing so, builds local capacity and sustainability.

The municipalities that participate in FORAGUA levy fees on water users, which are first aggregated within the FORAGUA trust fund and then used to finance the management and conservation of the municipalities´ watershed forests. Ninety percent of these funds are allocated to the municipalities´ own watersheds; the remaining ten percent is used to fund the operating budget of its Technical Secretariat, which provides oversight and technical assistance to the municipalities. Since FORAGUA was created in 2009, these water fees have generated an average of $388,651 annually to be invested in watershed management and conservation programs.

Water quality results include reduced fecal coliform levels at a local scale, corresponding with a decrease in water treatment costs. Conservation results include 174,028 acres declared as municipal reserves and 37,681 acres purchased to protect and restore the ecosystems that supply water for more than 430,000 people while conserving watershed forests of high biodiversity.

In forming FORAGUA, the participating municipalities have established a common fund, sharing the costs of its operation and management. This enables smaller municipalities to be included in the fund, municipalities that may have important conservation areas but lack the population to generate substantial financial resources that otherwise would be required to implement a water fund mechanism.

II. Problem Discussion/Background

Most of southern Ecuador's cities and towns are experiencing growing water shortages due to rapid population growth. This becomes most apparent during the dry season from September to December when most cities experience serious water shortages, including intermittent supply. In the provincial capital of Loja where the population grew from 175,077 to 214,855 (22.7%) between 2001 and 2010 (INEC, 2010), the city center has

water on a 24 hour basis year-round, but newer neighborhoods have only 8-12 hours of water per day (PNUMA, 2007). Water scarcity is much worse in cities like Zaruma, Celica and Catacocha that are located on the drier western slopes of the Andes; during the eight month dry season, they typically have only two to four hours of water per day. Normal practice in these towns is to collect water throughout the day, then open the pipes for a few hours beginning at 6am.

Water quantity and continuity issues

Water scarcity in the region has been exacerbated by poor forest management in the valleys where municipal water supplies typically originate. Historically, valleys throughout the region were forested. In recent years, however, expanding land uses such as farming and livestock grazing have resulted in significant deforestation, reducing water quantity and quality, and the continuity of its supply.

The original forest cover benefited water supply in two ways. First, the forests increased total water supply by capturing horizontal precipitation directly from clouds and mist (Kiss & Bräuning, 2008). According to Bendix et al. (2008), cloud forests in southern Ecuador can accumulate up to 1,700 mm of water per year through fog condensation. Loss of these forests can mean losing up to 28% of the total water input (Ibid). Second, these forests act like sponges, retaining and slowly releasing water to even out flow during the year so that relatively more water is available during the dry season (Costanza et al. 1997). An estimated 200,000 liters are stored in each hectare of humid mountain forest, particularly in epiphytes (Kiss & Bräuning, 2008). These capture and storage functions are lost when the forests are cut.

In addition, global climate change has caused measurable changes in rainfall patterns in southern Ecuador, exacerbating the water supply problem, both through drought and flooding that overwhelms the water catchment system[1]. Monitoring by the German Science Foundation over the past 18 years shows that there is 100 mm per year more rain in this region, but also more extreme events such as storms and droughts (Marengo et al, 2010). The Intergovernmental Panel on Climate Change report on Central and South America (Magrin et al, 2014) states that rains have increased in southern Ecuador during November - January and decreased during the June - August dry season. A temperature increase of at least 0.1 ° C per decade is expected. Donat et al. (2013) also mention the increase of extreme events in the region, i.e storms in the rainy season and drought in the dry season.

Water quality issues

In addition to forest loss affecting supply, land use changes within watersheds have lowered water quality by creating sources of pollution. Principal problems are bacteria such as *E. coli* that originate from cattle and other domesticated animals as well as from human waste, and pesticides from agriculture. These contaminants have led to a 10.8% increase in the incidence of gastrointestinal illness in Loja Province over the ten year period between 2004 and 2013 (MSP, 2013). During 2013 in Loja Province, 4.13% of the population experienced water-borne stomach illnesses severe enough to require a

[1] In April 2015, the City of Loja experienced water supply interruptions in many neighborhoods after heavy rains and mudslides damaged several water intakes.

hospital visit (Ibid). These problems are even more serious in the smaller rural towns where inhabitants typically drink untreated water.

Watershed funds established before FORAGUA

Prior to FORAGUA, water funds had been created in the major Ecuadorian cities of Quito and Cuenca. There are similarities and differences between these funds and FORAGUA, including the degree of reliance on water user fees, whether the funds contribute to an endowment or are spent annually, and what kinds of activities are funded.

The Quito water fund, FONAG was established in 2001 and was instrumental in establishing the concept of a water fund in Ecuador. FONAG is a trust fund constituted of both public members, notably the Quito water and sanitation utility, EPMAPS (Empresa Pública Metropolitana de Agua Potable y Saneamiento) and electrical utility, EEQ, and private ones such as the brewing company, Cervecería Andina and the non-profit, The Nature Conservancy. All revenues go into an endowment of which only the interest is spent. The income is derived from government bonds at 7% interest. The Quito water company originally contributed one percent of its total income toward the endowment, but in 2007 raised its annual contribution to two percent. This endowment has grown from $3 million in 2005 to $11.4 million at the end of 2013 (FONAG, 2013), and generates about $800,000 annually to be spent on programs.

The Cuenca fund, FONAPA followed in 2008. It is a trust currently constituted of nine members, seven public and two private. These include Cuenca´s telecommunications, water, and sanitation utility, ETAPA (Empresa Pública Municipal de Telecommunicaciones, Agua Potable, Acantarillado y Saneamiento) as well as hydroelectric companies, NGOs, and two municipalities.

