



# **Land-Water Linkages in Rural Watersheds Case Study Series**

## **Water user associations in the Cauca Valley, Colombia**

**A voluntary mechanism to promote upstream-downstream  
cooperation in the protection of rural watersheds**

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## **Introduction**

Watershed management and protection has been an objective of many Latin America countries. At the same time, water is usually undervalued and heavily subsidized, without considering all costs involved in its management, such as the regeneration of the resource. In the majority of these experiences have an underlying premise: the leading actor involved is a public entity. (Dourojeanni, 1997) Usually the programs have been designed, promoted, implemented and funded by a government organization, whether it be at the national, state or local level. This case presents a public-private partnership to protect watersheds that has developed in the Cauca Valley, an agricultural area in southwest Colombia.

Based on an institutional mechanism created by the 1974 Natural Resources Law, Associations of Water Users were established in the late 1980's and early 1990's. Due to a growing concern with the supply of water for agricultural purposes, large-scale agricultural water users in the valley decided to take action and fund the implementation of subwatershed management plans. These Plans by the Cauca Valley Corporation (CVC), the regional environmental authority, which lacked the resources to invest in implementation serve as the guiding instrument for investment in order to benefit upland communities in the watersheds. This public-private collaboration can be an effective way to leverage results since the government authority has a wide base of support and input.

Today, there are more than 12 Associations of Water Users, operating and implementing a wide range of activities in favor of upland communities.

A key feature of this case is the collection of voluntary fees, which has the benefit of mobilizing private funds for environmental protection. Members of the associations pay a fee according to their water concession. The funds are used to pay for activities to protect forests and vegetation cover in the highlands in order to increase flows and stabilize discharges during the rainy season.

The level of awareness and commitment of water users who accept an additional user fee is inherently high. On the other hand, voluntary schemes can have the drawback of discontinuity. Considering that this experience has been underway for almost a decade, the Water User Associations and CVC face the challenge of reviewing their successes and failures and redirect efforts to insure the fulfillment of their environmental objectives.

## **The Cauca River Valley**

The Cauca River Valley, located in the Department or province of the same name, *Valle del Cauca*, is one of the most fertile agricultural valleys in the world. With an

agricultural area of 336 000 ha, the valley spreads between the Western and Central mountain ranges of Colombia. Traditionally, the valley has been a producer of soybeans, sorghum, sunflowers, cotton and sugar cane. In the beginning of the 1990's, sugar cane gained area amounting to over 200 000 ha to supply 13 sugar mills with their raw material. The Cauca Valley's agricultural sector is recognized throughout the world because of its technological development.

Part of the reason for this agricultural success has been due to the work of the *Corporación Autónoma Regional del Valle de Cauca* (CVC) created in 1954. Modeled after the Tennessee Valley Authority, CVC was created as a regional development corporation with the double mandate to promote development of the Cauca River Valley and protect its natural resources, including the river network shown in Figure 1. CVC built and operated flood control dams, hydroelectric plants and irrigation projects. Parallel to this, CVC developed the first water pollution abatement program in the country and designed a watershed management plan for the area. The organization is recognized for its technical expertise and innovation. Its work is based on working and building consensus with the private sector, including the agricultural sector, which is important politically and economically, as well as a leading user of natural resources.

[\[Click to view Figure 1: Hydrographic network of the Cauca watershed\]](#)

CVC's structure has been modified over time. Currently, due to the 1993 Environmental Law, CVC limits its jurisdiction to environmental and resource management in the Cauca Valley department, rather than the whole watershed. With a population of over three million in the department, CVC is the province's environmental authority and is in charge of natural resources management in general. Its operations are decentralized among 5 regional offices that coordinate field activities.

