Case Study of Watershed Valuation in the

Lake Yojoa Multi-use Area

Final Report

Based on a September 2004 site visit

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Foundations of Success

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Acronyms

ASDI	Agencia Sueca de Desarrollo Internacional (Swedish International Development Agency)
AMUPROLAGO	Asociación de Municipios para la Protección del Lago de Yojoa y sus Zonas de Influencia (Association of Municipalities for the Protection of Lake Yojoa and its Areas of Influence)
BMP	best management practice
DINADERS	Dirección Nacional de Desarrollo Rural Sostenible (National Office for Sustainable Rural Development)
ENEE	Empresa Nacional de Energía Eléctrica (National Electricity Company)
FOS	Foundations of Success
KFW	German Development Bank
PANACAM	Parque Nacional Cerro Azúl Meambar (Cerro Azúl Meambar National Park)
PANAMOSAB	Parque Nacional Montaña Santa Bárbara (Santa Bárbara National Park)
TNC	The Nature Conservancy

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Foreword

TNC supported the development of this case study to promote the sharing of experiences and lessons learned across sites that are doing similar work. It is important to note, however, that many organizations have contributed to the watershed valuation work in Lake Yojoa (or supported complementary activities) in Lake Yojoa, including: the Honduran Forestry Agency (AFE-COHDEFOR), the U.S. Agency for International Development (USAID), the Summit Foundation, the United Nations Development Program (UNDP), Fundación VIDA, Strategies for Urban Quality (EQU), the Swedish International Development Agency (ASDI), the National Office for Sustainable Rural Development (DINADERS), the German Development Bank (KFW), the Honduran Congress, and community organizations. The work to revise the National Water Use Law in Honduras was supported by the United Nations Development Program (UNDP). Several people provided technical assistance to the process. One of them was Marlou Church, who gave technical input and advice both as TNC's Senior Advisor for International Water Policy and as an independent consultant.

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1 Introduction

1.1 Purpose of case study

For the last few years, The Nature Conservancy (TNC) has supported watershed valuation projects in several countries in Latin America as a strategy for achieving biodiversity conservation. Through the International Water Policy Program, TNC has provided technical assistance to the following countries and sites:

- Mexico: Chiapas (including the El Triunfo and La Encrucijada Biosphere Reserves)
- Mexico: Quintana Roo
- Guatemala: Sierra de las Minas Biosphere Reserve
- Honduras: Yojoa Lake Multi-use Area
- Bolivia: Sama Mountain Range Biological Reserve
- Ecuador: Condor Bioreserve

Watershed valuation projects are designed to link water users to watershed conservation. They seek to get water users to contribute to conservation either financially (through user fees or increased public financing of conservation activities) or by taking actions directly to reduce threats to water resources. Thus, watershed valuation projects involve close collaboration between conservation organizations and government agencies, water companies, citizens groups and other key stakeholder groups.

TNC asked Foundations of Success (FOS) to develop a series of case studies that document the experiences and knowledge that TNC and its partner organizations have gained about watershed valuation projects in these six sites. This document represents one of the six case studies. In addition to the case studies, we have written a cross-site lessons learned document to analyze the use and effectiveness of watershed valuation as a conservation strategy, based on the experiences of all of the sites. The purpose of developing these documents is to facilitate learning among these and other sites that are currently implementing watershed valuation projects or are interested in undertaking these activities.

1.2 Watershed valuation project theory

Many montane protected areas provide abundant, clean water that is valuable for human consumption, irrigation, hydro-electric production, industrial production, ecological processes and other uses. The basic intention of watershed valuation projects is to help local actors recognize the importance of these natural areas and take action to protect them, in order to ensure the integrity of this critical environmental service. Local people may not value the conservation of biological diversity, but they value water. Therefore, the theory is that if they can be motivated to take action to protect their water resources, this action will contribute to biodiversity conservation.

While this basic theory sounds relatively simple, in reality watershed valuation projects are quite complex. Before visiting these watershed valuation projects, we decided to develop a results chain to help clarify TNC's assumptions about how watershed valuation actions should lead to

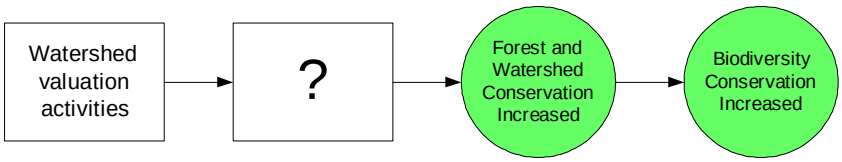
biodiversity conservation – in other words, to define in more detail the project theory and provide a framework for examining each step along the way from intervention to desired impact.

In order for any conservation project to be successful, the implementing organization must develop the project based on sound project theory, and they must execute the project well. Projects can fail to achieve their objectives due to poor theory, poor implementation, or both.

Usually, project theory remains hidden in the minds of the people who design and implement the project. Often, if a group of people is working together to implement a project, they each have different assumptions about how their actions will contribute to achieving their intended impact. Results chains graphically map a series of "if-then" statements that define how a project team believes that a specific conservation action will contribute to achieving a conservation impact. They are a tool used to make the project theory explicit so that it is clear to everyone involved and they can test and refine their assumptions over time.

FOS worked with TNC's Senior Advisor for International Water Policy to develop the results chain shown in Figure 1. She provided technical assistance to most of these projects for several years. Therefore, her project theory has influenced the approach taken in most (though not all) of the sites. We explain the results chain here, and we use it as a framework for all of the case studies and the cross-site lessons learned document. Within this framework, we describe the actions taken in the sites and analyze the extent to which these projects are achieving their intended objectives.

