



Natural Resources Management and Environment Department

Land and Water Division

**PAYMENT FOR ENVIRONMENTAL SERVICES: FIRST GLOBAL
INVENTORY OF SCHEMES PROVISIONING WATER FOR CITIES**

Branka BURIC

Jean GAULT

With an additional report of

François BERTOYE

Acronyms

CIFOR - Center for International Forestry Research

CATIE- Centro Agronómico Tropical de Investigación y Enseñanza

CEDERENA - Corporation for the Development of Natural Resources

DANIDA- Danish International Development Agency

FONAG - Fondo del Agua

GEF- Global Environment Facility

GIZ – German Cooperation Agency

ICRAF- World Agroforestry Centre

IDB - Inter-American Development Bank

IIED - International Institute for Environment and Development

IUCN–The World Conservation Union

NEPA - National Environmental Policy Act

TNC- The Nature Conservancy (TNC)

UNEP - United Nations Environment Programme

USAID – US Agency for International Development

WB - The World Bank

WWF - World Wide Fund for Nature

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i) Setting the problem: PES and Cities' water supply

Freshwater is a finite resource necessary for sustainable development, economic growth, agriculture (incl. forestry, fisheries and aquaculture) political and social stability, human and ecosystem health, and poverty eradication. Today, water shortages affect 40% of the world's population, while about 2.6 billion lack access to adequate sanitation. Scientists warn that by 2025 more than two-thirds of the world's population could face water shortages. Urban population grows by two people every second and 27% of the urban population in the developing world does not have piped water in their homes. (UN)

Throughout the most populous country in the world – China for example, 400 of the country's 640 major cities face water shortages, and 700 million people lack access to safe water.

The watersheds providing water for urban population are facing numerous threats, these being pollution, development, fire, soil erosion, drought, flooding, etc.

The production of surface water for municipal use is an ecosystem service that is generally neither paid for by cities nor individual water consumers, including industrial companies. Water tariffs usually account for the services of capturing, treating, and delivering water but not for producing the water. Therefore, the goods and services provided by healthy watersheds are of critical importance to water consumers. Flow regulation, flood control, filtration, and protection against runoff, erosion, and sedimentation are crucially important.

By using the market based mechanism of Payment for Environmental Services (PES) many cities worldwide have successfully safeguarded the natural water purification services of their watersheds and thereby avoided expensive treatment systems, thus saving their residents millions of dollars.

Payment for Ecosystem Service schemes mitigate the risks posed to watersheds by linking the payment for hydrological services to water consumers and using the resulting funds for investments into conservation, restoration, and land acquisition projects. The land users in the water catchment area are in the position to provide environmental services/benefits to the water users in the cities through numerous conservation practices. Typically, these benefits are not included in conventional markets and are unpaid for by recipients. Over the past few decades, research has demonstrated that healthy watersheds provide numerous, economically important services to society. Countries, municipalities, water districts, and other agencies are now aligning their economic and conservation objectives in ways that explicitly link the wellbeing of humans and the environment. PES schemes provide clear economic incentives for environmental stewardship by landowners or land users, and raise awareness among consumers of the values the ecosystems provide, and this is the main reason why these schemes have been gaining popularity worldwide, both in developing and the developed world. By allowing landowners or land users to internalize the watershed benefits they provide for the society, PES systems also promote stewards' communication and collaboration with downstream stakeholders. The PES schemes also help recognize that water has social, economic and environmental value. As such, PES programs are often a more efficient and cost-effective method of achieving watershed protection compared to regulations, or water treatment

alone. PES programmes lead to improved capacities, land rights or property improvement, and enhance water users awareness and involvement in natural resources management.

Despite of its rapid development worldwide in the last decades the PES concept is not new. In 1889 the Great Seattle Fire destroyed the business district and damaged the City of Seattle's water supply system. Shortly after the fire, voters approved bonds to finance construction of the Cedar River system, which continues to be Seattle's primary water source today. At the time, city leaders also formulated a plan to eventually acquire all land surrounding the entire 100,000-acre watershed and thus control all activities on those lands. One hundred years later, in the late 1990s, the city realized this plan for the Cedar River watershed, thereby securing Seattle's drinking water supply. Many cities in Latin America have been using PES schemes for decades to regulate their water supply and quality. A number of successful examples have also been found in Asia, Europe and Africa.

The critics of PES schemes in general argue that these schemes are challenging for evaluating the opportunity costs and ecosystem services delivery, high transaction costs, ensuring of conditionality, and sometimes cause conflicts over the land use right. In fact, precise concrete environmental results are often lacking and in many PES schemes here after, water quality improvement is not monitored.

However the number of sustainable PES schemes around the world, of which those providing water for municipalities and industries are presented in this document, illustrates the proven capacity of PES to mobilize local financial resources through a direct service provider – service user relationship and put ecosystem services at central stage in the management of natural resources. This practice shows that PES scheme work best when services are visible and beneficiaries are well organized, and when land users communities are well structured, have clear and secure property rights, and have strong legal frameworks. This is particularly important achievement in the context of growing population and higher pressure on the ecosystems, i.e. the scarcity of clean water supply. In particular, incentives to encourage early action to protect critical watershed areas and to institute water-user fees or water-rate structures that build the costs of watershed protection into urban water supply systems are critical to harvesting a fuller portion of the benefits of natural watershed services; monitoring evaluating and reporting are critical as well.

ii) **Background**

While water issues have long been on the international agenda, the debate over how to meet the growing global demand for freshwater has intensified in recent years. World leaders adopted the Millennium Declaration in September 2000 at the Millennium Summit, which inspired eight Millennium Development Goals (MDGs) with 18 targets, including the target to halve the proportion of people without access to safe drinking water by 2015.

Since the Millennium Summit a number of events have addressed the water issues:

The International Conference on Freshwater convened was organized in Bonn, Germany, in December 2001, in preparation for the World Summit on Sustainable Development (WSSD). The Conference addressed: equitable access to and sustainable supply of water for the poor; strategies for sustainable and equitable management of water resources; integration of gender perspectives; and mobilization of financial resources for water infrastructure.

During the **World Summit for Sustainable Development**, held in Johannesburg, South Africa, in August-September 2002, world leaders expanded the MDG target on safe drinking water by also agreeing to halve the number of people lacking adequate sanitation by 2015. Other water-related targets in the Johannesburg Plan of Implementation included the commitment to develop integrated water resource management (IWRM) and water efficiency plans by 2005. Governments, lending agencies and international organizations also launched several voluntary partnerships and initiatives in the areas of water and sanitation.

Organized by the UN, **the International Decade (2005-2015) for action “Water for Life”** focuses on the implementation of water-related programmes and projects and on strengthening cooperation on water issues at all levels. Priorities include: access to sanitation; disaster prevention; pollution; transboundary water issues; gender; capacity building; financing; and IWRM. Africa is identified as a region for priority action for the Decade.

World Water Forum: The World Water Forum, organized every three years by the World Water Council, is the largest international event in the field of water. The 1st World Water Forum was held in Marrakech, Morocco, in 1997. This Forum led to the preparation of a “Vision for Water, Life and the Environment in the 21st Century”, whose results were discussed during the 2nd World Water Forum in 2000 in The Hague, Netherlands. In March 2003, the 3rd World Water Forum in Kyoto, Japan, clearly stated its resolution to involve all stakeholders through, for example, the creation of a “Virtual Water Forum” and the gathering of thousands of testimonies within the “Voices of Water.” The Council presented its “World Water Actions” Report: an inventory of 3000 actions on the ground. By gathering more than 24,000 participants, the 3rd World Water Forum was the largest water-related event ever organized. For the 4th edition, the World Water Forum was organized in Mexico City, gathering approximately 20,000 participants. The Fifth World Water Forum was held in Istanbul, Turkey, in March 2009. It addressed all issues related to water and hosted a delegation of 33,058 people from 192 countries. Marseille, France will be the host of the 6th World Water Forum, in March 2012.

CSD-17: The seventeenth session of the UN Commission for Sustainable Development (CSD-17) held in New York, US, in May 2009, addressed inter alia: the importance of water for agriculture; sound water management; implementing sustainable and efficient water resource development and management schemes; and safe water access for rural populations.

“Water for Cities: Responding to the Urban Challenge,” was the theme of the **World Water Day 2011** (WWD 2011) convened in Cape Town, South Africa, on 22 March 2011. The focus of the discussions was on water and sanitation infrastructure in Africa, and the role of local government in bridging the water and sanitation gap; how best to address the urban water supply problems through: urban planning; public-private partnerships; using the expertise of local governments for effective implementation; and the necessity of adequate funding and

political will.

iii) **Objectives and Scope of the Report**

In the perspective of the World Water Day 2011 “Water for Cities” (March 22, 2011), the Natural Resources Land and Water Division (NRL) of FAO has launched an inventory of environmental schemes provisioning water to cities. Up to date there have been several studies addressing the payment for watershed services around the world, conducted by various UN agencies, NGOs, etc. None of these studies so far has focused on the PES schemes providing the water supply for cities and industries, i.e. urban areas. In that sense this inventory is unique.

The activities NRL/FAO has undertaken to collect all the information regarding the PES “water for cities” cases are the following:

- FAO has launched an electronic discussion group (D Group)¹, to share ideas, information about payment for environmental services (PES), ask questions, or build partnerships and collect the most valuable experiences in order to promote PES; East Africa and Kagera basin are one focus area for this D group.
- Based on extensive Internet and literature research, identified the particular “water for cities” PES cases around the world.
- Contacted the PES project managers, municipalities and other relevant persons, to request the information on each particular case identified.
- Based on the internet and literature research and personal communication, as well as on answers by the above mentioned contacts, created this report containing the description of all the PES “water for cities” cases identified.

The limitations of this report are a rather low response of the people responsible for the identified PES schemes contacted, possibly due to a limited time allocated for this enquiry. As a consequence, instead of the uniformly structured PES files, we have a varying level and quality of information, as taken from the original sources, and in order to present all the information available, with as many details as possible.

A second part has been added, that presents concrete water provisioning schemes, where Environmental Service Providers are NOT paid. Cities or economic entities pay for supporting measures, like quality monitoring, sensitising stake holders, buying land, financing infrastructures ... This part provides a complementary insight in a thematic domain which is permanently progressing, with fluctuant borders.

The report however offers a very useful inventory of identified PES “water for cities” schemes and “pre PES water schemes” around the world. It can be used as basis for further pursuit of information, updating some information through renewed careful inventory, analysis of the most relevant cases at least, and possible replication of these cases, primarily in East Africa that has become an area of interest lately for the potential development of this market based scheme in order to address the water issues of the region.

¹ Please write to PES-community@dgroups.org, to apply for membership

iv) The Science of Land Use and Hydrology

The relationship between land use and hydrology is complex, and established wisdom about their nature can also change over time. However some patterns are reasonably valid:²

- Intact natural vegetation cover guarantees optimum stream flow under given geo-climatic conditions. It also affords maximum soil protection and therefore provides optimum regulation of seasonal flows while moderating erosion and stream sedimentation loads.
- In addition, *montane cloud* forests and related cloud affected ecosystems such as *paramos* provide maximum amounts of stream flow due to a combination of high rainfall, extra inputs from cloud water captured by the vegetation, and low water use due to frequent occurrence of fog.
- Intact natural vegetation cover is no guarantee that floods or landslides will not occur, especially in large-scale watersheds under extreme weather events. Nevertheless, their frequency will be less with intact vegetation than is usually observed after conversion. For flooding, this is especially true in smaller-scale watersheds and for small and medium sized storm flow.
- Removal of old-growth forest at large scales (>10,000 km²) in humid parts of the world reduces rainfall during the transition between rainy and dry seasons. Annual average effects are modest (5-10%) but are higher during the transition.
- Removal of forest has an initial short-term effect of increasing annual water yield (100-800 mm for a 100% change in cover), with the size of change depending on rainfall and degree of surface disturbance. Subsequent water yield depends on the new land cover.
- Converting forest to non-forest cover increases flows (as long as soil degradation is kept moderate and mean annual precipitation totals in excess of potential evaporation, i.e. – 1,500 mm or more).
- Converting forests to other uses is likely to lead to reduced flows, if soil degradation has caused overland flow to exceed 15-20% of rainfall. This degraded stage is typically prolonged after exposure of bare soil to the elements, by intensive grazing or the use of heavy machinery, too frequent or poorly timed use or occurrence of fire hampering vegetation recovery, improper tillage regimes, and by introduction of compacted surfaces such as the roads.
- Reforestation does not re-create the ecological conditions of old-growth forests within the lifespan of most Payment for Watershed Services programmes, due to the higher water use of the rapidly growing trees compared with that of the vegetation the trees are

² The results are based on the findings of Bruijnzeel (2004)

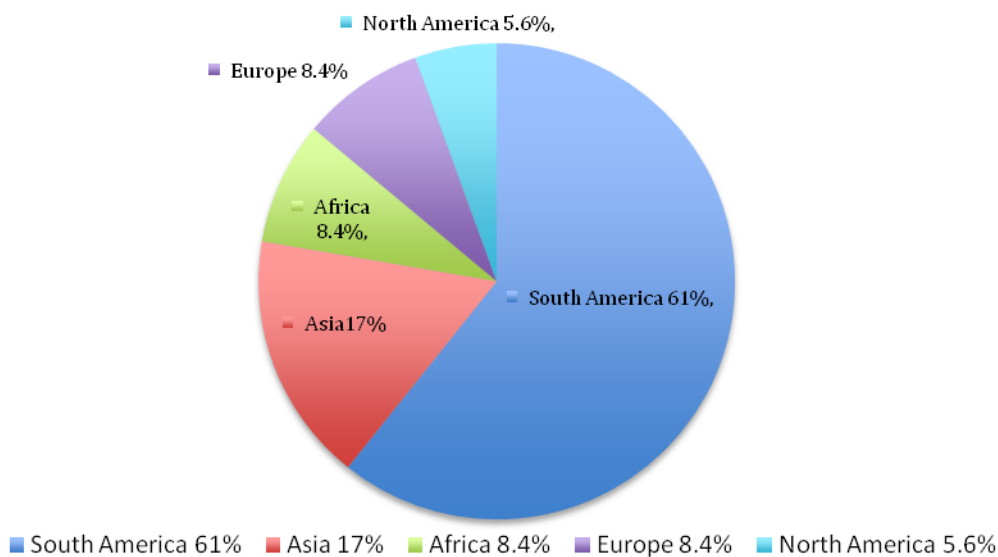
replacing. From the perspective of downstream water uses, the initial hydrological response to reforestation can in fact be negative i.e. reforestation results in less stream flow – due to high use of water by growing trees.