Due to the different development projects in the area, CVC has maintained a meteorological and hydrological monitoring network for over 20 years. The average annual flow rate of the Cauca River is 467 m<sup>3</sup>/s, fed by rivers that flow from the Central and Western Mountain ranges, as shown in Figure 2. The rivers that flow from the Western Range are less plentiful than those that flow from the Central Range (CVC, 2001b). Average rainfall in the Valley is 1 200 mm per year, ranging from 1 000 to 2 000 mm, with two marked dry and rainy seasons, January-March and July-September, and April-June and October-December, respectively. (CVC, 2001b)

In terms of demand, the principal water user is the agricultural sector as shown in Table 1, which was estimated based on water rights currently registered. Agricultural water use is substantial as most farmers use furrow irrigation, which is highly inefficient.

**Table 1: Water demand in the Cauca Valley 1992**

<b>Use</b>	<b>Quantity (m<sup>3</sup>/s)</b>	<b>percent</b>
Agriculture	147.7	86.4
Drinking water	11.8	6.9
Industry	4.9	2.9
Other Uses	6.5	3.8
<b>TOTAL</b>	<b>170.9</b>	<b>100.0</b>

Source: Plan del Agua CVC, Junio de 1992. Grupo de Recursos Hídricos CVC

Of the 33 municipalities in CVC's jurisdiction, 28 depend on the rivers for their drinking water. The rest use underground wells or a combination of ground and surface water. Even though total supply exceeds total demand, there are areas where deficits occur during certain times of the year. Human and industrial demand is concentrated towards the southern part of the valley where Cali the capital city, and Palmira and Yumbo, two leading industrial cities, are located. The population of this urban area amounts to over two million people of the three million settled in the Cauca Valley department.

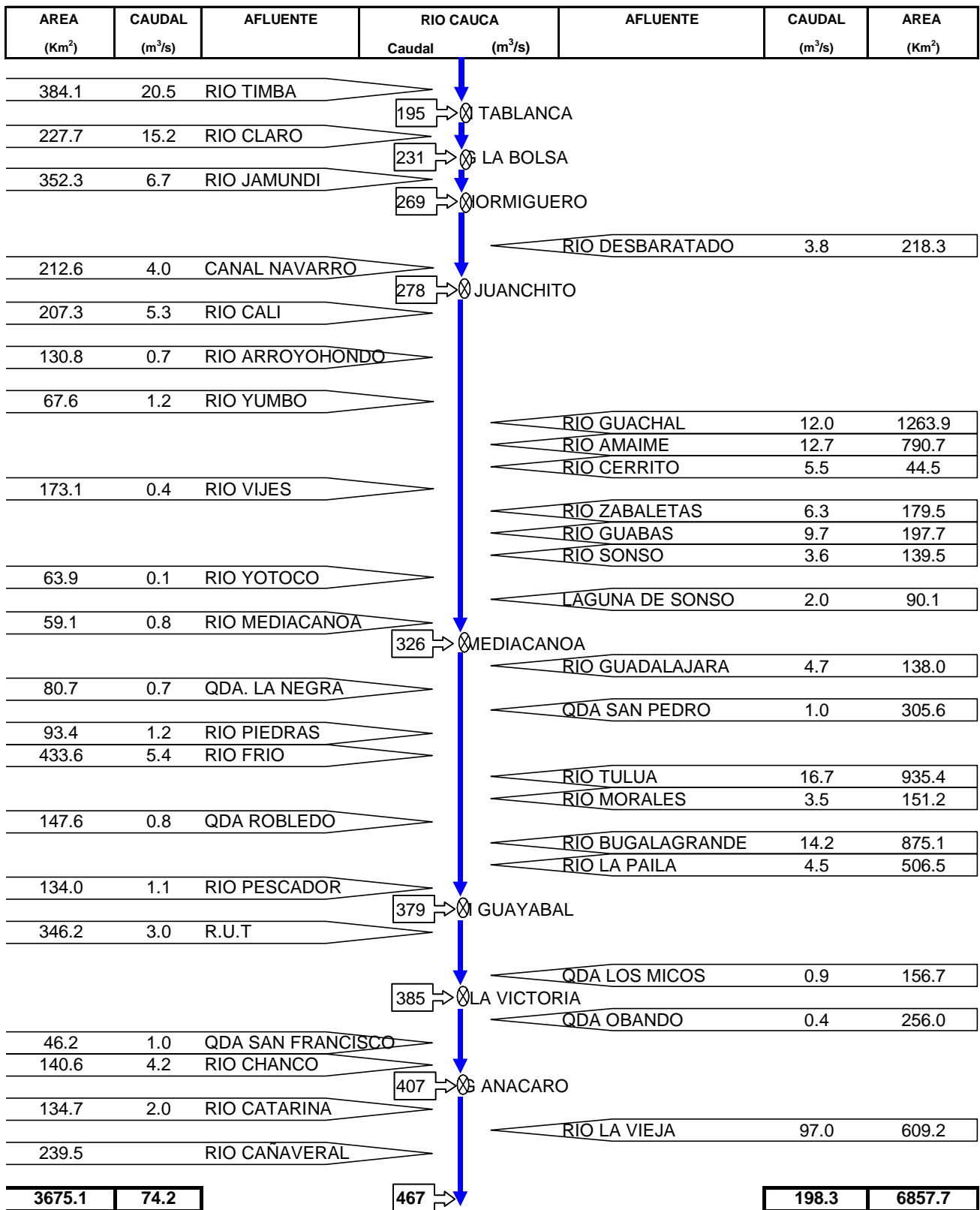
The national regulation for water resources in Colombia was based mostly on CVC's experience. All urban, industrial and agricultural users, whether surface or underground water is used, have to have a permit and pay a water user fee, based on the amount assigned.