FONAPA was like FONAG in that it originally did not include municipalities. In 2011, FONAPA began restructuring to include municipalities with the private NGO, Nature and Culture International´s (NCI) technical support. FONAPA and NCI are currently in the process of enrolling four more municipalities (in addition to the two mentioned above that are already participating). The ultimate goal is to enroll all 16 municipalities in the Paute River basin.

At first, annual contributions to FONAPA were noncompulsory[2]; FONAPA´s assets increased according to its constituents´ willingness to pay. To date, the trust has received approximately $1.1 million in contributions, primarily from ETAPA, and currently has approximately $550,000 in savings (FONAPA Technical Secretary, written communication, 2015). Since its formation in 2008, FONAPA investments have generated around $100,000 in interest income (Ibid). ETAPA also invests about $1.5 million a year from its general budget for watershed management and research of the paramos above Cuenca (Ibid). It funds activities including the management of Cajas National Park, which provides 30% of Cuenca´s water. As part of FONAPA´s strategic

[2] Contributions remain noncompulsory for all members except the municipalities who joined in 2011 or later. Payments may become compulsory for all members based on a change to the trust contract that is currently being considered.

restructuring, FONAPA now allows member contributions to be used on an annual basis for watershed management activities.

A principal difference between these funds is that the revenues raised by FONAG are used solely to capitalize its endowment and only the endowment´s interest is used for programs. In contrast, both FORAGUA and the municipalities entering FONAPA use all revenues for programs. Paying into an endowment is not considered feasible for medium sized cities and smaller towns; they need to allocate all revenues to programs in order for their programs to have a meaningful impact.

The funds also differ in the types of programs they support. FONAG invests primarily in communication, environmental education, and watershed planning and management activities (FONAG, no date). FORAGUA funds are spent on more direct conservation programs with a focus on developing and managing municipal watershed reserves. Activities include purchasing land, compensating landowners to remove cattle from the reserves to allow forest regrowth, and other direct land stewardship and protection activities. See Table 1 below for details as to Loja Municipality´s use of its funds.

Table 1 Loja Municipality´s use of FORAGUA funds by program (2012-2013)

	2012	**2013**
Salaries (2 technicians and 9 park guards)	$67,117	$63,988
Supplies and equipment	$5,928	$6,876
Vehicle maintenance	$1,242	$1,346
Environmental education	$11,899	$4,230
Land purchases	$58,800	$492,718
Management of watersheds and other protected areas	$1,612	$26,828
Productive projects in watersheds (fish farming and beekeeping)	$57,967	$5,140
Total	**$204,564**	**$601,126**

Source: City of Loja, 2012 and 2013 Water Fund Investment Plans

III. Origins of FORAGUA.

The concept for FORAGUA grew out of watershed conservation programs pursued by the municipalities of Loja and Celica between 2005 and 2007 with Nature and Culture International´s (NCI) assistance. These initial programs, funded principally by NCI, supported land purchase within the municipalities' watersheds to facilitate forest regrowth and reduce water pollution. At the time though it was recognized that ongoing funding would be needed to manage those areas. The concept of a water fund was first proposed by NCI in 2007 as a way to finance ongoing management as well as to fund additional land acquisition for watershed protection. Over the next two years, the concept was discussed extensively with local governments, communities, and water users throughout the region. On July 8, 2009, the municipalities of Loja, Celica, Pindal, Macará and Puyango, together with Nature and Culture International, signed a trust agreement with the National Financial Corporation as trustee, creating the Fondo Regional del Agua (known by its acronym, FORAGUA).

As with the water funds discussed above, the FORAGUA trust fund was created to aggregate and hold the funds raised (such as, from municipal water use fees), and to provide independent oversight over their expenditure, ensuring that funds collected would be used for the purposes intended. It was also felt that a collective fund was needed to facilitate knowledge sharing among participants and to create an economy of scale, for example for administrative and technical services, that would allow smaller municipalities to participate.

IV. Functioning and Structure

Governance Structure

FORAGUA is structured as a public trust fund with an eighty year term, and is governed by its constituent municipalities (Contrato Fideicomiso Mercantil, 2009). This accords with Title 2, Article 12 of the current constitution of Ecuador, which recognizes water as a human right to be provided by municipalities and public water companies. The trust fund mechanism is administered by an independent public financial entity, the National Financial Corporation, which ensures that revenues from the water fees collected by each municipality and from other sources are invested effectively and spent to manage watersheds and water resources of southern Ecuador (Ibid).

FORAGUA is a regional fund composed of separate accounts or sub-funds for each participating municipality. Its governing structure includes a constituents' assembly that meets annually and is composed of the member municipalities, each with one vote. The constituents' assembly elects a board of directors of five members, each elected for two year terms (Ibid). The directors generally have been representatives of the municipalities and the non-profit organization, Nature and Culture International. This shared governance structure provides added certainty that the funds entrusted to FORAGUA are used according to agreed-upon budgets and plans. A trust fund is needed as otherwise the funds could be spent by the municipalities for other purposes.

FORAGUA is composed of municipalities that have voluntarily joined the FORAGUA trust. In order to join FORAGUA, municipalities must adopt an ordinance with three elements (FORAGUA, no date (a)):

- Establish the municipality´s authority to declare municipal reserves to protect both watersheds and other areas of high conservation value.
- Impose a fee on potable water users and designate that the fee money collected and passed to the FORAGUA trust fund be used only for watershed conservation purposes and management of the municipal reserves.
- Authorize enrollment in FORAGUA.