- Reforestation is unlikely to reduce the risk of flooding to the same degree as former old-growth forest because the recovery of degraded soils often takes decades.
- Establishing forest on grasslands or degraded savannas leads to reduction of low flows when the trees increased water use is not offset by improved infiltration. In naturally non-forested landscapes such as southern African grasslands, tree planting will result in stream flow reduction of around 300 mm per year. In such areas, restoring the natural grassland vegetation is more likely to increase stream flow. Increases in low flows will require a scientifically large improvement in infiltration after revegetation. To compensate for the use of 300 mm of extra soil water by trees, a 30% switch from overland flow to infiltration is needed at an annual rainfall of 1,000 mm/year to break even. This can only be expected where surface soils are partly degraded yet are deep enough to store the extra infiltrated water.

I. EXECUTIVE SUMMARY:

Through the Internet and literature research we have identified some thirty-six PES 'water for cities' cases. Majority of cases, that is twenty two of them, are in South America, six in Asia, three in Europe, three in Africa and two in the North America. It is not surprising that Latin America is home to the highest number of PES schemes here presented, as it is the region leading in the overall number of PES schemes.³

Figure 1. Regional distribution of identified PES 'water for cities' cases:



Out of the twenty-two PES cases in South America, five are in Brazil; three in Ecuador, El Salvador, Guatemala, and Mexico; two in Honduras; one in Colombia, Bolivia and Costa Rica. Out of the six cases in Asia, two are in Philippines and India, and one in China and Indonesia. Africa is presented by one PES 'water for cities' scheme in South Africa, one in Tanzania and one in Rwanda (although the last case has not moved beyond the feasibility study). Out of the three European cases, Switzerland, France, and Germany are represented with one case each. The two cases in the North America are in the USA, in New York and Santa Fe.

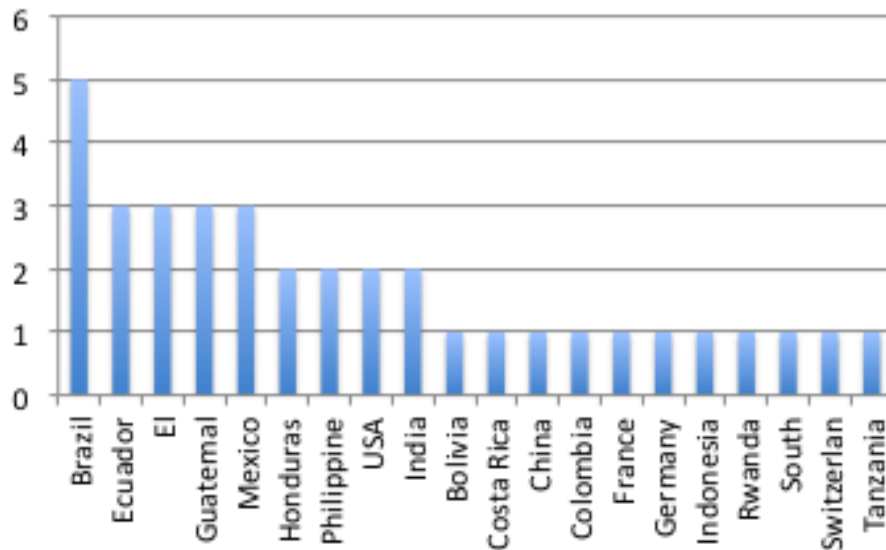
Five of the PES cases presented in the document have a national or regional character. One of them is in Switzerland, one in China; one is South Africa, and one in Brazil and one in Mexico.

³ Costa Rica in particular was the initiator of the first PES scheme and the PES term itself (that is PSA) was used there for the first time.

Figure 2. The list of PES 'water for city' cases by country

Country	No. of cases	Name of the PES 'water for city' scheme
<i>Brazil</i>	5	Lajeado (Sao Jose); Extrema; Brasilia; Rio De Janeiro; PCJ Consortium
<i>Ecuador</i>	3	Cuenca; Quito; Pimampiro
<i>El Salvador</i>	3	Tacuba; San Francisco Mendez; Sassembra, Yamabal, Guatajiangua, La Palma, San Ignazio
<i>Guatemala</i>	3	Montagua-Polochic River System; Puerto Barrions; San Jeronimo
<i>Mexico</i>	3	Coatepec; Saltillo; National PSAH Prigramme
<i>Honduras</i>	2	Campamento; Jesus de Otoro
<i>Philippines</i>	2	Kanla-on Spring Water Plant; Iloilo
<i>USA</i>	2	NYC; Santa Fe
<i>India</i>	2	Chandigarh, Bhopal
<i>Bolivia</i>	1	Tarija
<i>Costa Rica</i>	1	Heredia
<i>China</i>	1	Local Watershed Protection Schemes
<i>Colombia</i>	1	Bogota
<i>France</i>	1	Vittel
<i>Germany</i>	1	Munich
<i>Indonesia</i>	1	Lombok
<i>Rwanda</i>	1	Kigali
<i>South Africa</i>	1	Working for Water Programme
<i>Switzerland</i>	1	National PES scheme
<i>Tanzania</i>	1	Dar es Salam

Figure 3. Number of PES ‘water for cities’ schemes per country



The PES cases are referred to as ‘PES schemes’ rather than ‘PES projects’ since PES schemes are built to last, i.e. they should represent a rather permanent (sustainable) solution for the water supply problem, rather than a ‘project’ with a limited duration.

From the PES ‘water for cities’ cases listed in the report, we can conclude that there is no blueprint for setting the PES programs. The best mechanism for a specific watershed is based on what the landowners or land users are able to do to maintain the watershed and what the water users are willing to pay to maintain the ecosystem services provided by that watershed.

In the majority of cases the demand for water services mostly originates from the downstream water users, domestic water users in urban area and industries/businesses. Given the local nature of demand and the presence of a limited number of well-organized beneficiaries, it is relatively easy to mobilize the beneficiaries and involve them in the PES schemes.

The funding sources represent a mix of user fees to finance the improved management of the protected area upstream, and other sources, such as public funds, revolving funds, foreign aid, etc. A large majority of PES schemes did start with “external” seed money, from external stakeholders, and are also presently running with supplementing funds; in other words, many schemes are not financially independent. The revolving funds in South America, in financial terms and the actual conservation results have been proven a very successful mechanism, to be considered for new PES schemes.

Payments may be in cash or in kind, including labor and other inputs, one off or regular/periodic payments.

In the majority of cases land use change includes reforestation or afforestation. This suggests there is space for investigating whether these cases meet the requirements for inclusion into other market based mechanisms that is, obtaining additional funds from carbon sequestration in the future, or preserving landscape amenities or protecting wildlife and biodiversity. At the time most of the schemes were designed, there was no viable mechanism in place. However with the REDD + mechanism gaining momentum at present, there is an opportunity for bundling PES and linking these cases with this mechanism, which would be a potential source of additional income.

Development of PES schemes may also result in a number of potential co-benefits. Firstly it would be social and economic development, since PES provide a steady income for rural communities (the urban population downstream is almost always better off than the land users in the catchment area). PES also contributes to build capacities, to settle or clear land users' and property rights. Secondly, the changes in land use practices encouraged by a PES strategy could put special emphasis on investments and changes in practice that add to local natural capital and to the potential for the development of new businesses. A PES scheme for example could contribute to economic diversification by targeting, based on case-specific conditions, those ecosystem services that can contribute to ecotourism, sport fishing and hunting, agroforestry, or crop diversification. A third potential co-benefit is enhanced resilience and adaptability to climate change, by encouraging water management and agricultural practices that provide greater buffers to droughts, floods, and other stresses and shocks. In Tanzania (EPWS, Uluguru mountains), this co-benefit is realized and farmers benefit from the improved yield.

The cases presented in this report illustrate that the PES 'water for cities' schemes are multi-stakeholder affairs involving national and local (regional/municipal) governments, community groups, individual landholders, commercial enterprises, non-governmental organizations and various donors.

The drivers for the presented PES schemes vary, but are mainly focused around:

- avoiding expensive technological solutions to drinking water quality,
- acting early to protect critical watershed lands, i.e. avoid imminent water pollution induced by the change of land use practice;
- managing the risk of potential water degradation by making a preventive investment into conservation of the current water supply/quality;
- mitigation of the effects of degraded watershed in order to improve the quality of water.⁴

Clearly an early action is the most critical aspect of PES 'water for cities' schemes, as it has been very challenging to restore a heavily degraded watershed.

The participation of the private sector in PES has been so far sporadic and limited. However, the case of Vittel, Coca Cola, Florida Ice and Farm, several breweries, illustrate the feasibility and great potential of this type of PES for water quality protection.

An additional report presents 9 concrete cases, where cities or a Natural Mineral Water

⁴ These cases are the least successful in terms of quality and quantity of the water supply.

bottling company (Danone) secure their provision with measures differing from PES: Environmental Service providers are NOT paid, but other water provision securing measures are supported, like quality monitoring, sensitising stake holders, buying land, financing infrastructures ... This sector is very proactive: this second part provides an interesting insight in the creative capacities that are invested.

Recommendations

Based on the research conducted in the area of PES 'water for cities' cases around the world, and the conclusion that Payment for Environmental Services pose a potential sustainable solution for overcoming the water supply issues (current and projected), we recommend a further, full scale analysis of the PES cases presented in the document, or the analysis of a sample of core cases that may be identified based on this report, in cooperation with other services of FAO, primarily the Forestry service, given the important role of forests in almost each PES 'water for cities' case found. Bundling PES schemes that fulfil the requirements for participating in other market-based schemes, particularly REDD+ is also a potential way forward.

Given the multidisciplinary of the PES schemes, the activities can further include other UN agencies involved with PES schemes, primarily the Rome based agencies, such as The Global Mechanism (UNCCD), who is dealing with the sustainable land management (SLM) practices within the PES schemes⁵.

The large number of PES 'water for cities' cases in South America (61%) suggest that these schemes can be successfully implemented in the developing countries, in low governance contexts, provided de facto property/ users' rights are clear and an agreement can be reached between service providers and service beneficiaries⁶. This is particularly important for the East Africa region, where a number of various PES schemes have been designed, but remained at the conceptual level (see Kigali PES scheme)⁷. Given the fact that Africa is one adversely affected part of the world by climate change, and its constant and growing sensitivity to food/water shortages, the focus should be directed towards finding a best suitable model for replicating the successful PES practices in this area of the world.

Involvement of water buyers is of utmost importance: they are to be convinced in order to make PES schemes sustainable (that is to say, not depending from public funds or donors); therefore, monitoring, evaluating and reporting are of high level priorities. The effective results of PES on water flow and quality must be measured and communicated. So far anyhow, in many cases this data is absent.

⁵ Source: Ms. Siv Oystese, The Global Mechanism

⁶ PES has even the potential to improve governance structures through for example emerging demands for land title clarifications, negotiation processes, and effective monitoring and control institutions. [Rosa H., S. Kandel and L. Dimas 2003]

⁷ D Bertram:

http://www.fao.org/fileadmin/user_upload/kagera/resource/Positioning%20the%20Kagera_Bertram.pdf

II. PES 'WATER FOR CITIES' CASES AROUND THE WORLD

II. a South America

Case No 1: Chapeco – Brazil

Name of the initiative: Lajeado São José micro-watershed PES Scheme

[Source: *Watershed protection: Capturing the benefits of nature's water supply services*
Sandra L. Postel and Barton H. Thompson, Jr. 2005]

Country/Region: Brazil

Summary: An independent study by Bassi (2002), investigated the effects of this World Bank project in the Lajeado São José micro-watershed, which supplies drinking water to the city of Chapecó. Bassi's analysis showed that there was a 69% reduction in suspended sediment concentration and a 61% reduction in turbidity of the raw water entering Chapecó's treatment plant. This substantial improvement in water quality permitted a corresponding reduction in the need for chemicals to treat the water, which in turn yielded cost-savings of \$29,340 per year. These savings would be sufficient to pay back the entire cost of the Lajeado São José micro-watershed project in four years. Indeed, just one year of water treatment cost-savings exceeds the \$25,000 paid to project farmers as subsidies to encourage them to adopt land-improvement measures.

Thus, in the Lajeado São José micro-watershed, and presumably in other micro-watersheds where there is a downstream municipality, an opportunity exists to strike a deal between the municipal water supplier and upstream farmers that would more equitably split the costs and benefits of the project. The water supplier should be willing to pay a portion of the funding to upstream farmers in return for the reduced water-treatment costs. Such a transaction would transform what is now a project subsidy of limited duration to participating farmers into an ongoing compensation payment for a valuable watershed service that these farmers can continue to provide — the protection of drinking water quality.

Remark: Information found on this case is fragmented.

Case No 2: Extrema - Brazil

Name of the initiative: Extrema PES Scheme

[Source: European Environment Agency: *The Economics of Ecosystems and Biodiversity* (Cassola: *Implementation of Payment for Ecosystem Services Schemes by Local Governments: the Water Conservation Project of Extrema/Minas Gerais, Brazil*); The Nature Conservancy; and the personal communication with Mr. Paulo Henrique Pereira meioambiente@extrema.mg.gov.br and Mr. Celso DeCarvalho Celso.DeCarvalho@fao.org]

Country/Region: São Paulo, Brazil

Summary: Extrema, a city with a population of 25,000 in southeast Brazil, about 100 km from the metropolitan region of São Paulo, has successfully implemented a payment for ecosystem services scheme. Innovative initiatives like this one are likely to attract partners – strengthening both the initiative and making it an attractive model for similar projects and initiatives. This case gives an overview of the strategy adopted by the municipality of Extrema. Accordingly to the River Basin Management Plan, Extrema and three other municipalities in the state of Minas Gerais are responsible for 2/3 of the water supplied to the metropolitan region of Sao Paulo. For this reason, Extrema is a high priority area in the “Cantareira System.”