In terms of watershed management, CVC has been studying and developing management plans for each of the 39 sub watersheds that drain into the Cauca River, with an area of 1 144 300 ha. (CVC, 2001a) Each subwatershed has a Coordinator in charge of the area, and water inspectors who monitor water uses.

### **The Water User Associations**

The watershed management units are the basis for the Watershed Associations that are composed by the water users registered with CVC. The user fees levied by CVC in 2000 range between US\$ 0.50 to US\$ 2.00 per liter per second per month, depending on the flow. Greater consumption means a higher price. These funds are supposed to be used for the implementation of the of the watershed management plans. However, the resources collected are distributed among the different CVC programs so they are not enough to go beyond the payment of personnel. By creating the Associations, the members generate an additional fee to invest in activities that protect the watershed, which they hope will insure the long-term viability of the water resource. The pioneer organization was the Association of the Guabas River, Asoguabas, which acquired land in the upper part of the watershed to reduce deforestation rates. Currently, there are 11 entities that operate in the Cauca Valley. Table 2 highlights their general characteristics.

**Figure 2: Runoff in the Cauca Valley (average of several years, m3/s)**



FUENTE: Grupo Recursos Hídricos. CVC

As the data shows each organization operates in a different context, with varying sizes of watersheds and target populations. The membership, predominantly composed of farmers in the lowlands, varies because of the different flows of water within each watershed and the water rights assigned by CVC. The fee charged varies depending on the organization's decision, ranging from US\$ 0.16 to US\$ 0.55 per liter per second per month.

No systematic collection of information has been done to quantify the funds that have been invested since the Associations were formed (the dates of creation vary) and the evolution of the membership from year to year. In general, membership has dropped in the last few years, due to the serious economic crisis facing the country in general and the Cauca Valley in particular. The year 2000 is considered to be a low point (Claudia Calero, 2001). Therefore, as a rough, conservative estimate, based on the total collected in 2000, there has been an investment of over US\$ 1 500 000 in the last 5 years.