The municipality then petitions to join FORAGUA, and once accepted, becomes part of the constituent assembly. The water fees collected by the municipality are deposited in FORAGUA with 90% going to a dedicated account for that municipality´s watershed protection. However, an important innovation of FORAGUA´s is that the remaining 10% is used to support the Technical Secretariat and other operating costs of the Fund (Contrato Fideicomiso Mercantil, 2009). This allows smaller municipalities and rural populations to participate since they can access a level of technical assistance from the Technical Secretariat that their individual fees would be unable to cover.

Note that under FORAGUA and FONAPA, the municipalities themselves spend the ninety percent of funds allocated to them directly on watershed management activities.

Use of funds

According to FORAGUA´s statutes, the funds collected are to be allocated "to the development of programs and/or projects for the conservation, protection and recovery of the environmental services and biodiversity of fragile and threatened ecosystems of the provinces of Loja, El Oro and Zamora (Contrato Fideicomiso Mercantil, 2009)." The statutes further establish that the "funds can be only invested in: land purchases, payments or compensation for environmental services, control and protection of natural vegetation, prevention and control of forest fires, reforestation and restoration of habitats, reserve management (basic infrastructure, trails, fencing, signage), environmental education, support to conservation processes in rural areas, and the monitoring of water quality and quantity (Ibid)."

Property ownership

In addition to managing cash funds, FORAGUA also holds property in trust for enrolled municipalities and the NGO, Nature and Culture International. As of the end of 2014, FORAGUA held 14 properties totaling 2,236 acres that were acquired for the purposes of forest conservation and recovery of natural vegetation. There are two reasons for FORAGUA to hold property. First, the trust shields these land assets against the claims of potential creditors. Second, it provides a safeguard that the land won´t be sold by the municipal or non-profit owner during times of political or economic upheaval.

In addition, the individual municipalities and Nature and Culture International own 35,445 acres of reserves that aren´t held in trust by FORAGUA, as shown below in Table 2.

Technical Secretariat

To support its operations, FORAGUA currently has a Technical Secretariat with three professionals (an executive director, a forester and an accountant). Their primary functions are: recruitment of new member municipalities, oversight of the municipalities' use of the funds, fundraising from outside sources, and technical assistance to municipalities. In 2014, the Technical Secretariat´s annual budget was $37,485 (FORAGUA Financial Statements, 2014); it was covered by the 10% of water fees collected, plus a 10% administrative fee charged to all externally funded projects and grant funds executed by FORAGUA. A goal by 2016 is to have one FORAGUA technical staff for every five municipalities.

Nature and Culture International continues to provide technical assistance to the Secretariat, equivalent to 2.5 staff members. These staff members provide legal assistance and fundraising support (primarily from international donors) and help compile and analyze technical information (i.e. maps of vegetative cover, land rights, and water quality data etc).

The Technical Secretariat´s capacity is supplemented by technicians within the municipalities themselves. In smaller towns of fewer than 20,000 people, there is

usually one technician in charge of all aspects of environment management, including water and wastewater, garbage collection, and parks. This technician typically will also be responsible for FORAGUA-related issues. In Loja Municipality, there are two full-time technicians and as many as ten field staff who support reforestation and fire management activities and provide basic security within the protected watersheds (City of Loja, 2012 – 3). These are paid by the water use fee. Before FORAGUA, there was only one technician in Loja and no money for conservation activities.

Public information and transparency

Transparency is a key feature of FORAGUA. A web page was launched in 2009 (www.foragua.org) to promote the fund, publicize its achievements and provide samples of ordinances, maps and other information helpful to municipalities seeking to or in the process of joining FORAGUA.

There is also transparency for the water user. The monthly water bills received by each user are clearly marked with the amount charged for the municipal watershed protection program (see graphic below). Additionally, citizens are informed of the activities and achievements of the municipal watershed protection programs through print and other media.

FACTURA:

Nro. 051-001-000116070

Autorización electrónica:

1802201511460211600002400012981479449

Municipio de Loja

Ambiente de emisión: PRODUCCION

Matriz: José Antonio Eguiguren SN y Bolivar

Fecha de autorización: 18-02-2015 11:46:02

R.U.C: 1160000240001

Establecimiento: SN

CONTRIBUYENTE ESPECIAL RES. NRO. 0590

OBLIGADO A LLEVAR CONTABILIDAD: SI

Clave de acceso:

1002201501116000024000120510010001160700114825014

Cliente: SOLORZANO CARMEN CECILIA

R.U.C / C.I: 1103260020

Fecha de emisión: 10-02-2015

Cantidad	Descripción	V. unitario	V. total
1.00	SERVICIO DE AGUA POTABLE	4.19	4.19
1.00	ALCANTARILLADO	1.05	1.05
1.00	APORTES PLANES MAESTROS	0.84	0.84
1.00	SEGURIDAD CIUDADANA	0.40	0.40
1.00	PROTECCION MICROCUENCAS	0.60	0.60
1.00	COSTO BASICO DE FACTURACION	0.41	0.41
1.00	RECOLECCIÓN DE BASURA	0.84	0.84

INFORMACION ADICIONAL	
Número medidor	1109000654-735380
Estado medidor	Funcionando
Categoría	RESIDENCIAL
Ruta	109 - 2045
Lectura anterior	760
Lectura actual	780
Consumo (m3)	20.00
Tipo exención	NINGUNO
Valor exención	0.00

Subtotal	8.33
Base imponible 0%	4.19
Base imponible no objeto de impto	4.14
Descuento	0
Total	8.33

Example of water bill from City of Loja (Watershed protection line-item highlighted in yellow)

Process for adding municipalities to the Fund

Participation in FORAGUA

The process for a municipality to become a member of FORAGUA typically starts with a presentation to the Municipal Council explaining what FORAGUA is, how it operates, and what the municipality needs to do to join. If a municipality is interested, baseline technical information needs to be gathered describing the municipality´s water system, including supply, demand, and water quality issues, the state of the watershed, including land ownership and vegetative cover; and economic data such as number of users, cost of water, and payment information. FORAGUA typically performs these technical studies with support from the municipalities themselves, water companies, NCI, and local universities.