When we began building the results chain, it looked like this:

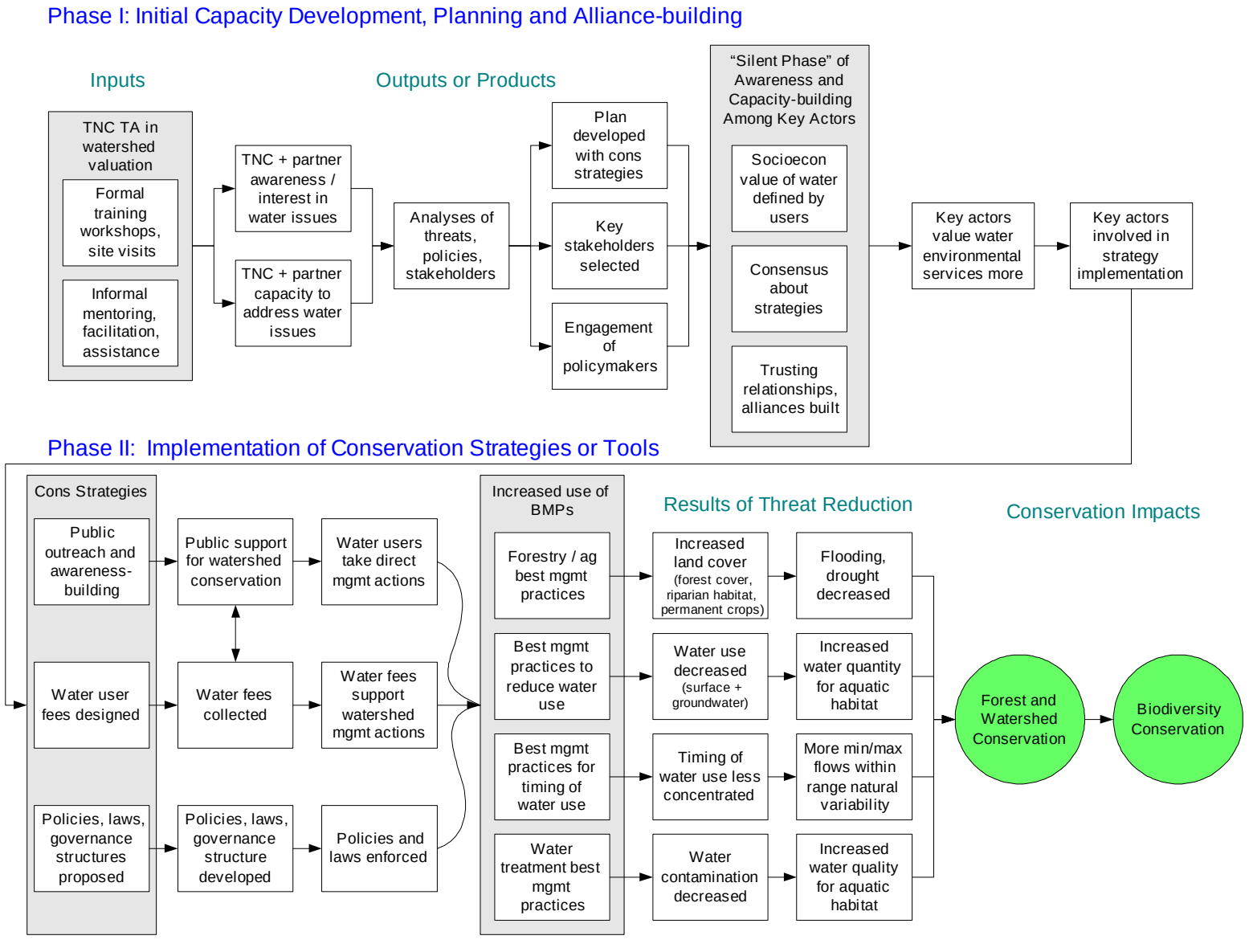


This initial chain says that TNC and its partners are conducting watershed valuation activities to achieve two long-term impacts. The first is an increase in forest and watershed conservation in the specific sites, which TNC believes will contribute to an increase in biodiversity conservation. The difficult part of building the chain is defining the intermediate results needed for the activities to achieve their desired impact.

The complete chain (see Figure 1) includes two project phases. Phase I focuses on initial capacity development, planning and alliance-building. Phase II involves the implementation of specific conservation strategies or tools. TNC's Senior Advisor for International Water Policy believes that Phase I is a necessary prerequisite to Phase II.

In Phase I, TNC provides technical assistance in watershed valuation, which contributes to building awareness and interest in water issues and capacity to address them. This interest and capacity enable partners to produce initial outputs or products such as analyses of threats, policies and stakeholders, which enable them to develop a watershed valuation action plan and select key stakeholders that need to be involved in implementing the plan. A "silent phase" of

Figure 1. Causal Chain Defining How TNC Watershed Valuation Projects Are Intended to Contribute to Biodiversity Conservation



information-sharing, awareness and capacity-building among key actors is necessary to achieve consensus about what conservation strategies to undertake and to build trusting relationships among the key actors. TNC calls this the "silent phase" because it may appear to outsiders that little is going on during this phase, but the implementing organizations usually develop important alliances during this period that create the foundation for achieving results during Phase II. During this period, a water valuation process is usually conducted and the key actors may form a watershed group. All of the products of the silent phase contribute to increased recognition by these key actors of the value of watershed environmental services, which contributes to the involvement of these key actors in the implementation of conservation strategies in Phase II.

According to TNC's program theory, Phase II focuses on the implementation of one or more of the following three conservation strategies: (1) public awareness campaigns, (2) water user fees, and (3) policy development and enforcement. For each of these strategies, a short chain explains expected results. Public outreach and awareness-building increase public support for watershed conservation, which will contribute to water users taking action to improve watershed conservation. The design of a water user fee will result in collection of water fees that are used to support watershed management actions. Engagement of policy-makers will result in the development of new laws, regulations or governance structures that are enforced.

If these conservation strategies are well executed, then they should result in increased adoption of best management practices (BMPs) related to forestry and agricultural activities, reduction of water use, the timing of water use, or water treatment. Which of these best management practices is relevant depends on the conditions in the specific site. For example, forestry and agricultural BMPs may be very important for montane areas, while water pollution reduction is vital to areas such as the Yucatan Peninsula that have complex groundwater systems that influence sensitive marine areas. Where they are relevant, forestry and agricultural best management practices can increase forest cover and other land cover, which will result in decreased flooding and drought. BMPs to reduce water use will reduce surface or groundwater use, which will increase the quantity of water available for aquatic habitat. BMPs related to the timing of water use will result in less concentration in the timing of water use (for example, by hydropower plants), which will increase the number of minimum and maximum river flows within the range of natural hydrologic variability. Water treatment practices will decrease water pollution, thus increasing water quality for aquatic habitat. According to TNC's theory, all of this will contribute to increased forest and watershed conservation, which will increase forest and freshwater biodiversity conservation.