**Table 2: Characteristics of the Associations in the Cauca Valley 2000**

Association	River	Area (ha)	Population in Watershed	Members	Funds Collected in 2000 (US\$)
Asodes	Desbaratado	19,920	1,620	90	18,600
Asofraile	Fraile	28,015	3,750	200	8,400
Asobolo	Bolo> Guachal	19,875	3,250	144	41,900
Asoamaime	Amaime	55,500	16,500	124	52,000
Asurnima	Nima> Amaime	12,120	3,200	21	8,400
Asoguabas	Guabas	17,000	630	452	18,600
Corp. Río Guadalajara	Guadalajara	13,000	30,000	160	12,600
Fundación Río Tuluá Morales	Tuluá/Morales	103,000	21,000	309	35,000
Fundación Río Bugalagrande	Bugalagrande	80,000	1,765	306	18,600
Asojamundi	Jamundi	61,000	12,400	40	22,300
Fundación Río Riófrio	Riófrio	28,000	8,000	22	15,000
Corpopaló*	Palo	92,000	12,308	44	42,800
<b>TOTAL</b>		<b>529,430</b>	<b>114,423</b>	<b>1,912</b>	<b>294,300</b>

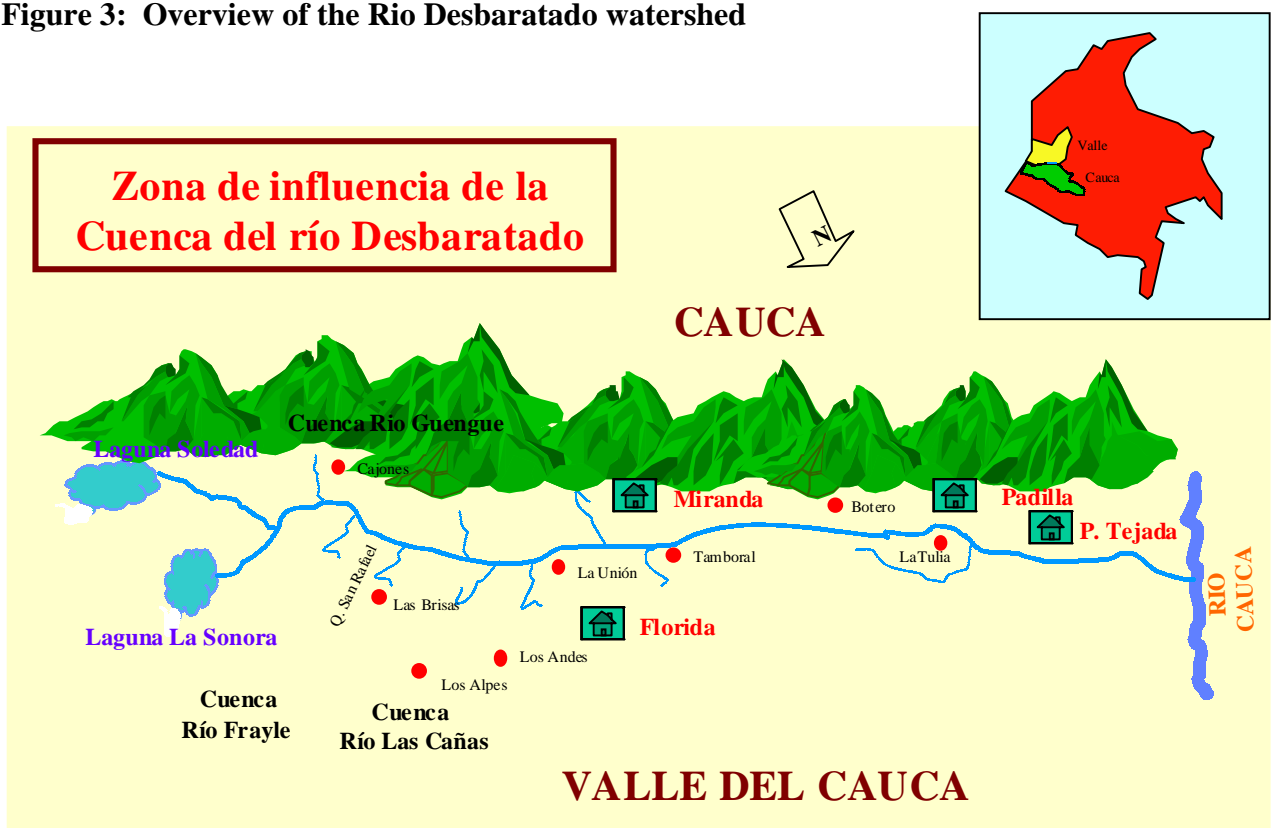
\*Corpopaló, located in Cauca Department, started under CVC's old jurisdiction of the Cauca watershed. Currently, the regional Cauca corporation works with Corpopaló. Source: Asocaña, "Asociaciones Cuencas Hidrográficas Sector Azucarero". 2000.