The process might involve field visits to provide the Council with a first-hand view and enhanced understanding of their watershed and its issues, for example, why forest loss

often causes problems, and how cows cause contamination. With some municipalities, NCI has demonstrated their water quality problems by putting a sample of their water into a petrie dish and showing how much E. coli bacteria grows in three days.

After collection, this baseline information is presented to the Municipal Council. Presentations address the expected water quantity, quality and biodiversity benefits of a watershed fund. The incremental cost of a new water fee is estimated, with comparison to what similar municipalities pay for water use (See the range of municipal water fees in Table 3). In some cases, additional studies have been completed such as opportunity cost analyses and users´ willingness to pay[3].

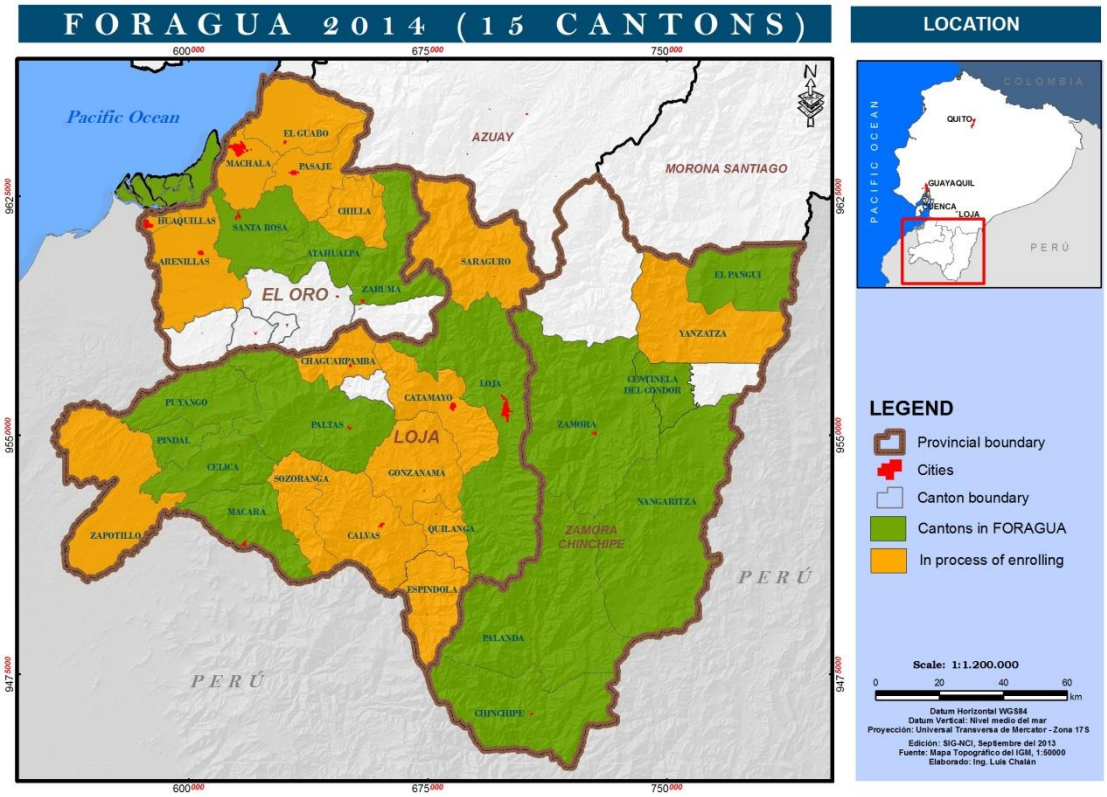
After the cost-benefit presentation, FORAGUA and the municipal technicians typically draft an ordinance (with the required elements as described above in the "Governance Structure" section) for consideration by the Municipal Council. Based on experience to date, once the process reaches this stage, its chance of coming to fruition is almost assured. Most municipalities that have reached this stage have passed the ordinance and joined FORAGUA with a unanimous vote.

Currently, there are 11municipalities that form FORAGUA: the original five; Zamora and Chinchipe in 2011; Centinela del Cóndor, Palanda, El Pangui and Zaruma in 2012. Four additional municipalities - Paltas, Santa Rosa, Nangaritza and Atahualpa - have passed ordinances and requested to become part of FORAGUA. Once approved, they will sign the FORAGUA enrollment contract with the National Financial Corporation (CFN), the trust´s fiduciary.

These 15 municipalities are shown in green on the map in Figure 1 below. Another nine municipalities - Catamayo, Calvas, Chaguarpamba, Gonzanama, Quilanga, Saraguro, Yanzatza, Espíndola and Sozoranga - and the Provincial Governments of Loja and Zamora-Chinchipe have expressed interest in participating. The ultimate objective of FORAGUA is to include all 39 municipalities in Ecuador´s Region 7.