Driver: In the industrialized state of São Paulo, pollution and sediment have caused water treatment costs to quadruple since 1996 (Bradley, 2010). The “Cantareira System,” an interconnected set of reservoirs, provides more than half of the water supply to the metropolitan region of São Paulo (approximately 18 million people). Water for this system comes mainly from the Piracicaba River Basin which, including tributaries, covers 49 municipalities in two different states (extending far past the boundaries of the metropolitan region). This water system has become an object of concern due to issues related to the maintenance and regulation of water flow. The river basin experiences intense environmental degradation. Approximately 70% of the watershed is used for various human activities, suffers poor quality vegetation and the rivers have an observable reduction in water quality. Diffuse pollution from rural sources, predominantly erosion and sedimentation is a serious threat that may potentially interfere with water quality and the operations of the reservoirs.

The municipality considered the ecosystem services approach when deciding on how to improve water quality and quantity. In the late 90s, water management commenced with water quality monitoring. The municipality then carried out an assessment of its seven sub-basins and developed a Geographic Information System with environmental data and a database of all rural properties in the municipality. The assessment indicated soil degradation, forest to agriculture conversion and a loss of income for farmers.

MARKET DESIGN

Aware of its importance to the “Cantareira System,” the assessment led to the development of “Conservador das Águas” (the Water Conservation Project) with the aim of restoring forest

cover. It focused particularly on vegetation that protected riverbanks, and springs and soils with higher susceptibility to erosion. It also aimed to adopt improved soil management practices and environmental protection measures. Water quality (a decrease of sediments) and flow regulation (in increase of infiltration) are the ecosystem services central to the project. Implementation was planned in steps, with focus on the seven rivers in the territory one at a time – beginning with the rivers with the largest areas of deforestation.

Extrema established the first water PES scheme in Brazil. The local government, on its own initiative, enacted a municipal PES law in 2005 creating Conservador das Águas (i.e. the Water Conservationist Project). It authorizes the use of the municipality's own funds to support rural producers who voluntarily commit to measures aimed at soil conservation, reforestation and environmental improvement. Further regulation of the law (2006) turned to the methodological aspects of the project – providing guidelines for its practical implementation.

Payment mechanism: Participating rural producers (farmers) commit to individually defined targets based on the full environmental state of their property. They are paid monthly for a period of four years. The payment is based on the total area of their property and on a reference value defined by the municipal administration (equivalent to ~87 USD/hectare/year in 2009). In order to continue receiving monthly payments, the farmer must demonstrate compliance. They are rewarded for their commitment and are also supported in implementation of the environmental improvement measures.

Supply: This initiative has attracted 100 farmers so far (approximately 2,821 ha), according to institutions involved in the project. To date, more than 438 ha have been restored. In most cases restoration has involved closures of areas used for cattle ranching or agriculture so that vegetation on riverbanks and around springs can recover. The project still has a long way to go (it is now addressing the second of the seven sub-basins) but it continues to expand. In 2009, the Municipal Fund for Payment for Environmental Services was established with the goal of extending payments to rural producers for a period longer than the four-year term.

The case of “Conservador das Águas” is an example of the role of investment in the capacity for local government to meet environmental goals. This process, from the initial engagement of the municipality in river management issues to the first payments, took more than a decade (1996 to 2007). Between 1996 and 1998 the municipality participated in a project with the Ministry of Environment aimed at fostering decentralized river basin management. Realizing that successful management measures were not possible in the context of a lack of information about its water resources, Extrema launched the project “Água é Vida”, or “Water is Life”. This project, financed by the Ministry of Environment and Extrema's own resources, assessed the sub-basins and was a building block for the Water Conservation Project. A study is currently being carried out to determine the exact costs of the PES scheme because it involves multiple partners who contribute both cash and in-kind contributions. It is estimated that one third of costs are related to the PES itself (including payments, personnel and administration) and that the rest is directed towards implementation of soil conservation measures and reforestation on farms.

Stakeholders: The municipality of Extrema has a history of environmental commitment. Extrema's long-term commitment to environmental issues has been recognized through prizes

received even before initiating the “Conservador das Águas” project. This commitment, supported by administration and management for the past two decades, could be considered an important contributing factor to the project’s success. In addition, the pioneering character of Extrema’s initiative attracted diverse partners, including The Nature Conservancy⁸ (TNC), the National Water Agency (ANA), and the forest agency of the state of Minas Gerais (IEF). These partners offered financial and/or technical support that strengthened the project’s development. In addition to that the municipality is forming partnerships (five-year contracts) with the production industries such as the biscuits producer - the Bauducco company who makes monthly contributions to support this PES initiative. The municipality signed an agreement with a milk company as well, which pays 10% more to producers who participate in the Project for the Conservation of Water. The list of contributors in this scheme is rather long, and it includes quite a few NGOs and private funds as well.

Costs: The following table shows the evolution of PES in the last 5 years.

YEAR	Nº CONTRACTS	HECTARES	VALUE PES (R\$) / USD
2007	21	459,18	16,164,66 (USD 9,877)
2008	14	300,88	106.858,15 (USD 65,296)
2009	26	725,08	226.101,39 (USD 138,161)
2010	15	866,70	340.528,56 (USD 208,083)
2011	24	470,04	66.767,90 (USD 40,798)
Total:	100	2.821,88	756.420,66 (USD 462,218)

The municipality and the private funding invest approximately R\$ 1,500,000.00 (Brazilian Real) per year. It is approximately 900,000 USD. The city administration contributes with R\$ 500,000 .

⁸ On April 1, 2008, The Nature Conservancy (TNC) launched the Plant a Billion Trees Campaign, an online fundraising campaign to support its efforts in the Atlantic Forest of Brazil. The goal is to bring the Atlantic Forest back from the brink of destruction by regenerating large tracts of native forest through an ambitious large-scale reforestation plan. In addition to replanting the 2.5 million acres by 2015, the program will also help connect more than 12 million acres in new forest corridors.

Since 2007, The Water Conservation Project has been included in a broader initiative instigated by the Water Agency (ANA) that aims to conserve and foster natural restoration of local water resources. It plans to establish PES schemes in which water usage fees are collected and used as a financial resource in priority Brazilian river basins. This broader project, called Produtor de Água (Water Producer), has selected the Piracicaba Basin for its pilot scheme. Extrema and two other municipalities in the state of São Paulo are included in the scheme and payments are likely to start soon.

The adoption of three kinds of practices will be rewarded with financial incentives: riparian forest restoration, forest fragments conservation and soil conservation. Payment values are based on local land-use opportunity costs, the area of the property committed to the project and the quality of the environmental services provided. The program includes the 100 farmers in Extrema, the soil conservation area of 510 ha, the conservation of 540 ha of forests and the restoration of 218 ha in Joanópolis and Nazaré Paulista (the other two municipalities). Other studies are currently in progress to verify the possibility of program implementation in other municipalities in the same region.

This pilot initiative has been replicated in the Guandú watershed (also located in the Atlantic Forest region), a vital source of drinking water for about 7 million people in the city of Rio de Janeiro. The initiative has also been replicated in the Pipiripau basin, where ANA and TNC are developing plans for the scheme because it is an important source of water for the Federal District. The Camboriú watershed, one of the most important tourist centers in southern Brazil has also used the initiative as a model.

As another outcome, the São Paulo state government proposed the introduction of a state PES policy that focuses on areas where the economic potential for providing environmental services is greater than the economic potential for agriculture – strategic areas for the provision of drinking water and areas of special environmental interest.

Case No 3: Brasilia - Brazil

Name of the initiative: Brasilia Water Producer Program

[Source: *The Nature Conservancy* <http://www.nature.org>]

Country/Region: Cerrado, Brazil

Summary: In June 2010, The Nature Conservancy launched a PES program in the Cerrado region of Brazil that will help protect the freshwater supply of Brasilia. Known as the Water Producer Program, it will compensate rural landowners who help improve water quality and quantity by restoring or preserving grasslands along streams and by implementing best management practices on cropland and cattle ranches. The Water Producer concept was first developed by Brazil's National Water Agency (ANA). ANA has partnered with the Conservancy to implement projects throughout Brazil, beginning with the Piracicaba-Capivari-Jundiá watershed in southeast Brazil in 2007, which was supported by the Great Rivers Partnership.

Stretching across more than 500 million acres of Brazil's central plateau, the Cerrado is one of the richest tropical savanna regions in the world. It feeds three of the major water basins in South America: the Amazon, Paraguay-Paraná and São Francisco rivers.

The Water Producer Program was launched in the Pipiripau River watershed, one of the headwater streams of the Paraná River. More than 180,000 of Brasilia's 2.6 million residents depend on the Pipiripau for water.

Driver: In recent years, the Brazilian Water Supply Company (CAESB) has seen an increase in water treatment costs in the Pipiripau watershed due to soil erosion and nutrient runoff from surrounding agricultural lands. The Cerrado region is a major producer of beef cattle, corn and soybeans, and more than half of the extensive Cerrado grasslands have been converted for ranching and agriculture.

MARKET DESIGN

Over the next five years, 3,280 acres of grassland will be restored and another 10,665 acres will be conserved as part of the Pipiripau Water Producer Program. Soil preparation and seedling production began in June and planting start in October 2010.

Similar to forests, grasslands hold water and help minimize erosion, keeping sediment and nutrients on the land and out of the rivers. Landowners are compensated for "producing water" on those portions of their land where native grasslands have been maintained or restored.

Funding: Sources of funding for the payments to landowners are will likely be similar to other

Water Producer projects where water-dependent industries and other water users in the watershed help fund the program.

This initiative is important not only because it is the first program in the Cerrado, but also because it recognizes the important role that grasslands play in protecting water quality and supply. If successful, it is likely this program will be replicated in other watersheds that provide water to the citizens of Brasilia.

Remark: Information found on this case is fragmented.

Case No 4: Rio De Janeiro – Brazil

Name of the initiative: Water and Forest Producers Program

[Source: *The Nature Conservancy* <http://www.nature.org>]

Name of the initiative: Water and Forest Producers program

Country/Region: Rio de Janeiro, Brazil

Summary: In May 2010, an innovative program designed to help protect the freshwater supply for Rio de Janeiro, Brazil's second largest city, was launched in the municipality of Rio Claro in the Guandú River watershed. Known as the Water and Forest Producers program, it will compensate rural landowners for forest restoration and land management efforts that protect freshwater resources. The rivers of the Guandú watershed provide about 80 percent of the fresh water and generate 25 percent of the electricity used by residents of the Rio de Janeiro metropolitan area, benefiting almost eight million people.

Maturity of the initiative: ongoing since 2010.

MARKET DESIGN

Service: Protection of forest, water resources, and provision of fresh water

Commodity: Clean drinking water; water quality

Supplier: The rural landowners in the Guandú River watershed

Stakeholders: The Water and Forest Producers program, which is modeled after water producer programs operating in other parts of Brazil and South America, pays rural landowners for the environmental services they provide — in this case, the protection and production of water resources. The Water Producer concept was first developed by Brazil's National Water Agency (ANA), which has been partnering with the Conservancy in the implementation of the projects throughout Brazil.

Forests hold water and help minimize erosion, keeping sediment and nutrients on the land and out of the rivers. Landowners are compensated for “producing water” on those portions of their land where trees have been planted or forests fenced off from cattle and restored.

Funding: Part of the funding for the payments comes from fees levied by the local watershed committee on water-dependent industries and other water users in the Guandú River watershed. Payment amounts vary depending on the location of the land, the quality of existing forests and the amount of revenue the landowners would have received if they used their land for economic activities such as cattle ranching or dairy production.

Remark: Information found on this case is fragmented.

Case No 5: PCJ Consortium – Brazil

Name of the initiative: PCJ- Inter-municipal Consortium in the Piracicaba, Capivari and Jundiá Basins

[Source: *Markets for Watershed Services - Country Profile Ina Porras and Nanete Neves – 2006*]

Country/Region: Brazil, State of Sao Paolo

Summary: Due to reduction in water quantity and quality, the municipal water utilities and some businesses in the area of the watersheds of the Piracicaba, Capivari and Jundiá rivers (PCJ) formed an Inter- Municipal Basin Consortium (PCJ) to manage a watershed protection fund (1999). So far, contributions to the fund come from the revenue of the water utilities not an extra charge on water users. The idea is to protect the water 'generating areas' (along water courses), improve waste management, water use efficiency, etc. Interesting legislation issues: a) the complications of setting up a scheme where one municipal water utility is required to invest outside its territory, resulting in the creation of the inter-municipal PCJconsortium, and b) this scheme helps landowners rehabilitate graded areas (along the margins of natural water bodies) that were meant to be protected under the national Forestry Code.

Status: *Ongoing since 1989* (contributions officially began in 1999)

Driver: Problems with water quality, especially in dry periods (due to proximity to urban areas and intensive agriculture and industrial activities) and reduction in water quantity due to sedimentation of the riverbed. In the case of Piracicaba in particular, water had to be sourced from the Corumbataí sub basin instead of the main Piracicaba river as due to declining water quality and flow this had ceased to be a viable source.

Stakeholders

Supply: *Private landowners:* The money is being used to establish nurseries and for forest restoration along riverbanks and in other crucial areas. Landowners whose land falls into this category are invited to participate in the project (see also Legislation Issues). **Demand** *Local government.* There are eight cities with approximately 550,000 inhabitants (Piracicaba 360,000); there are sixty-two municipalities in the area of the three basins (of which forty are part of the PCJ consortium); In addition, water supply for 55% of the population within the Metropolitan area of Sao Paulo is sourced from the Piracicaba river (31m³/s), although this is a potential source of demand since they are not contributing at the moment; there are eight municipalities in the Corumbataí sub-basin, but so far only Piracicaba and Santa Gertrudes are contributing.

Municipal water (and sanitation) utility of Piracicaba (SEMAE - *Serviço Municipal de Água e Esgoto*). SEMAE contributes with R\$0.01 (=US\$0.0045) per m³ of distributed/consumed water (only drinking water supply). Industrial and irrigation users are not required to contribute to the

PCJ fund, although some of them may do so of their own accord. For more information on the members of the consortium see www.agua.org.br

Intermediary: *Trust (local government and businesses)* PCJ Consortium – Inter-municipal Basin consortium of the Piracicaba, Capivari and Jundiaí rivers (in English): composed of municipalities and private companies.

MARKET DESIGN

Service: Water flow regulation (maintenance of dry season flows); water quality maintenance/improvement; erosion and sedimentation control.