The Associations have undertaken a long list of projects to benefit the communities in the watersheds, particularly upstream. The projects include the protection and regeneration of degraded forests, reforestation with native species, community organization, technical assistance, production activities, training and environmental education. This is an implicit transfer of resources from downstream users to upstream users. In order to illustrate the mechanism, how it works and what are results, the paper will explain in further detail the experience of the Association in the Desbaratado River.

### Case study: The Desbaratado Watershed

The Desbaratado watershed is located in the western flank of the central mountain range and is the dividing line between the Cauca Valley and Cauca departments. It has an area of close to 20 000 ha. The upper part with slopes above 60 percent, encompasses an area of 9 000 ha. The remaining 11 000 ha are located in the flat part of the watershed where large agricultural landholdings are located. The river is 53 km long from its beginning in the Soledad Lagoon at over 3 200 m of altitude to its drainage into the Cauca River at 1 000 m above sea level. The average flow is 3.5 m<sup>3</sup>/s with a stream flow capacity of 18 m<sup>3</sup>/s. As the name of the river suggests, the dry and rainy season fluctuations are historically extreme. Records since 1970's have varied from 0.01 to 43 m<sup>3</sup>/s (Asodes, 1998).

Figure 3: Overview of the Rio Desbaratado watershed



The watershed has lost most of its natural land cover with the vast majority of the area under pasture and/or agriculture. No data is available to illustrate the land use change over time.

In 1988, CVC conducted a study to understand the communities' needs and use as the basis for the management plan. The watershed has a total population of around 1 600 people or 324 families in 10 small villages. In the upper part of the watershed, the majority of the families hold titles to their land and live and work their land. 72 percent of the households have no sanitary facilities and 83 percent lack access to electricity. 70 percent of the working people are farmers, earning below the minimum

wage due to a lack of education and technical training. 30 percent of the population is illiterate. The diet is predominantly carbohydrate-based. (Asodes, 1998)

These social conditions combined with the unstable geologic conditions and poor soils in the watershed have amounted to serious erosion problems. The loss of forest cover is assumed to be reducing water flows during the dry seasons. Unsustainable agricultural practices, such as overgrazing, are assumed to affect the hydrological balance of the watershed and deteriorate water quality. Downstream users are predominantly sugar cane producers that have invested greatly in the preparation of their fields with sophisticated technologies, such as laser leveling and underground drainage and irrigation systems. The damage caused by past floods has not been quantified but it is significant enough for these farmers to believe that watershed protection measures are needed and they are willing to cover some of that cost.

The river supplies drinking water to local communities and the municipal centers of Florida in the Cauca Valley Department and Miranda and Padilla in the Cauca department, as well as irrigation water to the agricultural areas in the valley.

In 1988 CVC invited a series of private sector organizations to collaborate in the implementation of the management plan. Asocaña, the Association of Sugar Producers whose members comprise sugar mills and sugarcane farmers, was invited to provide funding. Other organizations, such as Smurfit Cartón Colombia, a paper company, the Federation of Coffee Growers and a Cooperative of agricultural producers, Cavasa, were asked to provide technical assistance to improve agricultural practices and the marketing of crops. The management plan is based on the belief that it is impossible to improve environmental conditions, before improving the livelihood, and therefore quality of life, of the watershed inhabitants.