[3] In Catacocha, 62.1% of the population expressed a willingness to pay an environmental fee of $1.24 per month to protect micro-watersheds and ensure supply and water quality (Encalada, 2013). The willingness to pay percentages were 65.2%, 62.8% and 67.9% for Nangaritza, Palanda, and Zaruma, respectively (Lopez, 2012 and 2013).

Figure 1. Municipalities participating in FORAGUA (2014)



V. Results of FORAGUA

A. Environmental Results

As of the end of 2014, the15 Municipalities listed above had created 174,028 acres of municipal reserves, protecting and restoring watershed ecosystems that supply water for 432,196 people.

Within these watershed reserves, some areas were already owned by the municipalities or subject to some form of protected status. To conserve additional areas within their watersheds, virtually all of the municipalities have adopted land purchase as their primary conservation tool instead of opting for annual compensation for environmental services (CES) payments to landowners. There are several reasons for this. First, there is a need for permanent protection of land in these watersheds that provide the drinking water for the public. Second, it can be more cost-effective to make a one-time purchase of the land than to pay annual compensation for many years. Third, converting the land to public ownership avoids the risk of having to rely on future governments to continue annual CES payments.

The table below shows the total area declared as reserve in every municipality and the percentage of that municipality´s main watersheds currently in conservation ownership.
Table 2. Protection of Watersheds under FORAGUA 2014

Municipality	Year of entry into	Total area of watersheds	Total area declared as	Intake Flow	Areas purchased or	% of the total watershed area

	FORAGUA	(in acres)	Municipal Reserves[4] (in acres)	(in liters / second)	owned (acres) [5],[6]	owned
LOJA	2009	11,861	4,663	1,200	7,186	61%
CELICA	2009	11,120	4,663	12	312	3%
PUYANGO	2009	7,413	11,550	21	2,403	32%
MACARÁ	2009	24,710	5,379	35	5,659	23%
PINDAL	2009	5,108	0	30	255	5%
ZAMORA	2010	2,518	0	Data unavailable	1,225	49%
CHINCHIPE	2010	1,888	529	18.7	1,951	100%
PALANDA	2012	4,196	13502	28.3	12,019	100%
EL PANGUI	2012	5,525	16,215	Data unavailable	0	0%
CENTINELA DEL CÓNDOR	2012	1,646	5,525	35	704	43%
ZARUMA	2012	4,364	1,646	68.7	2,347	54%
PALTAS	Pending	5,134	63,170	15.4	1,038	20%
NANGARITZA	Pending	907	0	Data unavailable	148	16%
SANTA ROSA	Pending	8,567	19,459	300	198	2%
ATAHUALPA	Pending	3,302	27,728	83.1	0	0%
TOTAL		**94,956**	**174,028**	**1,847.2**	**35,445**[7]	**37.3%**

Source: FORAGUA archives

[4] Declared by municipal ordinance as required by the FORAGUA enrollment process.
[5] Includes areas bought or previously owned by the municipality and NCI, state-protected areas, and private lands that have entered into formal long-term conservation agreements such as SocioBosque (a national program that pays landowners an annual incentive for conserving forest).
[6] Includes both areas purchased for primarily watershed conservation purposes and those purchased for other conservation reasons, i.e. high biodiversity value.
[7] This doesn´t include the 2,236 hectares held in trust by FORAGUA.

Biodiversity Impacts

From a biodiversity perspective, the municipal reserves listed above serve several functions, protecting critical remnants of highly-threatened ecosystems, serving as buffer zones that extend core protected areas, and increasing landscape connectivity by conserving forested riparian corridors. The municipal reserves in Celica, Macará, and Puyango include some of last well-conserved remnants of the species-rich, highly-endemic seasonal dry forests on the western slope of the Andes in Ecuador. Loja and Zamora´s municipal reserves border Podocarpus National Park while Chinchipe´s are adjacent to Yacuri National Park. Palanda has municipal reserves adjacent to both Yacuri and Podocarpus. These are examples of municipalities expanding what are already large, intact tracts of nationally-protected areas. Lastly, riparian zones can serve as movement corridors and by protecting watersheds and their riparian forests, often in valley bottoms where these habitats are particularly scarce, municipal reserves can enhance habitat connectivity.