Although the results chain is presented as a linear sequence of actions and results, we must remember that this is program *theory* – in reality results are often not achieved in the order presented by the chain. For example, some sites have jumped directly to working on the development of water user fees, without an extensive capacity-building, planning and alliance-building phase. These differences help us to learn about the advantages and disadvantages of different approaches and their relative effectiveness under different conditions.

1.3 Case study structure

The structure of this document is based on the results chain. We begin by addressing the last two factors at the end (bottom right-hand side) of the chain. In the site description we describe the

biodiversity that TNC and its partners are trying to conserve in the protected areas where they are conducting watershed valuation activities and in the project objectives and strategies we describe the project's objectives related to watershed and biodiversity conservation.

We then move to the beginning of the results chain. In the project history and planning and alliance-building process sections, we describe all of the achievements made related to the Phase I portion of the results chain. In the implementation of conservation strategies section, we describe all relevant activities related to public outreach campaigns, water user fees and watershed management policies and, if appropriate, how these activities have contributed to increased use of best management practices. We then describe any monitoring that partner organizations are undertaking to measure the effectiveness of watershed valuation work. Finally, we describe the principal lessons learned and provide concluding remarks.

1.4 Overview of this site project

This case study describes two different watershed valuation processes. First, it describes AMUPROLAGO's efforts to involve municipalities and local stakeholders in the conservation of upper watershed areas that provide drinking water to local communities. Second, it includes a brief description of a recent effort to revise Honduras' national water law. Although TNC was not involved in the latter, the person who led the efforts in Lake Yojoa (with technical assistance from TNC) left AMUPROLAGO and went on to coordinate the proposal of a new law at the national level. Because the new law would provide an enabling environment for watershed conservation and the application of innovative tools such as payments for watershed services, we felt it was important to describe the process.

2 Site Description

Lake Yojoa is located in central-western Honduras, approximately 125 km. northwest of the capital city, Tegucigalpa, and 75 km. south of the city of San Pedro Sula. It is Honduras' only natural lake and it covers about 79 km^2.

In 1971, the Honduran Congress declared Lake Yojoa and its watershed as a protected area. In 1975 the government developed a "multiple use plan" for the area. Since then, Hondurans have considered the lake and its watershed to be a multiple use area, although this management category has no legal basis in Honduras. The 1971 legal decree defined the boundaries of the protected area, but to date the area has no zoning. This means that the area does not have (as most protected areas do) a "core zone" that defines and protects the most intact and ecologically significant areas.

As shown in Figure 2, the lake is located between two other protected areas, established in 1987, when Honduran Decree 87-87 gave legal protection to all montane areas above 1800 m. On the western side of the lake is the Santa Bárbara National Park (PANAMOSAB) and on the eastern side is Cerro Azúl Meambar National Park (PANACAM). Together, these three protected areas cover 635 km^2.

The Lake Yojoa area contains diverse ecosystems that House et al. (2003) categorized into the following four groups:

1. the lake ecosystems, including wetlands and flooded forests,
2. the submontane, broadleaf forests around the lake,
3. the montane forests of Santa Bárbara and Cerro Azúl Meambar and lower, surrounding areas, and
4. the dry forests of the Zacapa and Ulúa river valleys.

The authors describe the Lake Yojoa region as an area with many distinct types of broadleaf forest and high biological diversity, due to high precipitation, the range in altitude and geologic diversity. Some parts of the region receive over 3,200 mm. of rain annually, the highest precipitation in the country. The large range in altitude is demonstrated by the fact that the lake is located at approximately 635 m., while the surrounding mountains of Sánta Bárbara and Cerro Azúl Meambar rise to 2,744 and 2,000 m., respectively. Santa Bárbara is the second highest mountain in Honduras.

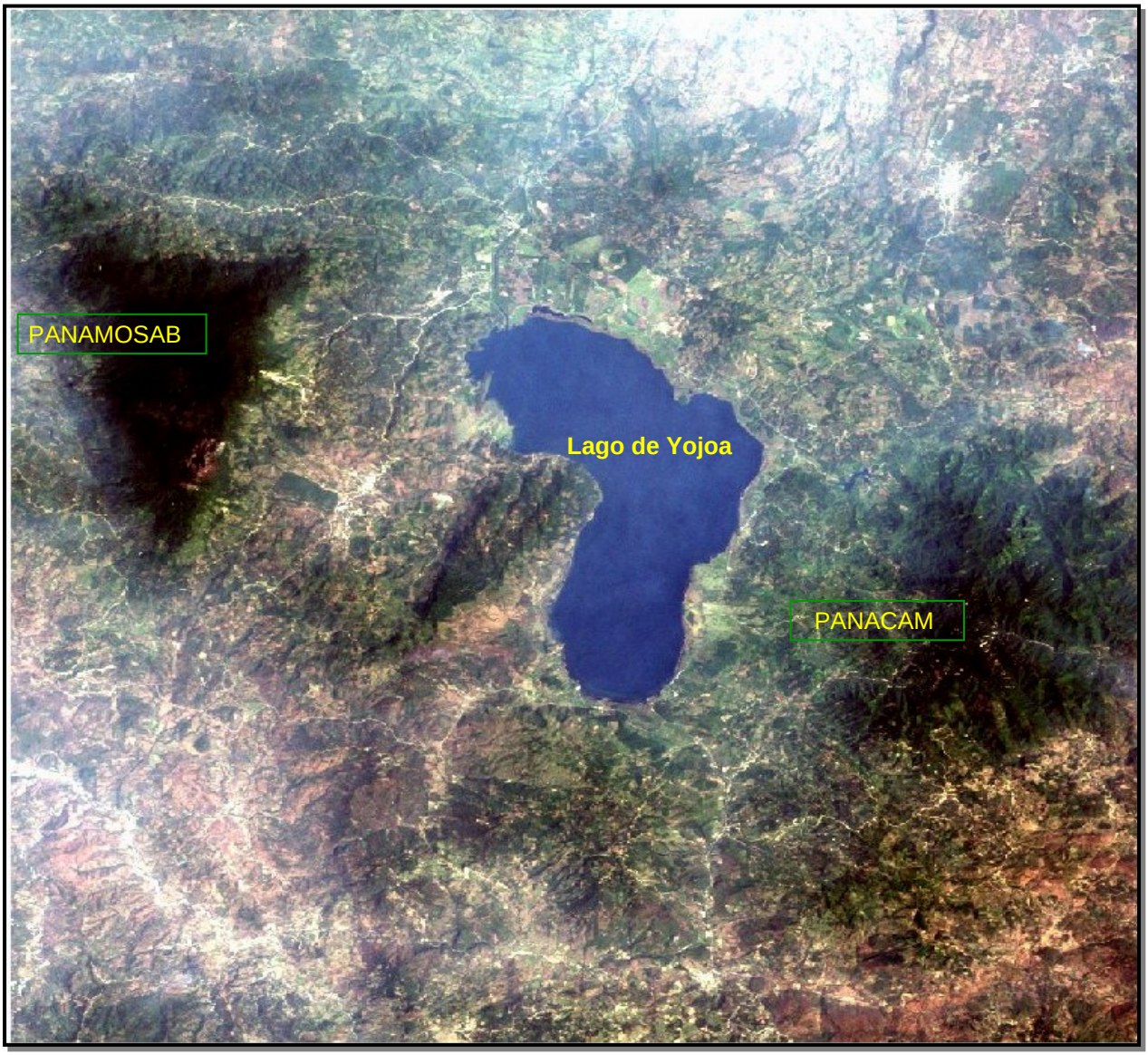
A few examples of the region's high biological diversity include the following:

- The Lake Yojoa region has the highest diversity of plants of any region in the country (802 species or 10.6% of the national flora), most of which is concentrated in the submontane zone around the lake. This floral diversity includes all of the Honduran plants on the CITES 1 list, 15 endemic plants, and 86.5% of the aquatic plants reported in the country.
- The 407 species of birds in this region represent 55% of Honduran bird species and 88% of the country's freshwater birds.
- The 31 species of amphibians and 72 species of reptiles represent 44.2% of the amphibian and 43.6% of the reptile species in the country.
- Scientists have reported 54 species of mammals, including endangered species such as the tapir, jaguar, giant anteater, spider monkey, white-faced monkey, and howler monkey. Some of these species may have gone extinct in the region, however, due to habitat destruction and fragmentation.

A recent analysis of the comparative value of Honduras' protected areas for biodiversity conservation concluded that Lake Yojoa is the fourth most important of the country's 98 protected areas, due to its high biodiversity, the presence of unique or uncommon ecosystems and rare and endemic species. Because Santa Bárbara has unique ecosystems that make it another high priority area, if one analyzed the three protected areas together, they would constitute the second most important conservation area in the country, after the Río Plátano Biosphere Reserve (House et al. 2003).

In addition to its biological value, the lake and its associated watersheds have high hydrologic value. Several economic activities depend directly on the lake. For example, the national government manages two hydroelectric plants located on tributaries of the lake. The beauty of the lake and sportfishing opportunities attract both international and national tourists. Residents have constructed aquaculture ponds around the lake, while a foreign-owned company cultivates tilapia in cages in the lake. In addition to these economic activities, the lake's watersheds provide drinking water to approximately 200 communities with over 36,000 residents.

Figure 2. Aerial Photograph of the Lake Yojoa Region



Despite the region's value for biodiversity conservation and the socioeconomic value of its water resources, land use practices have resulted in loss of biodiversity and watershed degradation. Other economic activities have caused water pollution, altered hydrologic flow patterns and contributed to the loss of native species.

Between 1986 and 2000, land use maps prepared by P. R. House show that almost all of the primary forests and pine forests in the Lake Yojoa Multiple Use Area were converted to agricultural lands. Forest cover also diminished dramatically in the Santa Bárbara and Cerro Azúl Meambar National Parks, but to a lesser degree, due to the rough terrain and inaccessibility of much of the two parks' primary forests (especially in the core zones). Because floral biodiversity is higher in the submontane region around the lake than in the two parks' montane forests, conversion of the forests in the Multiple Use Area has probably caused significant biodiversity loss.

As shown in Table 1, the predominant land uses in the three protected areas in 2000 were annual and perennial agriculture. Together these activities covered 63% of the area, while natural forest covered only 33%.

Table 1. Land Uses in the Three Protected Areas in 2000

Land Use	**Area (ha.)**	**%**
Broadleaf Forest	15,981	8
Pine Forest	51,081	25
Water	8,549	4
Coffee and Fallow Areas (with secondary vegetation)	65,521	32
Agriculture	61,616	31
TOTAL	*202,748*	*100*

Hydropower generation has altered the lake's hydrologic flow patterns. In the 1970s, the Honduran government constructed a canal in the northwest part of the lake to divert water for hydropower generation in two hydroelectric plants (Cañaveral and Río Lindo). The government also constructed a dike that blocked natural drainage into the lake in the southwestern part of the lake. To make up for water diverted from the lake's watersheds, the National Electric Energy Company (ENEE) diverts two rivers from other watersheds into the lake. Because these rivers are polluted, some people believe that they have contributed to increased eutrophication in the lake (Monterroso, 2003). The lake level is now controlled by the demand for hydropower production. This has lowered the level of the lake and affected wetlands that are ecologically adapted to the natural fluctuations of the lake.

Other sources of organic pollution that contribute to eutrophication include municipal sewage and floating aquaculture tanks. Most of the towns in the lake's watershed do not have sewage treatment plants. Aquaculture tanks cover 2.6 hectares of the lake, where 4,500 tilapia are grown each year. The food given to the fish every day is a constant source of organic pollution that contributes to eutrophication.

Heavy metals contaminate the lake's sediments and have been found in lower concentrations in the fish. Mining of gold, zinc, silver and lead in the lake's watershed caused heavy metal contamination beginning in the late 1940s. Wastewater from the mines and the processing areas (where chemicals are used to separate the minerals) used to flow directly into the lake, but the owners of the mining company constructed a settling pond in 1971 to minimize the flow of pollutants into the lake.

Agrochemicals are also a major source of water pollution. Ornamental plant nurseries, pineapple plantations and coffee plantations all contribute to this problem.

In 1954 black bass was introduced into the lake and in 1964 tilapia was introduced. Both of these exotic species have displaced native fish species. Before the introduction of these species, fishermen caught native fish, primarily *guapote* (rainbow bass) and *bagres* (catfish).