The CVC's Management Plan is composed of three programs:

- 1) The Social Program includes training and educational activities, such as community organizing, nutrition and food preparation, sewing, handcrafts, first aid, etc;
- 2) The Production Program includes the creation of home gardens in order to improve the home diet and also increase earnings; reforestation to reduce the pressure on the forest and technical assistance for fruit and vegetable planting improving land use practices;
- 3) The Infrastructure Program includes the improvement of sanitary facilities, drinking water systems, as well as, road building and construction of erosion control structures.

All the activities have resulted from meetings with the communities, so that the communities are not observers or mere participants, but rather an integral part of the decision-making process.

Aside from CVC, ASODES and Asocaña, the projects undertaken in the area also involve the municipal and state governments. CVC coordinates activities with the municipalities who are dependent on the river for water supply. For example, when machinery is needed the municipalities either have some available or can access help from the state or central government. There is presence of guerrilla groups in the area. Due to security risks, many social programs fail to be implemented the area. CVC's watershed protection work, with the support of ASODES, has continued under these difficult circumstances and the communities defend and recognize their benefit. (Claudia Calero, 2001)

It is important to highlight that the watershed lies in two different departments. When the Management Plan was drafted, the watershed was under CVC's jurisdiction. With the creation of the Cauca Department Corporation (CRC), an agreement was signed between the two organizations in order to coordinate activities. However, CRC has more limitations in terms of funding and implementation capacity than CVC, so the Plan has been under CVC's guidance. Even though CVC is only responsible for the Cauca Valley department, activities continue to be implemented on both sides of the watershed.

### **The Association of Water Users of the Desbaratado River Watershed**

In 1991, with the experience that Asocaña had gained in the watershed, the sugar mills and farmers directly involved around the river Desbaratado were invited to also participate in the Management Plan. The Association of Users of the River Desbaratado Watershed, ASODES, was formed by over 90 members. Its main goal is

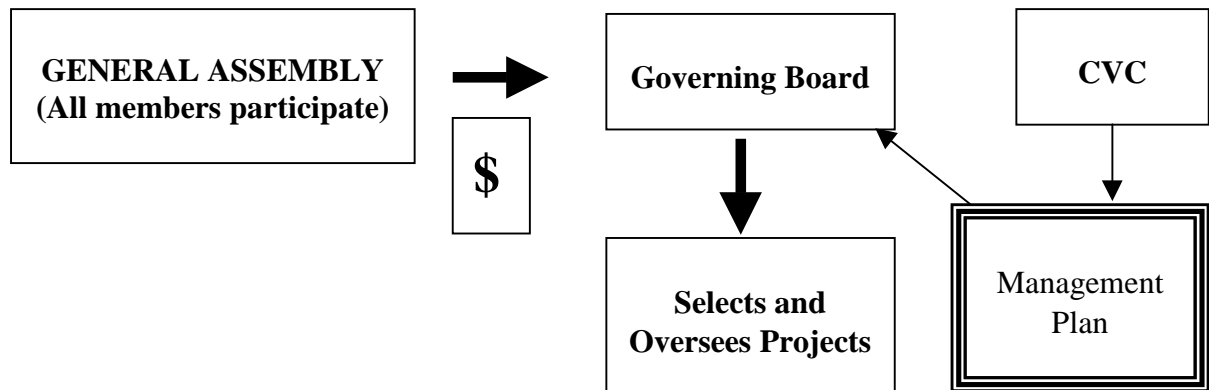
“to guarantee the hydrological regulation of the river, through an adequate forest cover by improving the quality of life of the river inhabitants through sustainable agricultural production and optimization of resources (human, technical and economic) through the active participation of the community and other entities.” (ASODES, 1999)

What is meant by hydrological regulation in this case refers particularly to flood attenuation and increased flows in dry seasons. As stated earlier, downstream users assume these benefits will result from the implementation of the Watershed Management Plan.