Water Quality Improvements - Example of El Carmen Watershed

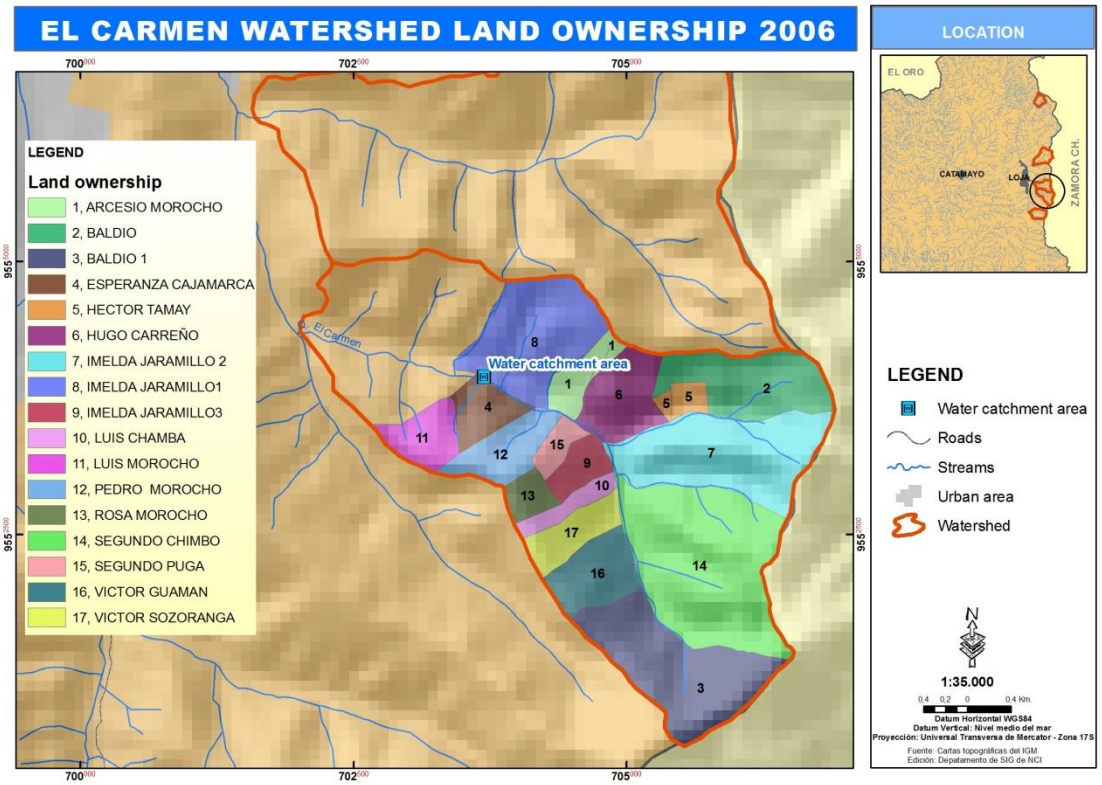
El Carmen, the watershed that provides 40% of the City of Loja´s water, provides a concrete example of how the FORAGUA water fund is benefiting its constituents. Between 2006 and 2013, Loja used FORAGUA funds to buy 13 properties in El Carmen, totaling 830 hectares and protecting 90% of the watershed. Only four properties of 90 hectares remain to be purchased (See Figures 2 and 3).

Immediately after the first land purchases in 2006, 200 cows were removed from the El Carmen watershed and fecal coliforms diminished by 80% [8](from 100 to 20 colonies per 100/ml of water) as shown in Figure 4 below. Between 2005 and 2012, the color of the water from El Carmen darkened significantly due to the presence of tannins, reflecting a major increase in vegetative cover (See Figure 5). Monitoring has shown that there has been no deforestation of the areas purchased. Additionally, since 2008, high school and university students have planted 60,000 native trees in El Carmen watershed.

Loja´s municipal water and sewer authority (UMAPAL) has noted that water is more consistently available during typical low flow periods in October and November. Before the first land purchases in El Carmen, 100% of the stream flow typically was captured at the City´s intake. Typically now, an ecological (instream) flow remains immediately downstream of the intake.

[8] Similar declines in fecal coliforms were documented following land purchases and exclusion of cows in Los Rubíes Watershed in Chinchipe, another municipality enrolled in FORAGUA (Luis Lopez, Nature and Culture International, personal communication).

Figures 2 and 3. Changes in Land Tenure, El Carmen watershed from 2006 to 2013



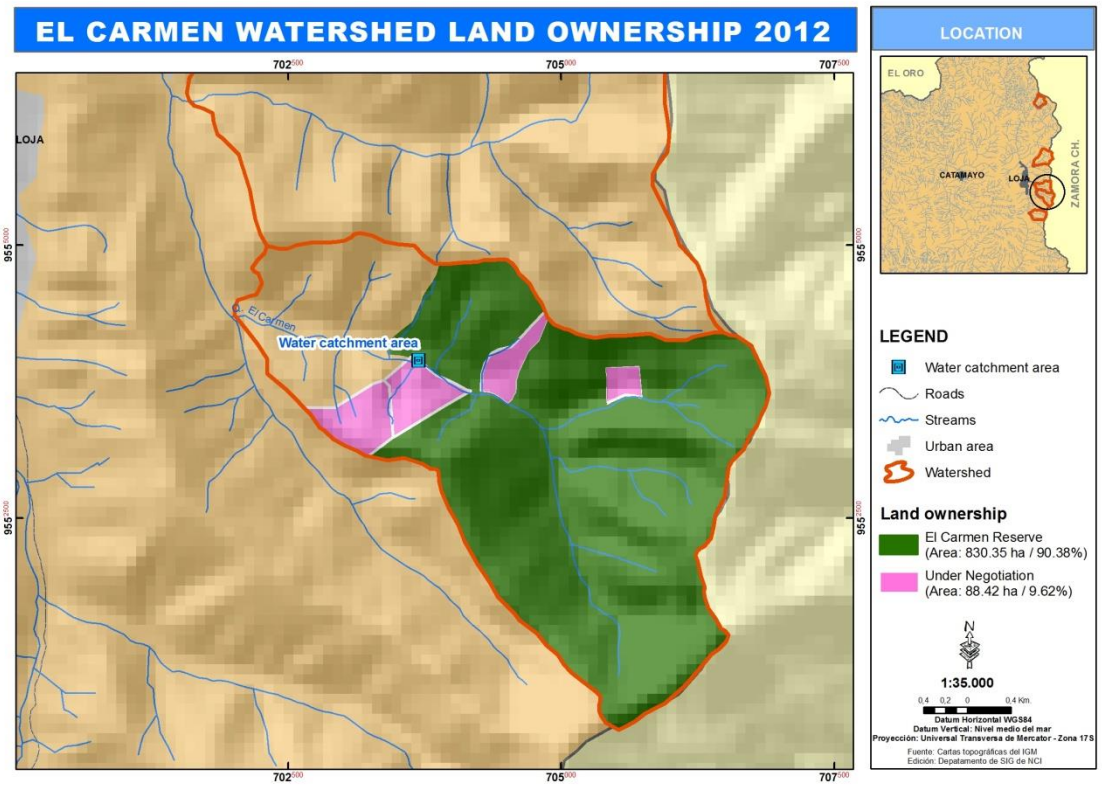
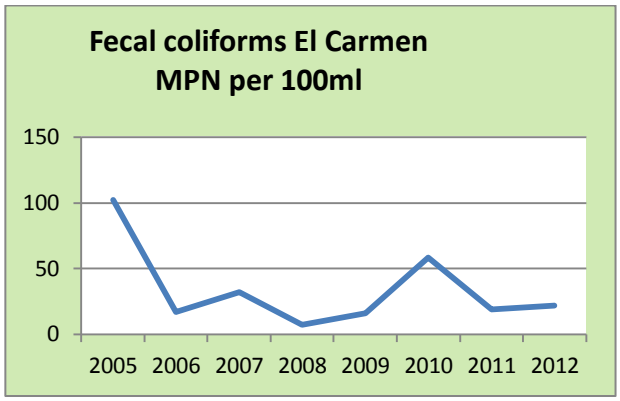
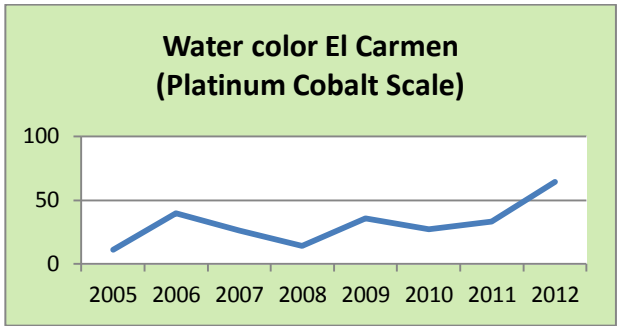