Commodity: Rehabilitation of degraded ecosystems along riverbanks.

Payment mechanism: Pooled, intermediary-based transaction: Priority areas and amounts to invest are decided among the members of the PCJ (municipalities and businesses within the basins of the three rivers). Each municipality elaborates an annual action plan that is then presented to the PCJ for funding allocation.

Terms of payment: *In-kind and one-off:* participants receive a reforestation plan (including approval by the relevant environmental authorities and technical assistance) and (native) tree seedlings; plantation and maintenance are responsibility of the landowner; there are no further incentives given after this initial phase. ii) Users: SEMAE contributes R\$0.01 (=US\$0.0045) per m³ of distributed/consumed water, but this does not involve an additional charge imposed on the final users.

Funds involved: With the pooled contributions from state and federal institutions and the private sector, the annual investment amounts to about R\$ 1 million. According to a spokesman, if all municipalities within the basins of these three rivers contributed, this annual amount could double to R\$ 2 million/year. (http://www.riob.org/relob/relob_bpiracicaba.htm). The PCJ consortium also sources funds from national programmes for reforestation and natural resource management (for example the FNMA: National Fund for the Environment, FEHIDRO- Federal Fund for Water Resources).

Cost Benefit Analysis

Economic

Costs: For the participating users (SEMAE): a contribution of R\$0.01 (=US\$0.0045) per m³; the end users have no extra costs.

Non-participant water users are considered to 'free-riding', as they do not pay for water at all. Although there is no evidence that reforestation will have effects on water quantity.

Benefits: It is claimed that both middle and end users benefit from avoiding increased water charges (costs of sourcing water elsewhere, or treating it further) but without evidence of the impacts of the reforestation if this cannot be substantiated.

For the provider i.e. the participants in the reforestation programmes there are no direct financial benefits, as there is no payment beyond initial support to implement the reforestation plan.

Environmental

Up to this point, reforestation has been targeted at riparian areas, but the objective is to rehabilitate the surviving patches of Brazilian Atlantic Rainforest (Mata Atlântica) still in the area. It is not clear if the objective is for the sake of the water resources or for biodiversity in general. In addition to reforestation of riparian areas, PCJ's action plan includes: organizing a programme to source financing for a liquid and solid waste management scheme, environmental education and technological improvements (to reduce water loss). At this point in time, it is still very early to notice any improvements in the water, but the system is at least expected to avoid any further damage.

Social

For the providers participating in the scheme: the areas targeted by these annual municipal reforestation plans are areas that are “permanently protected” by law, Even if the participants do not receive any post-plantation incentives, they are being assisted to comply with the law. This may be their main benefit although there is no evidence on whether and to what extent they perceive assisted compliance as a benefit.

For users/providers in the municipality: increased environmental awareness raised by SEMAE environmental education programmes, already ongoing for over twelve years. The actions supported by this scheme target primarily environmental problems; their social implications do not appear to be a concern at this point. Impacts on vulnerable social groups have not been identified and it is stated that this is not an area with particular poverty issues, therefore this has not been of particular concern in the design of the scheme.

Legislation Issues

The scheme began unofficially, in Piracicaba, with a contribution of 1% of SEMAE's annual revenue -worth about \$2,500/month in 1998 - to the Municipal Environment Council which comprised representatives from private, NGO and public sectors; at the time, the problem was how to legalize investment from one municipality across the whole watershed. In 1999, a municipal law was passed to overcome the initial legal impediment of having one municipality investing in an inter-municipal unit (the watershed), provided the funds are invested in the management of the watershed. The PCJ consortium was created to amalgamate municipal contributions and manage their investment.

According to the Forestry Code - federal law 4.771 of 15/09/65, the forests and other natural vegetation formations located along the margins of natural water bodies, such as rivers, lakes or lagoons or man-made water reservoirs, are designated as “permanently protected”. Despite this, such areas have suffered degradation, and the offer of the PCJ to help the landowners in their rehabilitation, may be an incentive to participate in the scheme.

Monitoring: Monitoring is frequent but insufficient due to the lack of resources: monitoring of compliance is still one of the main problems and there is a need for additional funding to ensure more effective monitoring.

Main Constraints

The main difficulties for the implementation and success of this initiative: very limited funds are available (current investment in reforestation is insufficient to ensure that the reforestation/ rehabilitation is achieved within a useful time period – it will take over 100 years at current level of investment) due to low contribution levels and not enough demand captured, . Funds would increase significantly if the scheme could engage demand from the Sao Paulo Metropolitan area, since 55% of its water supply is drawn from the Piracicaba watershed. Also, there is a lack of awareness about the environmental impact of intensive agriculture and industrial activity in the area and lack of evidence on the impacts on water supply and quality of the reforestation programmes.

The introduction of charges for raw water use for Federal waters (spanning more than one state) in January 2006 and for state waters (in process of implementation) is expected to increase the resources available for management of the resource. It still remains to be seen how much of this will be directed to land management activities.

Main Policy Lessons

The decentralized management of water resources can be useful as it captures local resources for local needs; ii) in this case, a big part of the problem is non-point source pollution affecting water supplies, although the lack of proper treatment of waste waters also becomes a problem. If contributions from users remain at the level, the initiative is unlikely to remain financially self-sustainable and environmentally effective.

Remark: Data to be updated.

Case No 6: Tarija – Bolivia

Name of the initiative: Tarija/Sama Biological Reserve PES scheme

[Source: Markets for Watershed Services -Country Profile *Ina Porras and Nanete Neves – 2006*]

Country/Region: Bolivia

Summary: NGO-led initiative to increase funding for the management of the Sama Biological Reserve, containing the two watersheds that supply water to the city of Tarija. No payments are being made by water users but in 2004 watershed conservation group PROAGUA was established as a discussion forum with representation from private and public users and providers. Several preparatory studies have been conducted which show that there is a connection between land use and water availability and avoided costs and that there is willingness to pay (WTP) downstream; however no scheme of payments has been applied yet due to "the negative political environment for creating a 'new tax' and, on the provider side, unclear property rights would make payments to providers a difficult and contentious process" Robertson and Wunder (2005)

No payments are being made by water users, but there are plans to introduce them. WTP exists but there is no political will to implement. More 'preparing the ground' work has been conducted than in most other ongoing PES schemes. A watershed conservation fund established in 2002, and in 2004 a new private institution, PROAGUA, was set up to protect the water resources that serve the city and surrounding villages.

Driver: The NGO PROMETA has been promoting this initiative from the start. Funds were established to finance the protection of Sama Biological Reserve and its watersheds: Victoria and Tolomosa. Tarija, a city of 140,000 inhabitants, does not have continuous water supplies, in large part due to irregular water management (<http://www.ipsnews.org/interna.asp?idnews=26772>)

Stakeholders

Supply: Landowners within the Sama Reserve (farmers and ranchers): The reserve status permits human habitation and exploitation of natural resources for subsistence use within the protected area. About 25 communities live inside the reserve, with a total population of 4000 inhabitants.

Demand: *Current demand:* international donor, TNC (The Nature Conservancy). *Future demand* the city of Tarija: 145,000 domestic water users. 75% of Tarija's drinking water comes from the Victoria River via a cement-covered canal. The Tolomosa River, to the west, provides at least 30% of the irrigation water to farmers in the Central Valley. The San Jacinto Dam on the Tolomosa receives 80% of its water from the Sama Reserve.

Intermediary: PROMETA (Foundation for Protection of the Environment of Tarija)

Facilitator: TNC; *members of PROAGUA:* public institutions: Council of the Department of Tarija, local government of Tarija and San Lorenzo, National Service of Protected Areas; *private institutions:* Rural Labour Federation of Tarija, Public Services Cooperative of Tarija, Civic Committee of Tarija and PROMETA;

MARKET DESIGN

Service: *Increased water quantity* (for domestic and irrigation users) and *sedimentation reduction* (at the dam) from avoided forest fires.

Commodity: Unclear at this stage. Although some of the projects sponsored include reforestation and some best- management practices through fire control. **Payment mechanism** At the moment the scheme is donor-funded, but PROAGUA has been established and is expected to pool contributions from some of its members in the near future. PROMETA conducts watershed protection activities upstream, in a project-based manner.

Terms of payment: In-kind. Upstream landowners participate in PROMETA's conservation projects.

Funds involved: watershed conservation fund, financed entirely by external donors; in the future, they expect to set up a trust fund (working only with the interest generated) that will be financed by tax on urban water consumption and external donors. Domestic charges are US\$2.6 per month/ household. Demand for irrigation is high and increasing; Hydroelectric Company San Jacinto provides 25% of Tarija's electricity supply

Cost Benefit Analysis

Economic. Baseline studies. PROMETA conducted studies quantifying both water-consumers' willingness to pay for watershed protection and the economic losses that would be incurred without protection.

i) a contingent valuation measuring water *consumers' willingness to pay* (WTP) for watershed protection either in cash (annual average of US\$15 per urban household) or labour (24 work-days, equivalent to US\$75.6 per rural household which is much greater than the urban contribution on a per-capita basis)— rural users currently do not pay for water. Based on this valuation, "the total calculated value of the environmental service provided by Sama to the urban and peri-urban rural consumers is US\$484,134 per year." Robertson and Wunder (2005)
ii) an *avoided cost method analysis* for the Tolomosa dam looks at the costs if the dam reservoir dipped below its functioning capacity due to decreased dry-season flow. Sediment accumulation has not been quantified. A "without" project scenario indicates that water flows will drop 28% in the dry season, resulting in a loss of approximately US\$236,832 in revenue during the dry months. In 2002, the critical water level was not reached and the dam did in fact incur major revenue losses. (Brezo and Crespo, cited in Robertson and Wunder, 2005). Also, the study looked at the effect of reduced dry season water flow on the water cooperative's revenue: "with a 15% decrease in water level in the Victoria watershed, the water cooperative would lose

US\$22,283 in annual revenues." (Brezo and Crespo, cited in Robertson and Wunder, 2005) Based on this valuation the value of the environmental service to be protected by the watershed protection fund is US\$743,249 per annum. (WTP from urban and peri-urban rural consumers - US\$484,134 per year - and estimated avoided costs from the water cooperative and San Jacinto Hydroelectric - US\$259,115 per year. (Brezo and Crespo, cited in Robertson and Wunder, 2005)

Environmental: *Current situation.* Annual rainfall of 600mm; activities being sponsored by the fund: fire control, reforestation (a 2-year native species reforestation project in the headwaters of the Victoria river), control of soil erosion and improved agriculture; enclosure and patrolling of protected areas.

To provide a basis for the establishment of the PES system, PROMETA began an environmental education campaign, a reforestation project, and a fire control project. It also conducted a hydrological study (based on existing data entered into predictive hydrological models), which concluded that: "further deforestation (mostly through uncontrolled burning) and land-use degradation of natural grassland and shrublands (from expanding agriculture, ranching and population growth) would have substantially adverse effects on dry-season flow." Robertson and Wunder, 2005 p.54

Social: Institutional strengthening of Tarija's water cooperative through creation of a water management association - the Association for the Protection of Water Sources of the City of Tarija and Surrounding Communities (PRO-AGUA, in its Spanish acronym) in 2004. This association builds on the existing water cooperative (responsible for water collection, treatment and distribution), and includes 7 other private and public bodies (PROMETA, regional and municipal authorities of Tarija, the National Protected Areas System and the agriculture laborer's union).

Legislation Issues

Land use restrictions within the Reserve are unclear.

Main Constraints

Despite the encouraging results of both the hydrological predictions (showing a connection between land use and water availability) and valuation studies (showing WTP and highlighting avoided costs), PROMETA has not yet implemented a scheme of payments to protect the watershed. According to Robertson and Wunder (2005) the reason for this might be the negative political environment for creating a 'new tax' and, on the provider side, unclear property rights would make payments to providers a difficult and contentious process. Instead, PROMETA has been working on a more strategic level by creating PROAGUA, the watershed conservation association.

Main Policy Lessons

This project provides important lessons regarding public perceptions and institutional credibility (Robertson and Wunder, 2005). In this case, no political support exists despite detailed

background studies showing a connection between changes in land use and their effect on the environmental services and willingness to pay from users. The creation of a discussion forum (PROAGUA) is expected to provide the platform for engaging, and become the driving force towards watershed protection. Its success will depend, ultimately, on its institutional capacity, credibility and strategy.

Remark: Data to be updated

Case No 7: Bogota – Colombia

Name of the initiative: Chingaza and Sumapaz National Parks PES Scheme

[Source: *The Nature Conservancy* <http://www.nature.org>]

Country/Region: Colombia

Summary: 8-million residents of Bogota obtain water from Chingaza and Sumapaz national parks. Borrowing strategies from the realm of high finance, the Conservancy has created a conservation trust fund to protect rivers and watersheds in Colombia — and help provide clean drinking water to Bogotá. The fund will attract voluntary contributions from Bogotá's water treatment facilities to subsidize conservation projects, from strengthening protected areas to creating incentives for ecologically sustainable cattle ranching, that will keep sedimentation and runoff out of the region's rivers.

Status: Ongoing since April 2008.

MARKET DESIGN

Service: protection of rivers, watershed and provision of clean drinking water.

Commodity: drinking water for citizens of Bogota

Driver: Without such projects, the facilities have to spend millions to remove the pollutants in order to provide clean drinking water for Bogotá's 8 million residents.

Stakeholders: This initiative brought together a broad range of public and private stakeholders, many of which had never collaborated before, to navigate complex regulations and broker the landmark agreement. All these efforts culminated on April 16, 2008, when Mr. Samuel Moreno Rojas, mayor of Bogotá, and dozens of other community and business leaders gathered to launch the new water fund. Bogota's mayor said that this plan is voluntary and will not raise water costs for residents, while helping the city to save on treatment costs.

According to a study undertaken by the Nature Conservancy and its partners, water treatment facilities in Bogotá could save \$4 million per year by proactively investing in watershed protection.

Funds involved: The fund, based on a pilot program in Ecuador, is projected to raise \$60 million for conservation projects over the next 10 years. Partners will work to grow the Bogotá water fund by securing additional investments from national agencies. The fund will be managed by a board, which will include representatives from the Conservancy, the water companies and other stakeholders, including Bavaria, a brewery and one of the biggest private companies in Colombia. Bavaria donated \$150,000 to start up the fund. Guidelines are also being developed for how funds will be dispersed and overseen.