The General Assembly is composed of all participating members or water users that are in CVC's register that attend and pay fees to CVC. This implies that these are large scale agricultural users in the valley, since CVC does not provide permits and charge fees to small scale producers due to the logistical cost of overseeing such a system. The Assembly selects a Board of Directors composed of President, Vice-president, Secretary and Treasurer. The Assembly also determines ASODES' statutes and the fee charged to all members on a trimester basis. In 2000, ASODES members were paying around US\$ 0.34 per liter per second, which is lower than the CVC fee. The fees are charged using CVC's distribution and charging system. The members in

2000 totaled 90 and pay their membership into ASODES' bank account managed by the Board of Directors. The Board, based on the guidelines of the Assembly, selects projects to finance, which are coherent with the CVC's Watershed Management Plan.

**Figure 4: Structure of ASODES**



One of the first projects the Association undertook on the suggestion of CVC was to purchase a property in the most unstable part of the watershed. The Las Brisas Environmental Education and Technology Transfer Center was built on a 208 hectare farm to establish an environmental educational center and begin to demonstrate more sustainable land use practices. Working with another regional watershed organization called CORPOCUENCAS<sup>1</sup>, the Center has undertaken environmental education workshops with rural community teachers and students, as well as agricultural and pest control techniques. With the Federation of Coffee Growers, ASODES established a program to study and conserve the genetic forest resources of the cloud forest and reforest 82 ha of Las Brisas property. There are demonstration plots for different crops and practices. In 1997, CVC built a 450 m path in Las Brisas to show the process of forest succession or natural regeneration.

ASODES and Asocaña have been instrumental in leveraging political, economic and technical resources, for CVC's management plan for the Desbaratado River. The Plan has resulted in the active participation of 100 families, the recovery of 718 ha of natural forest and the reforestation of 83 ha, including 26 ha for wood production to substitute the use of natural wood. This has meant a change of attitude and awareness of the community towards environmental protection and a long-term commitment towards watershed conservation. There is no contractual arrangement of any kind; rather, their participation in the activities of the Plan is voluntary, and dependent on their involvement in particular projects to be eligible to receive funds. For example, one project involved the building of efficient wood burning stoves and planting of trees to reduce deforestation rates. CVC worked with the communities that were more organized and motivated and where results could be had in the long-term. The

<sup>1</sup> CORPOCUENCAS was created by the Governor of Cauca Valley State as an organization with public and private involvement to protect the state's watersheds.

families provided the labor for building the stoves and planting the trees and CVC provided the materials and technical advice.

### **Main linkages between land use and water resources**

The main objective of ASODES, as well as many Associations, was to increase flows and stabilize discharges throughout the year. Although CVC does continuous monitoring, no study has there been undertaken to determine a trend in the dry-season flows or flood attenuation, for example. The changes and challenges facing CVC in the last decade have reduced the available resources and limited the capacity to control compliance and monitor hydrological goals. No study has been undertaken to effectively review how the increase in land cover in the uplands has improved or stabilized water flows. However, some anecdotal evidence does exist.

In the case of the Desbaratado river, it has been observed that between 1988 and 1998, the river did not present the extreme flooding incidents that had occurred previously. (Calero, 2001) Yet, it is difficult to know how much was due to the watershed conservation efforts or to milder weather conditions. In 1999 during El Niño phenomenon, a major flood occurred. However, since the management has been integrated, the community organization is considered a great success, with the local inhabitants now in a position to generate their own proposals and enrich the Management Plan.

There are other examples where hydrological returns have been identified. In the Nima and Amaime watersheds that feed Palmira's drinking water system, the springs have been isolated and protected and measurements taken indicate increased water flows during the dry seasons (Tenorio, 2001). In the Guabas River, where land was bought and protected in the upper watershed, an improvement in flow has been seen during the dry season (Tenorio, 2001). However, without concrete numbers, it is difficult to assess the actual hydrological impacts of the interventions up to date.

### **Conclusion: A mechanism with untapped potential**

The experience of the Watershed Associations in the Cauca Valley underscores the importance of building a constituency for watershed protection. All users need to be involved in this environmental challenge, and agricultural users have a real interest in water protection. Usually, there is little interaction between upstream communities and downstream users. Watershed management authorities can not work alone, no matter the amount of resources or legal mandate. Public participation is needed to have success. The Associations of Water Users provides a forum for such a participation of parties interested in watershed protection.