Figure 4 . Change in level of fecal coliforms, El Carmen watershed (2005 to 2012)



Source: Municipal Laboratory of Loja

Figure 5. Change in water color, El Carmen watershed (2005 to 2012)

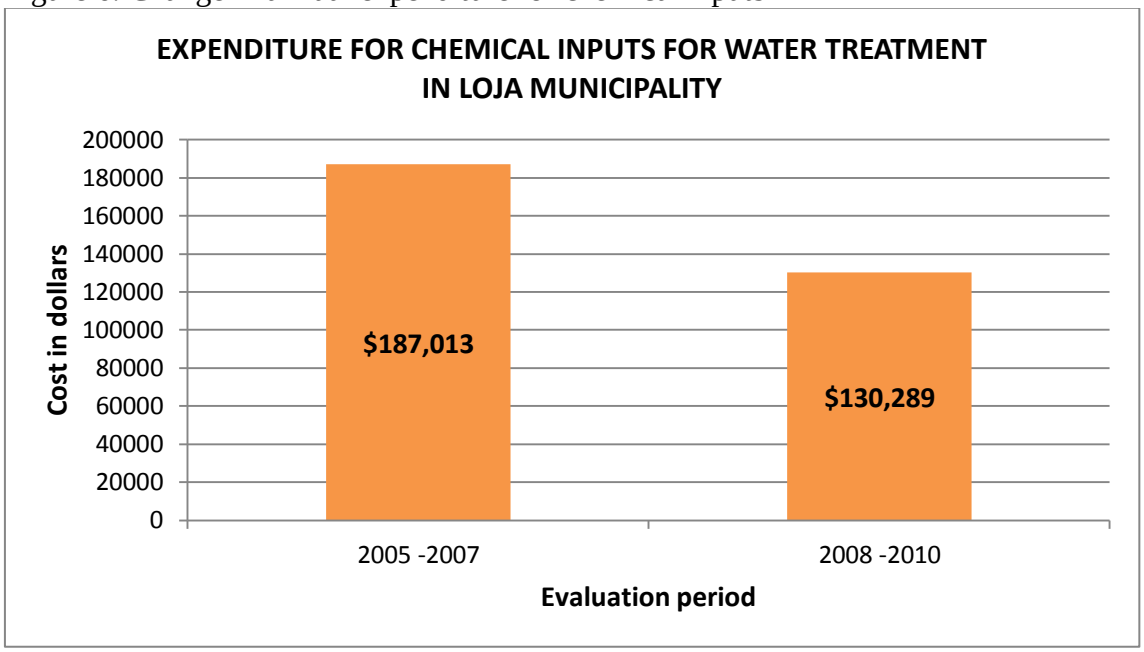


Source: Municipal Laboratory of Loja

B. Cost savings in water treatment from water quality improvements

A major benefit of the watershed conservation program has been the decrease in water treatment costs. UMAPAL estimates that the Municipality of Loja has saved $56,724 over three years (2008 - 2010) in reduced chemical use for potable water treatment following cattle removal from the city's watersheds.