Conservancy donors in the United States provided the seed money that enabled in-country staff to launch both of these funds. The Conservancy has plans to implement six more such funds in South American countries in the next two years.

Remark: Information found on this case is fragmented.

Case No 8: Heredia - Costa Rica

Name of the initiative: Costa Rica ESPH (Heredia Public Services Enterprise)

[Source: Email communication with Mrs Ing. Vivian Solano Valverde, vsolano@esph-sa.com; and Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Name of the initiative: Costa Rica ESPH (Heredia Public Services Enterprise)

Objective and size of the project: maintain water quality and regulate flows; total area of the watershed is 11 339ha, the contracted area is 871 ha (2010)+ 25 ha very fragile areas (400 000USD bought by ESPH)

Status of payment and activity implementation, duration: ongoing since 2002, project till 2018. Contracts with providers: direct payments to landowners for conservation activities, natural regeneration:140 USD/ha/year (For reforestation, payment is 700 USD/ha in the 1st year).

Suppliers: 35 land owners

Costs: Payments: 40 % of incoming funds. Administrative costs , land acquisition: 60%. Monitoring is done through the Geographical Information System and visits on the field.

Funding source: private water utility company, on behalf of 66 000 buyers (0.16 USD / cubic meter); private company (brewery, water bottling, fruit juices producing) till 2005, not after; total annual water fee contributions 2008: 100 000 USD.

Main partners (providers, users, main intermediary/facilitator): Service providers: 35 contracts (land owners); funders; intermediaries: FUNDECOR. State entities: ARESEP (Autoridad Reguladora Servicios Publicos); Área de Conservación de Cordillera Volcanica Central (ACCV).

Practices adopted: forest protection is main aim of the project, natural regeneration, reforestation of underused land.

Results so far: No quantitative evidence on the impacts on water flow and quality. Water quality remains at initial, high level. Social impacts: environmental education, social infrastructures (bridges, roads), increasing land tenure security.

Additional remarks:

The company pays very little for the water extraction rights (*Canon de Agua*). Some people argue that it is only fair that they should pay additional money for the environmental service but even that is not enough. This situation was likely to change with the application of the new Water Fees law (*Canon del Agua*), approved in 2006.

FUNDECOR deals with monitoring through Geographical Information Systems (GIS) and field visits.

The main constraint is one-to-one negotiations with the company are lengthy and expensive. However, these types of negotiations have contributed to capacity building in FONAFIFO and helped them design the stream-lined certificates (CES) to deal with private firms (see CES in this review).

This case presents an example of how to increase the attractiveness of the scheme, by pooling contributions from different users to increase the payment level in a priority area. The owners of FLORIDA ICE AND FARM are also the main investors in the Melia Hotel, which is now paying for watershed services in Guanacaste. The company also pays 1 colon (about US\$0.002) per bottle of water sold, and an additional 1 colon per bottle recycled, to the National Park Foundation.

Remark: Data to be updated.

Case No 9: Cuenca – Ecuador

Name of the initiative: Cuenca City - Land Acquisition & Watershed Protection Project

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country and region: Ecuador

Summary: In 1984, the Cuenca municipal water utility, ETAPA, introduced a surcharge on the water bill to finance watershed management projects; other water users contribute with annual payment. Funds are pooled into a water fund, administered by representatives from users and providers. No cash payments are made directly to landowners but investment in watershed management (mostly by buying and directly managing critical areas) and increasing efficiency in water use. The project provides loans and technical advice to farmers in the mid-watershed to help them increase their water use efficiency. Once the loans are repaid, somebody else can benefit from a loan as well.

In the early 1980s, ETAPA developed a municipal master plan for water, which included three main strategies: water supply, rational water use and wastewater treatment. Since 1984 ETAPA has invested more than US\$2 million in watershed conservation, especially through land purchases and direct administration of critical areas. What began as a land acquisition programme developed into a programme of integrated management of water resources, which includes protection of watersheds, rational use of water and treatment of waste water. (Echavarría et al 2003)

Maturity of the initiative: Mature - set up in 1984.

Driver: Recognition of importance of forests to water supply and growing competition for water downstream.

Some of the water threats faced by ETAPA are: (1) Over-use of the resource: more water has been assigned than is available, as shown by the study of the Machangara watershed developed with the Water Resources National Council. (2) Erosion: Sedimentation of reservoirs is a problem for hydroelectric generation, as well as for drinking water and irrigation systems. (3) Wastewater pollution: the operation of industries, a meat processing plant and many flower plantations, added to untreated wastewater from rural communities has seriously affected water quality. (see Echavarría et al, 2003)

Stakeholders

Supply: Public national park and private landowners. The city of Cuenca has four main river watersheds: Machángara, Tarqui, Yanuncay and Tomebamba. These four rivers are tributaries of the Cuenca River. At present, the two main watersheds, Machángara and Tomebamba provide 17.5 m³/s to meet the city's demand (60% and 40%, respectively). Machangara also

serves 50% of the city's industrial park, cattle ranching and fish production, and hydropower. At present almost 50,000 hectares in the Cajas National Park (in the upper parts of the Tomebamba river) and the Machangara Watershed have been protected. The midsections of the Machangara watershed are under watershed management through the Machangara irrigation users.

Demand: Local government through the municipality. Contributions from water users (drinking water, hydroelectricity, irrigation) are pooled by the watershed council. ETAPA is the Municipal Enterprise for Telecommunications, drinking water, sewers, and environmental management in Cuenca-Ecuador and it is the biggest contributor to the scheme. Since 1984 it has invested more than US\$2 million in the conservation of the watershed, especially through buying and directly managing critical areas. The watershed serves more than 260,000 inhabitants in the city.

The four watersheds provide water for the following uses: Drinking water for the municipality; Irrigation for potatoes, grains and other crops; Cattle raising for milk production; Recreational activities for local, national and international tourism such as fishing and hot springs. Also Elecaastro, the electricity utility company generates 50% of the electricity for Cuenca city and the provinces of Cañar and Morona.

Santiago from the Machángara River. Cuenca's industrial park takes water directly from the Machángara River. There are also trout farms within these watersheds. **Intermediary Local government-led - Users Council.** In July 1998, with the leadership of ETAPA, a Watershed Council was created in order to build an adequate legal framework that guarantees the conservation of the resource in all the watersheds involved, with the participation of the water users (Lloret, 2000). This council has nine member institutions: the electrical utility company (Elecaastro), the Center for the Economic Development of Azuay, Cañar and Morona Santiago provinces (CREA), the National Water Council (CNRH), Cuenca University, the Azuay provincial government, the Environmental Ministry, the water irrigation boards of the Machángara river (that includes 4,500 families who use a major irrigation canal in the lower part of the watershed), the municipality's environmental council and ETAPA.

MARKET DESIGN

Service: Regulation of water quantity (through improvements in water use) and water quality through reduction in sediments.

Commodity: *Best management practices* through watershed protection contracts in the mid-sections of the watershed. *Conservation and protection of existing ecosystems*, through management of a National Park and purchase of over 8,000 ha of land by ETAPA in the upper parts of the watershed.

Payment mechanism: *Pooled transaction/user fees. Intermediary-based* through a stakeholder council. The water utility (managed by the municipality) imposes a 5% surcharge on water bills and a local hydropower company (ELECAUSTRO) has contributed significant annual sums to the fund. The fund is administered by a multi-stakeholder group that makes decisions on the use of the income. A secretariat coordinates disbursements, technical assistance and field visits.

There are no direct cash payments to farmers. The project provides loans from a revolving fund and technical advice to farmers in the mid-watershed to help them increase their water use efficiency.

Type of payment: *From users:* continuous cash payments based on water bill collection from ETAPA, and periodic (mostly annual) from ELECAUSTRO).

For farmers in the mid-watershed. No direct cash payments are currently used. There is technical assistance and loans in improving water use and productivity in the farm. ETAPA is currently considering a payment for environmental services to farmers in the Yanuncay watershed to encourage forest conservation.. It carried out a feasibility study (also for Yanuncay watershed - in 2005 ETAPA was planning to start extracting water from there to expand its drinking water system).

Funds involved: Costs of watershed protection to date amount to more than US\$2 million. No figures for benefits.

Cost Benefit Analysis

Economic: Farmers in the mid-watershed benefit from credit access to improve their production. Technical assistance supports and encourages technology transfers. No information is available about the number of families who benefit from the loans and technical advice.

Activities implemented by the Machangara Council:

- Technical assistance to a savings cooperative with 55 active members in Chiquintad for the development of an ecotourism operation in a native forest.
- Created community nurseries with over 50,000 trees.
- Training in production of native tree species.
- Creation of sixty family gardens that provide food for the families and allow some surplus to be sold locally.
 - Improvement of pastures.
 - Soil conservation program.
 - Community training in pastures, family gardens, rational use of water and beekeeping for adults and children.
 - Honey production with eighteen women from the Sidcay town.
 - Use of non-forest products.

Environmental

Water losses are reduced through more efficient use of water for irrigation. Farmers switched from irrigation by flooding (which caused considerable soil loss) to drop-irrigation and the use of greenhouses. Purchase of critical areas and management of the park in the *paramo* area guarantees the protection of important recharge areas.

Environmental activities implemented by the Machangara Council:

- Studies to analyse and implement solutions to control the damage caused by the landslide of the Soroche stream.
 - Water quality and soil studies in the watershed.

- Installation of four meteorological stations, connected to the network in the Paute watershed.
- With the National Water Resources Council, a comparative study of available water versus the water designated for all users in the watershed.

Social: Farmers are happy with the results, and by paying back their loans they support the fund and allow other farmers to access credit. Field visits and exchanges among farmers are encouraged by the council. Capacity building, environmental education and alternative income activities are encouraged.

Activities implemented by the Machangara Council:

- In a participatory process, a Development Plan was designed for the 110 member Board of Irrigators of the Machangara, which then evolved into the preparation of a Development Plan for Chiquitad, a small town of 3,000 people.
- With three towns, totalling 6,000 people the first phase of a reforestation plan of the mid-upper part of the watershed was developed. 144 hectares were planted with 86,400 trees, which has greatly improved the relationship between the electrical utility and the community.

Legislation issues: Supporters of this initiative are enthusiastic about the way that local solutions have been discussed and found for local problems, within existing regulations and without involving national government.

Monitoring: Monitoring is done through the Secretariat. It is not clear what happens with non-compliance.

Main Policy Lessons

The project offers several important lessons. The creation of a multi-stakeholder committee that involves both users and "providers" encourages the feeling of ownership and provides a useful platform for discussing water issues. The use of a revolving credit fund (instead of direct payments) ensures that smaller amounts of money go further, and reduces the expectation of subsidies from the farmers. By encouraging water-saving activities and protecting important recharge areas the project is able to ensure the availability of water flows (rather than assuming that protection of forests or *paramo* will increase flows). The project presents an excellent example of where local groups gather together and deal with a local problem rather than waiting for a national-level solution.

Remark: Data to be updated.

Case No 10: Quito – Ecuador

Name of the initiative: Quito PES Scheme

[Source: *The Nature Conservancy* <http://www.nature.org> and *Watershed protection: Capturing the benefits of nature's water supply services*, Sandra L. Postel and Barton H. Thompson, Jr. 2005]

Name of the initiative: Quito PES Scheme

Country and region: Ecuador

Summary: Quito, the capital of Ecuador, is home to more than 1.5 million people, Quito derives about 80% of its drinking water from two protected areas, the Cayambe Coca Ecological Reserve and the Antisana Ecological Reserve. People, local industries and irrigation fields use more than 17 billion liters (4.5 billion gallons) per month of water taken directly from these areas. These reserves encompass 520,000 ha of high-altitude grasslands and cloud forests. Although formally protected as part of Ecuador's national park system, these reserve lands are also used for cattle, dairy, and timber production by the 27,000 people living within or around the reserves. Thus the area has been adversely affected by unsustainable agriculture and cattle ranching practices, infrastructure projects, illegal hunting and inappropriate logging exploitation.

Driver: Concern about the impact of these activities on the quantity and quality of water supplied to Quito led to the establishment of a trust fund.

Strakeholders: WHO ARE THEY!!!

Supply: The improved water supplies are expected to be achieved through investment in watershed protection, initially in the Cayambe-Coca (400,000 ha) and Antisana Ecological Reserves (120,000 ha) surrounding Quito, which are the main sources of water for the city. The area may be extended to incorporate the Condor Bioreserve. Glaciers in these areas store 1.4 km³ water. The area is inhabited by 27,000 people distributed in small communities, who use water for agriculture and use the plateau for extensive livestock grazing.

Demand: Water users in Quito and surrounding areas. These include a municipal water supply agency (EMAAP-Q) for domestic users, industrial users and tourist operators, irrigators, commercial flower plantations, and hydroelectric power stations. Quito's electricity supplier, Empresa Eléctrica de Quito (EEQ), generates about 22% of its hydropower in the watersheds surrounding the capital (Echavarria, 2002).

Intermediary: The Nature Conservancy (TNC) led the development of the first such water fund in Quito, Ecuador in 2005 to finance watershed protection measures. Proposed in 1997 by

Fundación Antisana (an environmental NGO based in Quito), and established in 2000 with support from The Nature Conservancy and the US Agency for International Development (USAID), and the local partners (Fundacion Antisana), the trust fund (called Fondo del Agua, or FONAG). From a modest \$10,000 start-up investment, the fund has already reached \$6 million in capital and will disperse \$900,000 this year for conservation in watersheds that supply drinking water for Quito's 2 million residents. The fund's Board of Directors has representatives from local communities, HEP- the national protected area authority, local NGOs and government. It is designed to pool the demand for watershed protection among the various downstream beneficiaries. .

MARKET DESIGN

Service: Regulation of water quantity and quality.

Commodity: Best management practices, through conservation activities, and projects that encourage local people to engage in sustainable income-earning activities in surrounding areas. Activities also involve land purchase in critical areas and promotion of agricultural improved-management practices

Costs: Users pay different water use rates depending on whether they extract water or not. Local government (municipal water supply) -EMMAP-Q- (Water users in Quito (1,5million) and surrounding areas (27000); national government (MBS-Cangahua irrigation project); private corporate (brewery) Cervecería Andina, Cerveceria Nacional, (HEP) - Empresa Electrica de Quito (EEQ), HCJB, Electro Quito-Quijos project, INECEL-Cuyuja Project and INECEL-Coca Codo Sinclair Project, (spa&resort) Papallacta Hot Springs Spa & Resort; private landowners (irrigation); International NGO (donor) – SDC.