3 Project History and Objectives

In 1995, a group of mayors from municipalities around the lake (both within and outside of the lake's watershed) got together to analyze the problems facing the lake and to discuss common social and economic problems that they all faced. They formed the Association of Municipalities for the Protection of Lake Yojoa and its Areas of Influence (AMUPROLAGO), with representation from 10 municipalities. AMUPROLAGO now includes representatives from 14 municipalities.

In 1999, AMUPROLAGO hired its first Executive Director, Tulio Monterroso. The Executive Director invited a Spanish specialist in municipalities and *mancomunidades* (organizations formed to act on behalf of a community of municipalities) to help AMUPROLAGO define the organizational structure of their *mancomunidad*. She helped them to develop their articles of association and apply for legal recognition of the association under Honduran law (their *personería jurídica*), which eventually gave the organization the ability to receive financial contributions.

During these early years, AMUPROLAGO needed to define its programmatic priorities. The members wanted to assure broad participation and transparency in their decision-making and avoid politicizing their priority-setting process. Responding to their expectations, the Executive Director of AMUPROLAGO proposed that the organization undertake three inter-related, participatory planning processes: (1) strategic planning with the municipalities in the Lake Yojoa watershed, (2) a site conservation plan for the Lake Yojoa Multi-use Area and the two surrounding protected areas, and (3) a watershed valuation process. Although each process used a different methodology, the results of the municipal strategic planning process and the watershed valuation process were quite similar and reinforced one another. TNC's Senior Advisor for International Water Policy, Marlou Church, worked to build AMUPROLAGO staff's technical capacity in water resources (especially watershed valuation) and provided technical assistance for the second and third process. TNC's Director of the Gulf of Mexico Initiative, Rafael Calderon, worked to develop the site conservation plans. Other organizations and projects that contributed to one or more of these processes include: the Honduran Forestry Agency (AFE-COHDEFOR), the U.S. Agency for International Development (USAID), the Summit Foundation, the United Nations Development Program (UNDP), Fundación VIDA, Strategies for Urban Quality (EQU), the Swedish International Development Agency (ASDI), the National Office for Sustainable Rural Development (DINADERS), the German Development Bank (KFW), the Honduran Congress, and community organizations.

The Lake Yojoa watershed strategic planning process brought together representatives of the municipalities and other stakeholders in the Lake Yojoa watershed. With financial support from Fundación VIDA and technical assistance from various sources, AMUPROLAGO invested significant time in facilitating a series of participatory workshops in 62 communities around the lake. Participants analyzed socioeconomic and environmental problems and needs in relation to infrastructure and services. As a result of the process, AMUPROLAGO produced strategic plan documents and maps for each municipality and a strategic plan for Lake Yojoa. The more important product that resulted from this process, however, was the engagement of local stakeholders.

In February 2002, AMUPROLAGO and The Nature Conservancy (TNC) collaborated in organizing a site conservation planning workshop for the area encompassing all three protected areas (Lake Yojoa, Santa Bárbara and Cerro Azúl Meambar). The purpose of this workshop was to bring together scientists, managers and key stakeholders to identify the most important ecosystems and species (the site's conservation targets), analyze the viability of each target, analyze the threats facing each target, and define indicators to measure success in reducing those threats and conserving the site targets.

Finally, with technical assistance from TNC's Senior Advisor for International Water Policy, AMUPROLAGO initiated a watershed valuation process. As we will discuss in the next section, AMUPROLAGO organized watershed valuation workshops that brought together major water users, those who benefit most from the lake (including representatives from the electric company, hotels, and an aquaculture company) and those with the capacity to either pay for watershed environmental services or otherwise contribute to the management of the lake.

As a result of these planning processes, AMUPROLAGO defined its mission and programmatic priorities. The mission of AMUPROLAGO is "to promote the sustainable development of the AMUPROLAGO region through the joint effort of the 14 member municipalities." The organization has four programmatic priorities, one of which is the conservation, protection and valuation of Lake Yojoa and its watershed. Within this programmatic area, the organization has chosen to focus on reducing water pollution, conserving priority ecosystems (such as the lake's wetlands), and involving the municipalities in natural resource management.

4 Planning and Alliance-building Process

The watershed valuation process developed by TNC's Senior Advisor for International Water Policy brings together the site's major water users and those who benefit the most from the lake and its watershed and leads them through a qualitative valuation process. The objectives of the process are to get the participants to recognize the true value of water and to realize that they need to contribute to watershed management either by paying a water user fee or by participating directly in management actions. The subsequent step in the process is to develop mechanisms such as user fees, policies, private land conservation tools, zoning and others that link water users with sustainable management.

To carry out the watershed valuation process, AMUPROLAGO and TNC identified all of the stakeholders that needed to be involved in the process. The most important stakeholders included the electric company, an aquaculture company that produces tilapia in cages in the lake, hotel owners, fishermen, people who sell fish, the owners of restaurants that sell fried fish, the mining company, municipalities and community groups that manage potable water systems. They also invited other groups, including international and national donors, representatives of relevant government agencies and watershed management projects from other regions, local leaders and other members of civil society. AMUPROLAGO contacted most of these stakeholders individually, to explain the watershed valuation process and the importance of their participation. AMUPROLAGO also took advantage of other events to promote the watershed valuation process as the first process of its kind to take place in Honduras.

AMUPROLAGO and TNC organized a series of watershed valuation workshops with representation from all of the major stakeholder groups. The workshops consisted of both presentations and working group exercises. Participants worked together to define all of the valuable services that the water from Lake Yojoa and its watershed provide and to identify water users and beneficiaries. They also defined the threats to the lake and its watershed. Finally, they defined management objectives and identified audiences that would need to be involved in order to achieve each objective.

According to the Executive Director of AMUPROLAGO, the process produced several very significant results. First and foremost, it brought together a diverse group of stakeholders with different perspectives and a history of conflicts and got them to think beyond their own interests and recognize the collective value of the lake and its watershed. It enabled participants to recognize the value of water and even succeeded in convincing them of the need to pay more to protect their water resources; surprisingly, participants recognized that they do not currently pay enough to ensure the conservation and management of this vital resource. Second, as a result of the workshop, two municipalities initiated processes to protect springs that provide drinking water to their communities. Finally, participants proposed the creation of a Watershed Advisory Committee, a multisectoral group with 24 members from different sectors. The proposed role of this committee was to assure that AMUPROLAGO's priorities and projects respond to the needs of all the stakeholders in the watershed.