Figure 6. Change in annual expenditure for chemical inputs



Source: UMAPAL 2011

VI. Income generated by the Fund

A. Initial investments

FORAGUA was originally created with the contributions of five municipalities and NCI as follows: Municipality of Loja $240,000; Nature and Culture International $204,500 including cash and 11 properties located in the watersheds of four municipalities; Municipality of Puyango $37,146 ($11,000 plus two properties in its watersheds); Municipality of Celica $11,263; Municipality of Pindal $3,351; Municipality of Macará (future income from the water fee of $50,000/year). (Contrato Fideicomiso Mercantil, 2009)

B. Annual income generated by the Municipalities

One of the requirements that municipalities assume by joining FORAGUA is to implement a special fee on water users that will generate revenues for the FORAGUA trust fund. These fees vary from 2 to 15 cents per cubic meter of water used per month, depending on the municipality and the user type (domestic, commercial, industrial, or government). This generally represents between 20% and 25 % of the total monthly bill paid by users for clean water, or about a dollar per user per month. Some municipalities tier their domestic user fee depending on high or low usage. The Municipality of Paltas is unique in that it charges a flat fee of $0.50 per user per month regardless of the quantity of water consumed. Zamora Municipality is also unique in charging a $1 annual fee to the property rather than a water use fee.

Table 3 below shows the number of users and water fees charged per cubic meter for each municipality as well as total amount transferred to FORAGUA by each municipality for 2013 and 2014. Macará, El Pangui, and Pindal are currently delinquent in their payment transfers to FORAGUA. Macará municipality has had technical difficulties adding the water fee to its water bill statements. El Pangui municipality is in

the process of transferring its 2013 and 2014 payments to FORAGUA. Their transfer has been delayed due to a state of emergency caused by heavy rains this winter.

Table 3. Number of users, water fee charged per cubic meter, and total amount contributed to FORAGUA by municipality.

Municipality	**N° water users**	**Population**	**Water conservation fee**	**Contributions to FORAGUA for 2013**	**Contributions to FORAGUA for 2014**
Celica	910	14,468	9 cents/m^3	-	$5,731.01
Centinela del Cóndor	885	6,479	4-10 cents/m^3	-	$2,020
Chinchipe	754	9,119	2-5 cents/m^3	$3,500	Pending
Loja	28,000	214,855	3-8 cents/m^3	$480,717.09	$459,108.87
Macará	2,683	19,018	8-10 cents/m^3	-	-
Nangaritza		5,196	2-5 cents/m^3	Enrollment pending	Enrollment pending
Palanda	573	8,089	4-10 cents/m^3	$7,047.24	$11,141.28
Paltas	2,160	6,617	0.50 cents/user	Enrollment pending	Enrollment pending
El Pangui	1,500	8,619	10-15 cents/m^3	-	-
Pindal		3,580	4-10 cents/m^3	-	-
Puyango	1,300	15,513	11 cents/m^3	$14,234.06	$12,423.07
Santa Rosa	12,635	69,036	4-10 cents/m^3	Enrollment pending	Enrollment pending
Zamora	11,000	27,510	$1/property	$128,400	$11,512
Zaruma	2,162	24,097	4-10 cents/m^3 plus an additional 30%	$5,000	$19,000
TOTAL	**64,562**	**432,196**	**NA**	**$635,398.39**	**$520,936.23**

Sources: FORAGUA financial statements and ordinances

C. External financial support for FORAGUA

One of FORAGUA´s benefits is that it creates a structure that allows funds to be raised from external sources, including the national government, international aid agencies, private companies, and non-profit organizations. A number of national and international agencies have provided funds to FORAGUA for watershed management activities including land purchase, reforestation and other kinds of habitat restoration, institutional capacity-building, assistance for smaller municipalities, and water quality monitoring.

From 2007 through 2014, FORAGUA has received external funding totaling $2,088,850 to strengthen municipal watershed conservation programs with major contributors being:

- Since 2007, Nature and Culture International has provided annually the equivalent of 2.5 full time employees and funds for technical assistance, and over $500,000 for 23 land purchases;
- The Overbrook and Tinker Foundations have supported the Secretariat with policy development and activities oriented toward enrolling new municipals.
- The Flemish Fund for Tropical Forests has provided funds to strengthen municipal processes and for habitat restoration;
- RARE has supported environmental education campaigns in various watersheds;
- IUCN-Netherlands has supported watershed land purchases; and
- The US Forest Service and USAID have helped with meteorological monitoring expertise and equipment.

Source: FORAGUA, no date (b)

All these projects were implemented through Nature and Culture International and / or by the Technical Secretariat.

Conclusion

As a watershed conservation fund, *FORAGUA* plays a number of important roles. First, *FORAGUA* facilitates the development of municipal ordinances that both establish water user fees and declare the watershed reserves where this financing will be used for watershed conservation programs. Second, *FORAGUA* is the legal mechanism through which these municipal watershed conservation programs are funded. Third, *FORAGUA* builds the capacity of municipal environmental departments by providing the equipment, information, and training needed to manage their integrated water resource programs, and conserve these important watersheds. Importantly, for the first time in southern Ecuador, FORAGUA has generated a sustainable and significant source of local funding for conservation and watershed management. That said, another of FORAGUA´s important functions is to raise complementary funds from external sources, to expand the scope of municipal programs.

FORAGUA is also significant in that it creates a model for a shared water fund structure that includes both small and large municipalities. It currently has 11municipalities enrolled and four more pending, many sufficiently small that they would not be able to pay for the technical services needed for a water fund without this shared structure.

A water fund such as FORAGUA importantly creates a local mechanism and capacity that achieves both water and biodiversity conservation. In doing so, it builds a local and financially sustainable response to the global crises of loss of natural habitat and ecosystem functions that sustain life on earth. It builds these municipalities´ economies and welfare, making them more in command of their water supply and less vulnerable to new threats such as global climate change.

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