Conditions to participate in the scheme are: “contribute to water quality and flow protection, be compatible with the protected areas’ management plans, promote community participation, be action-oriented, follow the bylaws determined by the fund. The selection is done by a competitive and transparent process implemented by a specialized institution (NGO in particular).”

Possible activities that could be financed through this scheme include: land acquisition in critical areas, provision of alternative income for local residents, supervision, implementation of improved agricultural practices, education and training. According to TNC, although the land within the reserves is technically patrimony of the government, the original landowners were never compensated for their loss of land title deeds. Because of the continuous conflicts over land, the new strategy suggests that compensation should be attempted rather than expropriation. For example, using conservation easements or payments for environmental services designed to encourage more appropriate land uses to ensure the protection of water sources.

Payment mechanism: *Trust intermediary & user fees/pooled transaction* - regular payments by beneficiaries for watershed protection will be channeled through an independent trust fund, the Water Conservation Fund (FONAG). From a modest \$10,000 start-up investment, the fund has already reached \$6 million in capital and will disperse \$900,000 this year for conservation in watersheds that supply drinking water for Quito's 2 million residents. The fund's Board of Directors has representatives from local communities, HEP, the national protected area authority, local NGOs and government..Total seed capital was US\$ 21,000. In 2005, the fund amounted to 3 million US\$. Up to now the fund has been spending only the interest accrued but is considering using the capital to finance part of its activities: expenditure is equivalent to the annual interest raised (12% in 2005), which would result in an annual expenditure of US\$360,000.

Management of the Fund: 1) managed by Enlace Fondos, an independent private asset manager; 2) governed by a Board of Directors with representatives from local communities, HEPs, the national protected area authority, local NGOs and government; 3) legally registered - use of funds will be made in cooperation with the environmental authority; 4) execution of projects funded is done through specialized conservation entities and involves active local participation; 5) administration costs are limited to 10-20% total expenditure. In addition to creating a central funding institution to coordinate watershed protection, users may form user associations to contribute to the fund.

Terms of payment

Downstream users pay a combination of one-off payments and cash-instalments based on the amount of water they use.

- Quito water utility (Metropolitan Enterprise of Water and Sewer Systems in Quito - EMMAP-Q) uses 1.5 m³/wk for drinking water and has agreed to pay 1% of monthly water sales, about \$14,000/month (US\$ 168,000/year) (it has also contributed US\$15,000 in seed capital)
- Brewery "Cervecería Andina" (entered in March 2003), one-off payment of US\$6,000.
- Hydropower producers: Quito Electrical Utility (Empresa Electrica de Quito -EEQ) which generates 22% of hydropower from watersheds around Quito, pays \$45,000/yr; HCJB (4.8 m³/wk power generation); Electro Quito-Quijos project, INECEL-Cuyuja Project and INECEL- Coca Codo Sinclair Project (6.5 and 4.3 m³/wk for power generation respectively.
- Recreation: Papallacta Hot Springs (0.008 m³/wk); - Irrigation users: private farmers (2.1 m³/week); Ministerio de Bienestar Social (MBS) - Cangahua project (2.3 m³/wk);
- International donors: Cooperación Suiza para el Desarrollo, COSUDE, one-off payment in 2005.

Upstream farmers receive support for watershed programmes, but no direct cash payments.

Cost Benefit Analysis

Economic: The areas targeted are already nature reserves and protected under law. However, NGOs and groups interested in conservation face threats of conversion to agriculture. *Transaction costs* are limited to 10- 20% of total expenditure. Assuming annual expenditure is about US\$ 300,000, transaction costs would amount to US\$30,000-60,000. The time scale for the negotiation process and capitalization of the Trust Fund has been very long.

Environmental: Collected funds will be used for funding management and conservation projects in the water supply areas. These measures should also have direct positive impacts over biodiversity, as the area is rich in abundant flora and fauna, especially orchids, bromeliads, and birds. This area contains species in danger of extinction such as the condor, puma, jaguar, spectacled bear and tapir. There is no information about actual environmental impacts from funded projects.

Social: The project proposes a high degree of community participation. Environmental education will be encouraged in order to reduce poaching, garbage dumping and illegal fires. There is a component for capacity building to improve agricultural methods and encourage alternative environmental-friendly activities. The project supports capacity building in environmental-friendly production, improving agricultural methods, and organizational capacity.

The Cayambe-Coca reserve is inhabited by 7,000 persons distributed in small communities, who use water for agriculture and use the plateau for extensive livestock grazing. The adjoining buffer area is inhabited by about 20,000 people in tenant farmer cooperatives, indigenous communities, and private landholders, many of whom are poor. These communities will benefit from increased income from land purchases and more support in securing land tenure.

Legislation Issues

Market relies on the formation of supporting intermediary and implementing institutions. Unclear how much of the funding is transferred to upstream residents. Many regulations and laws concerning water in Ecuador. In Ecuador, environmental services are recognized by the Constitution. However, payments for environmental services are seen as contradictory to existing legislation that forbids changing land users.

Monitoring

According to Montserrat Alban, from EcoCiencia, an estimation of the cost of patrolling the upper parts of the watershed is approximately US\$ 0.001/m³, representing approximately

US\$ 0.04/month per family, for an average use of 40m³/month.

Main Constraints

According to Marta Echavarría, the Project Director, the process has been very slow and painstaking. "And project implementation is just beginning because we work only with the interest, not the capital, on the money in the fund. But it has been highly instructive."

The existence of FONAG as an institution depends on the continued financial contribution from the users. The board of directors of the companies makes this decision and it may change at any moment.

Main Policy Lessons

1. According to Echavarría, the first step in creating a fund like this is raising awareness. In most places, like in Quito, people do not realize that the quantity and quality of their water depends to a large extent on the conservation of protected areas upstream. In the case of Quito in particular, as much as 80% of the city's drinking water comes from just two ecological reserves: Antisana and Cayambe-Coca.
2. Secondly, the key users of water need to be identified, prioritized, and informed. In the case of Quito, the largest water user by far was the Municipal Sewer and Water Agency, a public entity that is accountable, ultimately, to the city's Mayor. For this reason, city government (and, as a result, the city's residents) became a key target audience for FONAG. One of the first - and Echavarría claims one of the most influential - things that FONAG did was to produce a short and attractive publication detailing, among other things, the idea for the fund and the importance of conservation to the maintenance of water quality and water flows. This publication, explains Echavarría, eventually became a key tool for convincing not only the Mayor's office, but also the boards of directors of the water utility company, the electric utility company and all other participants in the fund
3. Advantages of establishing a FUND: coordinate and enhance individual efforts; take advantage of the skills and capabilities of all players; ensure continuity and transparency in conservation activities; provide long-term conservation financing and; expand public/private participation in conservation.

Remark: data to be updated.

Case No 11: Pimampiro – Ecuador

Name of the initiative: Nueva America Forest Management Plan

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country and region: Ecuador

Summary: The programme was launched in 2002 as part of a larger community forest management plan. The PES scheme is based on a 20% increase in water use charges in the town of Pimampiro and involves payments to upstream forest landowners located in the area of the municipality water intake pipe. The municipality created its own environmental unit (which now also conducts other environmental management activities) and the scheme was set up in collaboration with the NGO Cederena. Unfortunately, users are not aware that the increase in water charges was due to the PES, they accepted the payment because there were simultaneous improvements in the water supply infrastructure that did in fact greatly improve supply.

Maturity of the Initiative: *Programme launched in 2000.* Payments commenced in January 2001 and are to be reviewed every 5 years.

Driver: Interest in improving water supply to the town of Pimampiro. Payments were set up to protect the 'Nueva América' forest located in the headwaters of the municipality's water system. The new pipes effectively alleviated water shortages problems in the town of Pimampiro. (Prior to this the town only had running water two hours a day, three days a week (Ordóñez 2004a).

Stakeholders

Supply: *Private landowners* -20 families part of the Nueva America Association- Agriculture and Cattle Production Association, who own the forest area (390 ha are forest and 163ha are páramo -high altitude grassland) located at the headwaters of the Rio Palaurco, where the town of Pimampiro (32km downstream) has its drinking water intake pipe. The forest is located in the buffer zone of the Cayambe Coca Ecological Reserve.

Demand *Local government.* municipality of Pimampiro representing 1,331 water users. Water is also used for irrigation and negotiations are underway to try to encourage these users to participate in the payment scheme as well.

Intermediary: *No intermediary, direct negotiation* between the municipality of Pimampiro (representing final users) through its newly created environmental department (UMAT) and farmers upstream, who although belonging to the association, have signed contracts on an individual basis.

Facilitator: Local NGO CEDERENA- Corporation for the Development of Natural Resources

MARKET DESIGN

Service: Maintenance of water quality and quantity through forest conservation.

Context of the PES programme: The Pimampiro PES initiative began as part of a natural resource management and agricultural assistance project (DFC), an FAO-funded project for community forest management worked with the Nueva América Association (ANA) to develop a management plan for their forest.

Later, with support from CEDERENA (an NGO that evolved from DFC), the municipality and with funding from the Inter-American Foundation, the project that had focused mostly on soil conservation, organic farming and sustainable forest management techniques, was updated. It now includes five programmes: 1) forest and *páramo* management (Non-Timber Forest Products – NTFP- such as medicinal plants and orchid-growing projects), 2) environmental awareness and education, 3) *environmental services*, 4) agro-ecological production and 5) research. (Ordóñez and Puglla, 2004)

Commodity: *Conservation and protection of existing ecosystems* through forest and *páramo* conservation; *Best Management Practices*, through land use management contracts.

Payment mechanism: *Fund - local NGO and municipality/user fees.* A fund was created to finance PES payments through seed capital from an initial investment of US\$15,000 (US\$10,000 from the IAF, via CEDERENA, and US\$5,000 from the FAO funded Community Forest Project, and a 20% increase in municipal water charges.) Contributions are pooled into a fund specially created for the PES by the municipality (*Fondo para el pago por servicios ambientales para la protección y conservación de bosques y páramos con fines de regulación de agua*). The fund is jointly managed by CEDERENA and the municipality's environmental department (UMAT).

Participant landowners agree to protect native vegetation from deforestation and land conversion. The agreement stipulates which areas are covered, establishes a land management plan and determines payments in accordance with current land use. (Echavarría et al., 2004) To receive payment, each member of the Nueva América Association must sign an agreement with the municipality of Pimampiro. Payments are made through the local offices of the Banco de Fomento.

Determining the payment level: The levels of payment were not based on any economic valuation of the cost to the landowners of providing the services or the benefit to the users (their willingness or ability to pay for the improved service). The initial calculation was solely based on how much land could be included in the scheme and how much money would be required (Ordóñez and Puglla, 2004).

Nevertheless, valuation studies of the environmental service provided were conducted later, with the objective of making the system self-sustaining. The valuation methodology was based on the formula developed for the ESPH in Heredia, Costa Rica (see Case Profile) by Barrantes and Castro (1999). The formula estimates the value of protection of the ecosystem (in this case the forest) in terms of water produced; plus the restoration value of the forest, which is the value

that should be charged to invest in recovering the hydrological capacity upstream. The application of the formula results in: the protection value of the forest for the production of water is equal to US\$ 0.03/m³) and on the cost of forest restoration was found to be US\$ 0.10/m³, suggesting that the value of the environmental service is US\$ 0.13/m³. This value corresponds almost exactly to the increase made initially: 20% increase in the existing charge, which corresponds to US\$ 0,16/m³.

Although the formula is relatively easy to apply, it received critics when it was applied in Costa Rica as it is strongly based on the perception (unproven by hydrological studies) that forest increase water quantity; and the methodological incongruity of adding two values calculated by different methods.

Terms of payment: *cash-payment, on-going payments.* The municipality collects payments from users on a monthly basis (on average US\$1.2 per family/month (for average use of 30 m³/month) and payments to landowners are made on a quarterly basis. Payment categories vary according to the condition of the value of the ecosystem to protect: US\$1.00/ ha/month for undisturbed páramo or primary forest, US\$0.75 ha/month for old secondary forest and US\$0.50 ha/month for new secondary forest.

Funds involved (after Álbán and Wunder, 2005)

- Start-up costs 38,000 US\$ representing US\$ 76 /ha. Three CEDERENA technicians and a representative of the Municipality worked together in the design phase and stakeholder negotiation process, for a year (implementation of the payments was carried out in 4 months).
- Donor seed funds: US\$15,000 used to set up the trust fund (non depleting fund, only uses interest raised, which in 2005 was around US\$700/ 800 a year).
- Payments from users (from water fee): around US\$4,700 a year (on average)
- Payments to providers: around US\$4,200 a year (on average) The difference is paid back in to increase the fund.
- Monitoring (US\$4800) and Management (US\$1800) costs are covered by the municipality

Cost Benefit Analysis

Economic: There was also an assessment of the users willingness to pay for water resource improvements, however this was not taken into account, due to the fact that it is was too low (0.035 US\$/m³ for a monthly consumption of 20 m³, corresponding to 0.01% of the average monthly income of these families. (Ordóñez and Puglla, 2004)

Transaction costs are about US\$6,600 per annum- this amount is about 1/3 over the funds collected through the water use fee and corresponds to 50% of the entire annual costs of the programme, including payments to landowners. These costs are covered by the municipality and not internalised into the scheme.

Income benefits: on average, participants receive US\$21.1 per month, which is equivalent to 30% of monthly household expenditure. According to Echavarría et al (2004), these extra funds are mostly used to cover basic expenses and the families' short-term needs: food, agricultural production, health and education. Due to the lack of funds however, landowners outside the Nueva America who have an interest in participating in the PES scheme, (like the community of La Florida) have not been able to join and may consider themselves discriminated by the

municipality.

Environmental *Delivery of the service*: there was a real improvement in water quantity and quality reaching the city, mainly due to the infrastructure improvements (undertaken by the municipality).