When it undertook the watershed valuation process, AMUPROLAGO was particularly interested in developing a mechanism to charge companies such as ENEE for watershed environmental services and using this money to improve the management of the lake's watersheds. ENEE is clearly one of the most important water users in the lake. The Cañaveral and Río Lindo plants, both of which use water from the lake's watershed to generate electricity, produce the cheapest energy in the country. The Cañaveral Plant Manager says that during the month of August 2004, the two plants together produced 42,091,000 kilowatt-hours (KWH) worth approximately $0.08 per KWH, or a total of $3,367,280. Annually, they generate about 800 million KWH worth approximately $64 million.

As mentioned earlier, the lake's water level has decreased in recent decades. Some people attribute the decrease to the water that ENEE diverts out of the watershed. Others, including ENEE managers, say that deforestation has decreased precipitation and thus decreased streamflow into the lake. ENEE's turbines operate when the lake level is between 631.5 and 637.5 m. in altitude; when the lake level drops below 631.5, the plants are shut down. During the drought of 1995, Honduras suffered an energy crisis because of the time that these plants and others around the country could not operate. Since then, ENEE has invested in the management of the El Cajón watershed, where the country's largest hydropower plant is located. ENEE dedicates very few resources to watershed management in Yojoa Lake, however. The company has only two staff members who work on reforestation and promotion of energy efficient stoves (to reduce fuelwood harvesting). The Cañaveral Plant Manager believes that the company ought to develop a watershed management plan for the Lake Yojoa watershed and dedicate significantly more resources to management activities.

Getting ENEE to either adequately finance its own watershed management activities or pay an environmental service payment to another organization (such as AMUPROLAGO) would require the support of ENEE's Executive Board. The Board includes the Director of the Ministry of Natural Resources and Environment (SERNA), the General Manager of ENEE, the President of the Honduran Congress, and other high level officials. ENEE's Cañaveral Plant Manager believes that AMUPROLAGO would need to conduct an economic valuation study to define how much to charge the company.

Another company whose business depends directly on the lake is Aquafinca Saint Peter Fish, an aquaculture company that produces tilapia in cages in the lake. As mentioned earlier, the company has 2.6 hectares of fish tanks and produces 4,500 fish per year. Some people claim that the fish meal fed to the tilapia each day contributes significantly to the eutrophication of the lake. The company believes that other sources of organic pollution, such as fertilizers and sewage, are the primary causes of the eutrophication. SERNA did not require that the company conduct an environmental impact assessment. In September 2004, the company agreed to pay a voluntary water use fee of L. 0.0025/m3 of water, or L. 876,000 (approximately $47,609) per year to SERNA. It is not clear how SERNA will use these funds or if they will benefit the lake.

Arnold Sánchez, a Congressman and Founder of AMUPROLAGO, believes that both stronger legal instruments and more technical information are needed before AMUPROLAGO could apply user fees to companies like ENEE and Aqua Finca Saint Peter Fish. He points out that even when water users are aware of the value of water and the need to support watershed management, there is currently no legal basis for water fees that include environmental service payments. AMUPROLAGO is not the *Autoridad del Lago*, the government agency responsible for overseeing the management of the lake. AMUPROLAGO would either need to be named the *Autoridad del Lago* or it would need to work with all eight of the municipalities in the lake watershed to develop municipal regulations that would allow each municipality to charge water user fees to be used for management of the overall watershed.

Sánchez also believes that AMUPROLAGO, SERNA and others involved in the management of the lake need more technical information about its hydrology and water quality. For example, they need a water balance study to determine why the lake level has decreased. They need maps of critical habitats such as wetlands, so that they can protect them. They need more information about current water quality and the relative contribution of different sources of pollution, so that they can direct their actions toward decreasing the most significant sources. Finally, he suggests conducting a study of the carrying capacity of the lake and using this information to regulate aquaculture and other activities that directly affect water quality. Managing the lake requires regulating the various uses of the resources and resolving conflicts between user groups. Resolving conflicts in a fair and transparent way requires a good base of technical information.

5 Implementation of Conservation Strategies

5.1 Upper Watershed Protection in Yojoa Lake (Forestry Best Management Practices)

During both the strategic planning process and the watershed valuation process, participants identified the need to protect microwatersheds -- especially upper watershed areas that provide drinking water to communities. For example, the Municipality of Santa Bárbara decided to parchase the land where its water sources are located. The Municipality of Santa Cruz de Laguna included in its strategic plan actions "to protect microwatersheds and improve water quality for human consumption."

TNC introduced AMUPROLAGO to an innovative legal tool, the conservation easement, to protect patches of primary forest of ecological and socioeconomic value. A conservation easement is a legal agreement between two pieces of property in which the "dominant property" acquires certain rights from the "subservient property." It is similar to a legal agreement that gives one property owner a right-of-way on another property owner's land. In this case, however, the rights given up by the subservient property are development rights. In some cases, the landowner of the subservient property may agree not to cut any of the forest cover in a certain part of his or her property. In other cases, he or she may agree to restrict the use of part of the land. Because the conservation easement is registered with the title to the property, when the property is sold, the restrictions on resource use are transferred to the new owner.

Conservation organizations in the United States have used conservation easements for many years, because they consider them a cost-effective tool for land protection. Establishing an easement is generally much cheaper than land acquisition, in the short term and over the long term. The initial cost of the legal agreement is generally a fraction of the market value of the property. Over the long term, the landowner continues to shoulder the cost of land management and the conservation organization is responsible only for monitoring the easement and legally upholding it, if necessary.

There are several incentives for landowners to place a conservation easement on their property. The Honduran government has made all land included in a conservation easement exempt from property taxes and it has committed to giving the landowner help in fighting forest fires, if necessary. In this case, AMUPROLAGO also provided legal assistance to help the private landowners obtain legal rights or official title to their land. In one case, a member of the AMUPROLAGO Board also paid for the construction of a road to the property.