The institutional and social virtues of the Associations need to be recognized. As the Associations have gotten off the ground the members have realized that their

hydrological objective is more complex and long term than they first considered. The many community needs have made environmental goals secondary, since it is difficult, if not impossible, to involve unmotivated and needy communities. Environmental goals can not be met without community involvement. ASODES and other Association members continue to support the scheme because of a general environmental commitment. As the leading users of water in the Valley, the sugar mills and cane farmers realize that besides reducing consumption rates, they need to invest in the regeneration of the resource (Calero, 2001). This willingness may be due to a growing environmental awareness in general and the environmental management efforts undertaken at the sugar industry level in particular. In addition, the social unrest that Colombia faces, also makes farmers realize the need to invest in the rural areas and the Associations' work point in that direction.

CVC officials also value the role of the associations (Tenorio, 2001). They have even considered the possibility of delegating to these institutions the administration of the water resource.

It is assumed that what upland communities fail to do in terms of watershed management and protection can affect the water flow and quality of downstream users. On the other hand, if downstream users, who receive a benefit in the form of water, do not involve themselves in the protection of the resource, there is a risk of losing the resource over time. These relationships between land use changes and hydrological impacts are far from clear (FAO, 2000). Currently, there is an interest on the part of Asocaña and the Associations to determine indicators that would give some measure of the effectiveness of the interventions. There is also an interest on the part of CVC to begin land use studies and monitor them on a consistent basis (Sandoval and Tenorio, 2001). At a regional scale, this undertaking might show interesting results. The Cauca Valley situation is a potential laboratory to quantify land use changes and monitor hydrological impacts.

The resources collected by the Associations constitute an important increase in private environmental investment. This case illustrates a voluntary mechanism to increase those revenues in an institutional form that allows users to feel in control of those resources. It is not a tax, where users feel that they continue to pay for a government bureaucracy without benefits. What the associations do or fail to do is mostly their concern. Working in alliance with the natural resource entity, in this case CVC, can insure greater results than working alone. CVC and the Associations have to have a clear commitment to working together and complementing each other.

This is where the main drawback or risk of the Associations lies. If the environmental authority does not collaborate, the Association can not succeed. It does not have the legal mandate, or sufficient resources to effectively protect the watershed. As the scheme is voluntary, its sustainability is unsure. If not, the fact that they are voluntary could mean that over time, the members will stop supporting the organization. The lack of continuity and institutional capacity could mean an ineffective use of resources. In addition, if the downstream users are not shown the hydrological

benefits of their investments, they might quit the scheme unless they see additional benefits.

This highlights an additional issue - the common *free rider* problem. Those users that are less environmentally aware ride free on those that do participate. This has happened in the Cauca Valley, where not all water users registered with CVC participate in the Associations. This is socially unfair and there is untapped fundraising potential.

The Association of Water Users requires a motivated group of stakeholders that are willing to invest in long-term goals. In the Cauca Valley, the sugar mills and large cane farmers consume a large amount of water and know the risk they would face if the resource deteriorates. They want to feel they are doing something to prevent that from happening. In the words of Claudia Calero, the Head of Asocaña's Environmental Management Department, "although we have reduced consumption, we can not forget the quantity of water that the sugar industry uses, which makes necessary for us to be involved in the integral maintenance of the resource." Asocaña's environmental policy and program includes watershed protection as an explicit goal.

This experience is replicable internationally, although it would need to be adapted to local conditions and improved. This case holds a combination of interesting features that can be used to promote participation. Watershed management requires a technical understanding of the hydrological system, a committed group of government, private sector and community group of stakeholders and long term financing. Watershed Associations can be a mechanism to leverage the involvement of stakeholders, such as agricultural users or other water users, and increase the resources available. Yet, this case reiterates the importance of improving our understanding of hydrological systems and land use impacts in order to insure that watershed protection measures effectively fulfill their stated environmental objectives.

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