Additionality: there has been reduced intervention in forest and *páramo* land. Although monitoring shows that at some point there have been some violations to the agreements (in the form of slash-and-burn practices, unauthorised selective timber extraction and soil and undergrowth extraction), the frequency and intensity has reduced following introduction of the PES.

Vogel (2002, and personal communication, 2004) highlights that payments could have been devised to reflect these different opportunity costs: the areas within the forest are under less conversion pressure, than the rims.

Ordóñez, R.Y. (2004 b) highlights an increase in environmental awareness among the families involved in the project. At the same time, the creation or strengthening of environmental institutions, to deal with the PES system, like the municipal environmental unit, has allowed other environmental problems to be addressed.

Social: The PES is inserted in (and complemented by) a wider sustainable development project that includes several other environmental management initiatives aimed at improving overall livelihoods by complementing income and increasing food security (for more details on this see Ordóñez and Puglla, 2004). Through the scheme, participants received technical assistance and training to develop agro-ecology projects (creation of organic family gardens) and agro-forestry projects (medicinal plants collection and commercialization, and production of highly valued ornamental plants, like orchids). *Poverty issues*. Although San Pedro de Pimampiro is a poor rural municipality, it could be argued that farmers receiving PES in Nueva America are relatively well off, as but most of them live (and have land) in the mid-section of the watershed. However, livelihood opportunities are very limited, access is very difficult, and the land is not very productive. The PES has become a very significant part of the family income.

Legislation Issues

This scheme presents an example of how a PES scheme can be set up to encourage landowners to adhere to existing (but poorly enforced) Forest Law (1981) that forbids from forest being converted to other uses without permission- this has been a controversial characteristic of this PES scheme, and common to others, in the sense that it is questionable whether paying somebody to follow the law is the correct approach; In the national legal context of Ecuador, PES is a recognized tool to "create and promote the legal basis and mechanisms to allow the payment for environmental services provided by forests, so that their owners will receive a monthly payment in cash for the services they render." (in Ecuador's second Strategy for Sustainable Forest Development). The National Biodiversity Policy, recommends establishing PES for the protection of mountainsides, provision of water from forests and *páramo* and coastal protection, for hydroelectric generation and human use by providing adequate compensation to the landowners of the lands that generate these services.

Monitoring

Monitoring has only been carried out to ensure compliance with the PES agreements. The committee chooses four families at random and technical experts from UMAT, CEDERENA and the municipality evaluate the condition of their land. The experts then write a report, which is assessed by the committee before payment is made. There has not been any assessment of the hydrological changes due to the PES protection. Water quantity is restricted by infrastructure deficiencies and the quality is not monitored only pollution sources are prevented.

Main Constraints

UNSUSTAINABILITY OF THE FUND: *Shortfall of funds* collected as water charges due to i) low collection rates (only 60% of the water billed is actually paid for) and ii) insufficient demand being captured by the project, since irrigation users, as the largest and most inefficient users, are still not included in the project. At time of writing negotiations with the Irrigation Boards had ceased.

High running costs: Monitoring and administration costs alone, are higher than the total annual input to the scheme, which is about US\$ 5,500 (water fees and interest raise from the fund), rendering the scheme financially unsustainable.

Lack of support for PES investment: Users believe that funding raised through the water fee is being invested in general water improvements (including infrastructure for increasing water flow (water uptake and transport, treatment and distribution), and not PES payments to upstream landowners. Álbán and Wunder (2005) point out that in fact, the municipality has not found the right momentum to inform the users of the existence of the PES scheme, even though willingness to pay for watershed conservation was verified. In the future, this may be one of the main constraints for expansion of the scheme, particularly due to strong pressures from the providers, to increase the level of payments. In addition, Ordóñez (2004 b) believes that “the main obstacle is the lack of ‘payment culture’ of people in small cities”.

Since the leading NGO CEDERENA has now recently left the scheme; Álbán and Wunder (2005), consider that it is uncertain whether the Municipality will assume the monitoring and management costs, and from what sources it would finance it. In addition, they highlight the fact that since the funds are kept in a simple saving account, instead of in a structured trust fund, these could easily be assigned to other purposes, due to the municipal control on the decision-making organ of the fund.

Contracts were to be renewed in 2005 and the amounts awarded were to be re-negotiated as well, according to participants’ requests. We could not contact people in CEDERENA or the municipality (UMAT) to learn how the process was organized or if there had been any recent changes in the scheme.

Main Policy Lessons

Water quality: Forest or pipes? The real problem addressed here was more the lack of basic water supply, due to infrastructure deficiencies, rather than forest degradation. Had there not been parallel investments in the supply system, potential benefits forest protection would remain

undermined by the inadequate supply system. Users willingness to pay certainly owes more to this, than to forest conservation, in this case. In fact, according to Alban and Wunder (2005), the two main factors that lead to the support for the PES scheme were the long period of drought during 1999 and the construction of a canal to increase the flow of water. The combination of both resulted in a very visible increase in the quantity of water available to the city in the following year, and this created a very positive environment for the municipality to establish the new water fees. According to the same authors "the municipality has not yet told the population of the city about the PES process. They fear that they will be against it".

PES is only one part of the livelihood puzzle: It's important not to count on PES alone, has a livelihood improvement tool. Other components are required to generate alternative sources of income, such as the sale of NTFP (medicinal plants, orchids) and ecotourism, and to alleviate the pressure on forest, while giving the communities alternative rural activities to engage in. As Cuellar and López (2002) have put it: "Payment for ecosystem services does not solve all the socio environmental problems of an area. It's important to complement this conservation strategy with the implementation of a variety of alternatives to bring about social, environmental and economic improvements."

Other information:

Replication of the experience in Pimampiro- the case of El Chaco: Based on this model, the InterAmerican Foundation (IAF), has also awarded CEDERENA a grant of US\$320,400 over three years, to "launch Payment for Environmental Services Protection Programs in ten municipalities based on its successful water conservation model in the Pimampiro municipality. Its project will include activities to increase capabilities of Municipal Environmental Unit staff, training for 1200 farming families, and exchanges and dialogue between key stakeholders" (IAF 2004). One of these projects is in **El Chaco**, where there have been ongoing negotiations between the municipality and two landowners (total of 50ha). According to Alban, M. (personal communication) the scheme is encountering difficulties because the two families do not accept the proposed agreement and the municipality is considering expropriating the land.

Remark: data to be updated

Case No 12: Sesembra, Yamabal, Guatajiagua, La Palma and San Ignacio – El Salvador

Name of the initiative: The Programme for Sustainable Agriculture on the Hillsides of Central America (PASOLAC)

[Source: Watershed Markets <http://www.watershedmarkets.org>]

Country and region: El Salvador

Summary: The Programme for Sustainable Agriculture on the Hillsides of Central America (PASOLAC), funded by the Swiss Agency for Development and Cooperation (SDC/COSUDE), is supporting the development of three local PES schemes in El Salvador (along with seven others in Nicaragua and Honduras). PASOLAC provides technical support with the design and implementation of the schemes and assists with initial funds. The schemes started in 2002, and are developed in association with local municipalities and promote the adoption of soil and water conservation techniques and pollution control measures. Municipalities thus achieve the protection and improvement of water resources.

The initiatives in El Salvador are in the Cerro Cacahuatique in Morazán (involving the municipalities of Sesembra, Yamabal and Guatajiagua), public utility company of Tacuba (Ahuachapán) and Municipalities of La Palma and San Ignacio (Chalatenango).

Yamabal: In the case of Yamabal: the watershed of the river Gualabo is small (24.5 km²), with steep slopes. It is highly degraded. Forest covers 30% of the watershed in the form of shade coffee, living fences and small remnants of forests. Approximately 602 families live in the watershed. Most of them are poor (average of 2.5 ha) dedicated to subsistence agriculture. In the Yamabal case there is a local NGO, CODECA, supporting the negotiation process, i.e. acts as an intermediary while PASOLAC (SDC/COSUDE) acts as a facilitator.

Improved management practices are achieved through avoiding slash-and-burn practices, crop-residue management, construction of water cut-off drains, hedgerows and improved agroforestry systems (140 to 200 tree/ha).

The municipality of Yamabal created a fund (Environmental Services Fund) with seed capital from PASOLAC and with revenue from a new added fee to the existing water use charges. Users contribute with a new environmental fee, added onto their water charges.

In the department of **Chalatenango**, the Local Environmental Committee has been working for many years on an Environmental Management Plan for the province. The plan stresses the role of the province in providing environmental services- as an "environmental service-providing zone", especially water, since this area is the catchment for the River Lempa that services El Salvador's metropolitan area and it also supplies considerable hydroelectricity generation.

(Herrador, 2002 in Rosa et al 2003; Comite Ambiental Chalatenango, 1999)

Remark: data to be updated

Case No 13: Tacuba, El Salvador

Name of the initiative: Tacuba Pilot PES Scheme

[Source: *Ecosystem Services Conservation and Farmer Livelihoods in a Shade Coffee Landscape of Western El Salvador*, V. E. Méndez, S. Taylor Lovell; *Experiencia de Pago por Servicios Ambientales (PSA) de la EMSAGUAT Municipio de Tacuba, El Salvador*, M. A. Mejía, G. Barrantes; personal communication with Tomas Lindemann tomas.lindemann@fao.org]

Country and region: El Salvador, Ahuachapán

Summary: The water supply system for the urban population was provided by ANDA, which led to conflicts with the settlers, until they achieved the agreement in 1996, that the system is transferred to the municipality of Tacuba, under the mandate to create the conditions for the formation of a mixed management firm. Efforts to achieve the sustainable water supply management system in crisis, required users to undertake a legal action before Congress in the city of San Salvador, in order to achieve the local participation in the management of water supply service. Thus the new management company EMSAGUAT was formed.

Tacuba region is quite hilly geography, with altitudes ranging from 700 to 1.375 meters above the sea level, dominating the cultivation of coffee and some areas with crops of maize and beans. In El Salvador, shade-grown coffee farms represent the country's principal forest cover. Since small farms (under 7 ha) represent 80% of individual farms, cooperatives of small growers play an important role in maintaining landscape-scale environmental services. Small shade-coffee growers manage mixed production systems, providing a variety of goods – fruit, firewood, medicinal plants and forage – besides coffee. These plots have an important role in self-provisioning and buffering households and extended families from the volatile international coffee market. Likewise, these fragmented holdings mean greater diversification at the plot level, and much more “inertia” for land transformation. This tenure “patchiness” impedes large-scale clearing more typical of large holdings, given the structural crisis in the agricultural sector and the current severe coffee crisis.

The Tacuba cooperatives play an important role due to their proximity to El Imposible National Park and because they fall within the proposed area for the Mesoamerican Biological Corridor (MBC). The environmental service of scenic beauty through ecotourism and recreational activities can be developed as well. There is, however, an evident need to strengthen the organizations and their capacity to relate to external stakeholders.

Maturity of the initiative: The pilot PES scheme was designed in 2001, however the present status is unclear. The last information from 2009 is that the scheme had not become operational.

Driver. Concerns about the sustainability of the water system over time, and thus a fund for PES was created, to help ensure the supply of water quantity and quality by protecting the two water micro-producing areas. The main problem in the two watersheds, is deforestation and decline in coffee prices as the main productive category in the area. An important part of the

land where water that supplies the town of Tacuba is "produced", is being used as coffee agroforestry system under shade and basic grain farming. The potential of this initiative is based on the interest of local residents and users, to participate in a process of managing service delivery and management and protection of water resources produced in the watersheds.

Stakeholders: The EMSAGUAT, a joint venture is legally constituted to manage the service of water supply and sewerage in the city of Tacuba. It is a mixed institution involving the representation of the Mayor and the general public. The highest authority of the EMSAGUAT is constituted by a General Assembly of 130 members, with 10 representatives of users for each of the 14 districts and neighborhoods that have access to water supply service.

SALVANATURA Foundation is working on the development of bylaws for the protection of the El Imposible National Park, together with the municipality of Tacuba, but so far, it has a close relationship with EMSAGUAT as another institutional actor, interested in conservation of the park, which form part of the watersheds that supply the aqueduct of Tacuba.

MARKET DESIGN

Service: Water supply and quality.

Commodity: Conservation and protection of existing ecosystems through the change of agricultural practices, land conservation and protection of vegetation and forests.

Supplier: 1) Las Colinas is a cooperative of the coffee producers, who are the third important actor in the watershed (together with the El Imposible National Park and the Tacuba River).

The farmers in the cooperative, under a reduced use of external inputs and management, have kept the shade trees and barriers in place; preserved the vegetation on the banks to ensure the water flow, and preserved the forest cover for the provision of drinking water. The PES Pilot Project area is cultivated mostly with organic coffee.

The cooperative members have also built a fence to limit access, which protects about 400 square meters around the water source.

2) Land owners at the Source of The Pyramids. This source is located much further down from the source of Las Colinas and is surrounded by agricultural fields with shade-grown coffee now without greater use of chemical inputs, but with more housing and people and animals moving through the area. The fence around three tasks has an open doorway, where there is free access to the site, which has reduced the tree cover.

Property owners have expressed their willingness to assist in the restoration and conservation of forest vegetation within the defined area around the water source. The wider environment of the watershed which belongs to several local producers have not been approached to promote the conservation of the watershed of this source or at least a water recharge area, much broader than that defined by the small fence around the water source.

The importance of conservation in the wider surrounding in which the sources are located, is

that the quality of water supply system depends on the protection of both sources. It does not operate as a separate system, but the water from both sources, is concentrated in a single storage tank, which feeds the supply system for the 13 neighborhoods and Tacuba.

3) Potential. Tacuba PES also requires negotiating with other actors present in the catchment area; such is the source of the Pyramids. In this case, approaches have been made with the owners of the land where the source is located and they also expressed willingness to cooperate in the reforestation of the area enclosed by the fence, around the source.

Demand side of this initiative are the water users in the municipality of Tacuba.

Payment mechanism: As of January 11, 2003 the administration of EMSAGUAT is independent from the direct administration of the municipality, but the collected tariff revenues are remitted to the accounts of the municipality. There are water supply authorities in other municipalities where user fees are paid to the account of ANDA, while the municipality does the management of funds. EMSAGUAT is responsible for its users, for asset control, demands for pipeline repairs and cleaning of tanks and the control of PES funds that water users pay through the water bill to the EMSAGUAT.