With technical assistance from TNC staff with expertise in conservation easements, AMUPROLAGO invested a significant amount of time in negotiating, developing and then signing five conservation easements. AMUPROLAGO owned a piece of property that represented the "dominant property" in the legal agreements. As shown in Table 2, AMUPROLAGO signed two easements with private landowners and three with the Municipality of Santa Cruz de Yojoa. The Municipality of Santa Cruz de Yojoa wanted to protect its drinking water sources. It decided that purchasing the land would not ensure permanent protection --

signing an easement would give the municipality the obligation to protect the land in perpetuity, irrespective of changes in municipal leadership.

Together the private and municipal easements protected almost 60 hectares of forest. Surprisingly, the legal cost of establishing the easements was only about $4,000, or $68 per hectare.

Table 2. Current Status of the Conservation Easements Established in Lake Yojoa

(adapted from AMUPROLAGO. Septiembre 2004)

Property Owner	Property Name	Size (ha.)	Location (Town, Municipality)	Current Status of Conservation Easement
Private landowner	Finca Bahr	2.68 ha.	Monte Verde, Santa Cruz de Yojoa	• conditions of contract not upheld by either party • wetland filled in (0.5 km. inside of wetland) • grazing in wetland • no monitoring • no technical assistance
Sr. José A. Zuniga, private landowner	Finca "El Crater"	25.91 ha.	Los Coquitos, Santa Cruz de Yojoa	• legal dispute over property • no monitoring • no technical assistance
Municipalidad de Santa Cruz de Yojoa	"El Sinai"	12.3 ha.	Meámbar, Santa Cruz de Yojoa	• no monitoring • no technical assistance
Municipalidad de Santa Cruz de Yojoa	"Yojoa"	15.5 ha.	El Crique de Yojoa, Santa Cruz de Yojoa	• no monitoring • no technical assistance
Municipalidad de Santa Cruz de Yojoa	"La Cusumba"	2.8 ha.	Santa Cruz de Yojoa	• no monitoring • no technical assistance
TOTAL HECTARES		**59.2 ha.**		

When AMUPROLAGO signed these conservation easements in 2000-2001, they represented a major step forward in the use of this conservation tool. At the time, conservation easements had been used extensively in North America, but their application in Latin America was quite limited. In North America, landowners who put a conservation easement on their land receive significant reductions in their property taxes. In some cases, this makes it financially possible for the landowner to keep the land. In contrast, incentives for the use of conservation easements in Latin America are usually not sufficiently attractive to offset the loss of development and resource use rights and the decrease in market value of the property. AMUPROLAGO proved that it was possible to sign conservation easements with local landowners and municipalities.

Since 2001, however, AMUPROLAGO has faced many challenges in upholding these conservation easements. On one of the pieces of private property, another landowner appeared who claimed that he was the rightful owner of the property. A legal dispute over the property has ensued. On the other piece of private property, the owners have not upheld the obligations of the easement. In 2002, a new mayor was elected in Santa Cruz de Yojoa and the new mayor does not support many of the initiatives of the previous mayor (including this one). In all 5 cases, AMUPROLAGO has not monitored compliance of the easement, nor has it provided

technical assistance as agreed in the easement. AMUPROLAGO has also not taken legal action in cases of incompliance. The Director of AMUPROLAGO left the organization in 2002 and a new Director was hired in May 2003. The new Director does not consider these easements to be a high priority for the organization and he does not believe that the organization has the capacity to ensure their enforcement.

5.1.1 Challenges and Enabling Factors

This experience demonstrates some of the challenges of using conservation easements in Latin America. Conservation organizations across the region could learn from this experience. The first challenge is that overlapping claims to land are common in the region and many people do not have legal title to their land; thus, conservation organizations run the risk of getting involved in land disputes, unless they conduct thorough background research on the property before signing the easement. Second, monitoring easement compliance requires an investment of staff time over the long term. Third, ensuring the legal enforcement of the easement can potentially be very expensive; conservation organizations do not generally have the resources needed to take legal action in cases of incompliance. Finally, because there is no legal precedent, it is not clear whether the Honduran courts would uphold a conservation easement.

5.2 National Watershed Management Policies and Governance Structure

Like many Latin American countries, Honduras' water legislation is outdated and inadequate to meet modern needs. The National Water Use Law was developed in 1927 and reflects the priorities of sectors that had strong political power at that time, such as the banana companies, the railroad and cattle ranchers. One of the weaknesses of the law is that it regulates certain water uses such as domestic water supply, irrigation, navigation, and industrial use individually (sector by sector), without considering overlaps and conflicts and the need for integrated watershed management. Another is that although groundwater is a finite resource that can be overexploited, the law allows landowners to freely drill wells and it considers groundwater as private property once it has been extracted by the landowner.

In recent years, the Honduran Congress has received and considered several proposals for a new water law, but it has never passed any of them. Several different laws, therefore, regulate different aspects of water use, resulting in legal gaps and inconsistencies, as well as overlapping institutional responsibilities and institutional gaps. Although the Ministry of Natural Resources and Environment (SERNA) has the responsibility to oversee the management of the nation's water resources, it does not have the capacity to exercise this authority and thus different aspects of water use are overseen by different sectors, resulting in overlaps and conflicts between different water uses.

Honduras needs a new water law that will help the country address many modern problems. For example, widespread watershed degradation has made the country vulnerable to flooding during extreme weather events such as the heavy rains that occurred during Hurricane Mitch in 1998. The country is also vulnerable to drought caused by "el Niño." Some regions of the country have inadequate water supply, due to limited surface and groundwater sources, and many

municipalities do not have the resources or qualified personnel to adequately maintain their water systems. Groundwater resources are not managed in most of the country. Water pollution regulations are not enforced, resulting in contamination of rivers and coastal areas (Monterroso 2004). Legislation that establishes a strong governance structure for water resources would help the country address many of these problems.

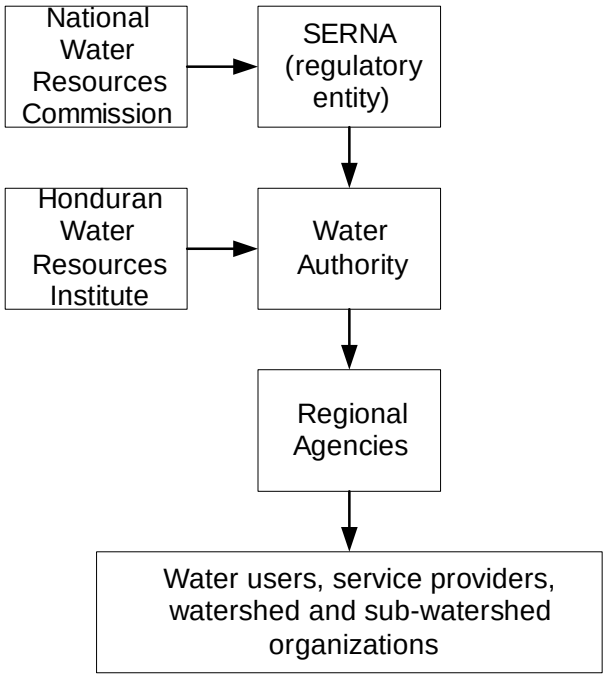
As mentioned earlier, Tulio Monterroso left AMUPROLAGO in 2002. He continued to work on water issues at the national level and within months he was involved in an initiative to propose a new water law, based on extensive technical input and a broad process of consultation with all relevant sectors throughout the country. We describe the process here, because it provides important lessons for people working in other countries that have weak water legislation. The process was supported by the United Nations Development Program (UNDP). Several people provided technical assistance to the process. One of them was Marlou Church, who gave technical input and advice both as TNC's Senior Advisor for International Water Policy and as an independent consultant.

In early 2003, the Environment Commission of the National Congress decided to reactivate the process of approval of a new water law by dusting off a proposed law introduced in 1998. The Commission asked a multi-sectoral grouped called the Honduran Water Platform (Plataforma de Agua de Honduras) to provide the technical assistance necessary to update and revise the proposed law. According to Tulio Monterroso, who coordinates the group, the Honduran Water Platform included 12 professionals with technical experience in different aspects of water resources, including potable water supply and wastewater management, irrigation, vulnerability to natural disasters, hydropower generation, and municipal and community interests related to the management of water resources. The group was created to promote the integrated management of water resources and capacity building in the water sector and to influence water policy development -- specifically, the development of a new water law.

Platform members spent several months conducting a technical review of the proposed law and developing a revised version that incorporated elements essential to integrated management of water resources and Honduran policies on descentralization, sectoral planning, public and private participation, regulation, and modernization of the state. They also ensured that the draft document incorporated government priorities related to conservation, sustainability, vulnerability, valuation, equity and gender. The group facilitated three working sessions to present this draft to the Environment Commission of the National Congress and make changes based on their feedback. They then sought input from at least five other Congressional commissions, party leaders and members of the Executive Board of the Congress. At this point, they produced their final draft (*dictamen final*).

According to Monterroso (2004), the proposed law both simplifies and strengthens the governance structure for water resources management by creating clearly defined, distinctive roles for different institutions. SERNA would continue to have responsibility for water policy and a National Water Authority with regional offices would implement the water policy and have responsibility for planning, regulation, research and promotion of integrated watershed management. Finally, a Water Resources Institute would be responsible for research and monitoring. The governance structure would include the following:

Figure 3. Governance Structure Included in the Proposed Honduran Water Law



Some of the other improvements in the law mentioned by Monterroso (2004) include:

- Establishment of ecologically and socioeconomically significant areas such as cloud forests, watershed recharge areas and sources of water for human consumption, wetlands, coral reefs and others as conservation areas
- Recognition of the economic, environmental and social value of water
- Establishment of fees for water use, incentives for conservation, and fines for water pollution
- Development of mechanisms for public participation in integrated water resources management

Beginning around September 2004, Platform members facilitated a series of workshops around the country to present the proposed law to representatives of all relevant sectors and get feedback about it. They also organized meetings to discuss the proposed legislation with groups that they considered likely to oppose it.

5.2.1 Challenges and Enabling Factors

The existence of the Honduran Water Platform was essential to the success of the process of technical review and public consultation about the proposed water law. The Water Commission of the National Congress trusted the group in part because it represented many different sectors and had different technical backgrounds and interests related to water resources. The diversity of perspectives within the group gave it credibility. The group also played an essential role in keeping the process moving by raising the necessary funds and bringing in outside technical expertise when needed.

6 Lessons Learned

6.1 Lessons Learned From Yojoa Lake

6.1.1 Watershed valuation processes take time and require continuity in leadership

Because watershed valuation processes require a long process of outreach, consultation and capacity-building of key actors, it generally takes several years for them to produce concrete results such as stronger local or national policies, water user fees, and more sustainable resource use. In this case, AMUPROLAGO succeeded in raising awareness and getting local stakeholders to work together to analyze problems and propose solutions. Because of a change in leadership in AMUPROLAGO, however, the process came to a halt. Because the new director of AMUPROLAGO has other priorities, the organization has not provided follow-up and the process has not achieved the on-the-ground results that it intended to achieve.

6.1.2 Conservation easements are only effective if they can be enforced

Conservation easements are an innovative legal tool for land conservation that may have great potential in Honduras and other Latin American countries. They will only be effective, however, in cases where the institutional and legal framework exists to enforce them. In this case, there was not sufficient capacity to enforce the easements. When the leadership of AMUPROLAGO changed, the monitoring of the organization's five conservation easements ceased to be a priority. The organization took no action to stop one private landowner from filling in wetland, nor did it get involved in the legal dispute over the other private property. If AMUPROLAGO had taken legal action, it is also not clear whether Honduran courts would have upheld the easements. Conservation easements are such a new tool that the country's judicial system does not have experience with them.

6.1.3 Good technical information is needed to resolve conflicts between user groups

In Lake Yojoa, many people blame ENEE for lowering the lake level, but ENEE claims that lower precipitation and deforestation are responsible for the low level of the lake. Some people believe that Aqua Finca Saint Peter Fish is contributing significantly to the eutrophication of the lake, but the company blames municipal sewage and agricultural runoff for the eutrophication. In both cases, it is the word of one group against another and there is not sufficient technical information to understand the root of the problem. As Arnold Sánchez, a Congressman and Founder of AMUPROLAGO, points out, SERNA, AMUPROLAGO and others involved in the management of the lake need more technical information. Managing the lake requires regulating resource uses and resolving conflicts between user groups. This can only be done in a fair and transparent way with a good base of technical information.

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