Another important aspect for EMSAGUAT is the commitment of the local government not to increase the water tariff and free up consumption, i.e. without the use of water meters, which for a part of the population is unfair, because poor pay the same as rich people who use more water and have a greater ability to pay.

Currently the water supply service, reported monthly income of about ¢. 17,000.00 colones (1,943 USD⁹) for water service, collected in two different tariffs. A ¢. 15.00 for the neighborhoods of the town of Tacuba and a ¢. 10.00 colones (1.2 USD) for the rural areas. The maintenance and administration costs amounted to about ¢ monthly. 9,000.00 (1,029 USD). In addition to paying the monthly water bill, each service user is obliged to pay ¢. 1.00 (0.9 USD) per month per user for the PES scheme. The water users pay additional 13% for VAT. The required fees fall into the category of fixed-price service, independent of the volume of water consumed. On the other hand, the survey found that average monthly water consumption is 14.00 ¢ (1.6 USD). The average tariff for water consumption is ¢ 0.7/m³.

The separate PES bank account balance as of 20 March 2003 amounted to \$ 1059.00. However there is a lack of regulation for the use of funds from this account.

The water supply service works six days a week, 16 hours of delivery per day. In some communities, there are some differences due to system conditions.

Cost Benefit Analysis

Economic. The plan is to make the economic assessment based on maintenance cost, opportunity cost and replacement cost. However, the maintenance cost is estimated at ¢ 0.125/m³. With regard to the opportunity cost, it is not clear enough how the method is going to estimate the value of the environmental services. Moreover, the proposed method does not

⁹ Exchange rate as of June 4, 2011, 1 USD = 8.75 SVC; XE

seem to give a comparison between all the alternatives identified, because the land value does not imply a cost of production and should not be compared with other options.

Regarding the replacement cost of the system it is clearly oriented to the water supply rather than resource conservation. The estimated replacement costs amount to U.S. USD 402,150.00, and given the socioeconomic characteristics of the area, it is not feasible.

A willingness to pay study was conducted among 120 EMSAGUAT service users. 16% of the surveyed population believes that the forest is important for water conservation, and deforestation is the main problem of the watershed. 51% consider that they have a regular water supply or good (46%) water supply. In terms of quantity and quality considered most consider the water service satisfactory.

An average household has 6 members and an average income of ¢ 545.00. A significant proportion of households have no work, which implies a lower socioeconomic status, which affects the proposed PES scheme. However, the town's inhabitants are aware that it is their responsibility to protect resources, on which their water supply depends.

Willingness to pay identified the range of 3.00 ¢ to 5.00 ¢ for an average of 4.00 ¢ extra per month. About 70% are willing to pay for soil and water conservation. Since the average consumption is 20 m³/month/household, the willingness to pay was an average 0.2/m³ ¢.

There were no studies that addressed a demand to assess the level of current use of water in Tacuba. So it is impossible to determine if there are problems of overexploitation of surface and groundwater sources of water.

Ecological. Fall in coffee prices internationally and locally, has helped to reduce pressures for the expansion of plantation areas, and thus reduced the chemical inputs and even reduced the number of workers at the coffee farms in the harvest season.

While alternatives are not presented for change of use of land cultivated with coffee, the potential to ensure multiple positive effects on natural resources is very high. According to data provided by the Economic Assessment Study, each hectare of coffee with shade is a reserve of 200 tonnes of carbon and 126 kg of net carbon dioxide sequestration.

Social. A favorable change in perceptions, attitudes and practices regarding the management of water services and conservation of watersheds that support quality, quantity and continuity of water supply. The most important thing based on the studies conducted is the widespread willingness to participate in payment schemes for forest protection and soil conservation. This is a favorable factor in the implementation of PES. This is also important given the history of struggle of the inhabitants of the municipality of Tacuba over the local management of water.

Legislation issues

Lack of regulation for the use of funds from the special PES bank account.

Main lessons

Some of the obstacles for establishment of this PES scheme are:

- The facilitation and support to establish the mechanism was insufficient. All stakeholders, including the cooperative board and its members, the water board, and the municipality required more training, and stronger facilitation to overcome their differences;
- From an ecological perspective, there was insufficient hydrological data to make adequate decisions, specifically in two areas: First, there was no knowledge of the origin of the water that surfaced at the cooperative spring, but which may infiltrate and flow outside of the cooperative; and second, there was no information on the volume of the spring, and the level of provision capacity for cooperative and town use;
- The cooperative did not have adequate negotiating or administrative power, which led to defensive positioning, and conflictive meetings;
- There is no information on what it would cost the cooperative to maintain a satisfactory water conservation management plan to ensure adequate use of the resource;
- There has been historical conflict between the cooperative and the municipality, which should have been dealt with before initiating the mechanism.

Remark: data to be updated

Case No 14: San Francisco Mendez – El Salvador

Name of the initiative: El Imposible National Park - Watershed Warden Sponsoring

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country and region: El Salvador

Summary: Water users in two communities of the San Francisco Menendez Municipality are contributing a share of their water charges to cover the salary of two additional park rangers of the El Imposible National Park, the primary water source for both communities.

Maturity of the initiative: Pilot, ongoing since 2001.

Driver: Demand driven - water users initiated payments.

Stakeholders

Supply: Government, as park owner. SalvaNatura, the NGO in charge of managing the park (through a co- management agreement with the government) works with the communities around the park to provide alternatives for the forest resources that are now off-limits. Its funding originates from international donors and corporations, as well as membership of national individuals and businesses.

Demand: Domestic water users in (the local communities of Conacastes and Cara Sucia) agree to pay 54 colones (US\$6.05) monthly to cover the costs of administration, operation and maintenance of the improved water supply system - this fee also covers the salary of two wardens of the National Park.

Intermediary: Local government (municipal water utility company): collects the water use fees transferred to the El Imposible National Park.

Facilitator: The drinking water systems and organization of community water boards were set up by the local communities, the Health Promotion through Water and Sanitation Project (PROSAGUAS), the Action, Management and Rational Use of Water Resources Project (AGUA) and support agencies. These water systems were then transferred to the communities under the agreement that the community's water use fees would also cover the salary of a "watershed warden" in El Imposible National Park "in recognition of the environmental service of "water protection" provided by the park". Rosa et al 2003.

MARKET DESIGN

Service: Water flow and quality.

Commodity: Conservation and protection of existing ecosystems through the support of the park's conservation measures, by sponsoring additional monitoring and enforcement.

Activities developed by SalvaNatura in EI Imposible:

- Set up support for micro-enterprise
- Promotion of soil conservation techniques (using live hedges and planting fruit and forest trees on their properties)
- Environmentally friendly certified products, among many other initiatives. ¹⁰

User fees & pooled transaction - payments made to cover the operation, maintenance and administration of the water supply system, including the salary of two park guards to act as watershed wardens.

Terms of payment: Water users make cash payments: 54 colones (US\$6.05) monthly per user, a part of which is invested in the park's surveillance system, in order to support its effective protection (the park has 1 warden for each 150ha).

Funds involved: Water users pay approximately US\$ 612,000 annually (since 2001), a share of which is to cover the salaries of the park wardens- unclear what share this constitutes. An estimate may be drawn from a parallel scheme, run by Salvanatura, through which the public can sponsor a park ranger (or one hectare of the park) for a year, at a cost of US\$ 3,000/year ¹¹

Cost Benefit Analysis

Economic: No information

Environmental: Expected: increased protection of water resources, through the additional work by the two extra park rangers. However, it is difficult to determine whether this is a significant benefit in terms of water supply received by these two communities.

Social: Equity: "From the perspective of equity, the case is controversial because poor rural communities are paying for environmental services generated in a national park." Rosa et al (2003)

Legislation Issues

Payments support government national park system; ii) there is a Forest Use Decree that prohibits cutting any vegetation, hunting any species and establishing or developing physical infrastructure.

Monitoring: The PES contribution aims particularly at strengthening the park's surveillance capacity.

Main Constraints: Herrador 2002 (cited in Rosa et al. 2003) states that most water users are not aware that the wage of the warden comes from their water use fees "because only the projects' representatives and members of both systems' governing boards participated in the

¹⁰ <http://www.nps.gov/centralamerica/salvador/>

¹¹ <http://www.salvanatura.org/Guarda.html>

negotiation of the agreement."

Remark: data to be updated

Case No 15: Montagua - Polochic River System – Guatemala

Name of the initiative: Guatemala's Atlantic Coast PES scheme

[Source: Payments for Environmental Services: An equitable approach for reducing poverty and conserving nature, WWF June 2006]

Country/Region: Atlantic Coast, Guatemala

Summary: Large industrial water users in the Motagua-Polochic River System will pay for the maintenance of the ecosystems from which the water they use comes. This PES scheme is anticipated to have broader implications at the policy level in Guatemala and to serve as a replicable model in Latin America and the world for landscape-scale conservation linking forest, freshwater, and coastal marine biomes.

Location: Guatemala's Atlantic Coast; the Motagua and Polochic rivers form part of the larger Mesoamerican Reef Ecosystem river basin.

Human population: Over 400,000 resource-poor people, including several indigenous groups of whom up to 90% live below the poverty line.

Origin: Tropical montane cloud forests within the Sierra de las Minas Biosphere Reserve (SMBR).

Importance for biodiversity: One of the most biodiverse regions within the Mesoamerican Biological Corridor; the SMBR itself is one of the largest unbroken extents of cloud forest in Mesoamerica, covering around 1,300km², of which some 65% is primary forest. Water flowing from this system also impacts on the Mesoamerican Reef, the second-longest barrier coral reef in the world.

Water users: Industry (hydroelectricity, coffee processing, bottling, paper); export and subsistence agriculture; domestic.

Threats to watershed services: Forest and freshwater habitats are being lost and degraded mainly due to deforestation, cattle ranching, forest fires, agricultural expansion, and pollution from pesticides, fertilizers, and domestic and industrial effluent. This has led to declines in water quality and quantity for the various stakeholders in the system, and threatens biodiversity in the wider Mesoamerican Reef system.

PWS project approach: In 2006, there were no financial mechanisms in place to charge and channel user fees upstream to the managers of the SMBR or to compensate forest owners for the important environmental services they provide.

The WWF-CARE-IIED project is addressing this by focusing initially on large water users with the greatest financial capacity and willingness to pay. These potential buyers include 15 municipalities, agro-industrial exporters, the Coca-Cola bottle plant (ABASA), a paper mill plant

(PAINSA), a rum plant (LIZASA), a beer company (Cervecería Centroamericana), and a hydropower company.

Other work: This project is one part of a much broader initiative that takes into account other approaches, including integrated river basin management, efficient irrigation systems, scientific research development, clean production, strengthening local water management and governance capacities, and undertaking environmental education and awareness-raising among target groups.

Remark: data to be updated

Case No 16: Puerto Barrios – Guatemala

Name of the initiative: Cerro San Gil Protected Area PES

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country/Region: Guatemala

Summary: Initiative to protect the water flow in the Escobas River upon which the municipality depends to supply almost all inhabitants' water needs. An extra charge has been added and is invested in the management of the Cerro San Gil Protected Area. The scheme has produced visible results, so the users have agreed to make a higher contribution to the initiative.

Maturity of the initiative: Ongoing since 2001.

Driver: The water supply of the town of Puerto Barrios depends almost entirely on the water in the River Las Escobas, which flows out of the Cerro San Gil Protected area. Together with environmental NGOs interested in the conservation of the protected area, the water users from the town have agreed to support additional conservation measures, within and in the buffer strip around the reserve. The role played by the municipality in driving this initiative is unclear.

STAKEHOLDERS

Supply: Cerro San Gil protected area in the headwaters of the River Las Escobas.

Demand: Municipality of Puerto Barrio: estimated 80, 000 domestic users.

Intermediary: FUNDAECO (Foundation for Eco-Development and Conservation- Guatemala).

FACILITATOR: The Nature Conservancy (TNC), the US Agency for International Development (USAID) Regional Environmental Program for Central America (PROARCA) and the German Cooperation Agency (GIZ)

MARKET DESIGN

Service: *Regulation of water flows.*

Commodity: *Improved Management Practices* projects implemented in the buffer strip around the park.

Conservation and Protection of Existing Ecosystems though land acquisition- The Conservancy and local partner FUNDAECO purchased approximately 9,000 acres to consolidate the Cerro San Gil National Protected Area (most of it in the Prístino Forest nucleus of the region). The Conservancy also helped acquire a 1,223-acre tract of forest in the vital watershed of Las Escobas, a basin that provides water to nearby towns.

Payment mechanism: Unclear. Funds collected are invested in both the management of the

park and the sustainable agriculture programme in the buffer strip.

Terms of Payment: Users have agreed with an increase in the municipal water charge. The amount agreed upon and periodicity of the contribution is unclear.

Funds involved: Unclear.

COST BENEFIT ANALYSIS

It is unclear to what extent these impacts are expected or already underway.

According to Morales, C. (World Wildlife Fund – Central America) in 2005, negotiations were taking place to double the initial contribution due to the fact that the users have realized the benefits of the system and want to increase their support. This suggests that water users did perceive improvements in water services. However, we have not been able to obtain further information from those closely involved in the project.

Economic: Increased funding for the management of the protected area.

Environmental: Lower impact agriculture along the buffer strips.

Remark: data to be updated

Case No 17: San Jerónimo – Guatemala

Name of the initiative: San Jerónimo PES Scheme

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves - 2006]

Country/Region: Baja Veracruz, Guatemala

Summary: Project to support the creation of a compensation system to the owners of the “water-producing” upper river basin (San Isidro) for “protection of the forest and the soils, as elements that regulate the flow and quality of water” flowing down to the urban area of San Jerónimo, in Baja Verapaz.

Maturity of the initiative: Ongoing since 2004

Drive: Embedded in GIZ-supported decentralization programme which generated information on the value of the drinking water supply infrastructure in the urban area, its cost of operation and the value of the protection function of the micro-basin that supplies water to the municipal capital. Payment for environmental services is seen as an alternative in the absence of legal regulations and the implementation of corrective measures in the use of natural resources. Rojas et al. 2005

STAKEHOLDERS

Supply: Community of San Isidro located in the middle and upper parts of the watershed of the San Jerónimo River. The community operates under a collective land management system and covers an area of around 1,250ha. The upper parts of the watershed are within the Sierra de las Minas Biosphere Reserve- see case profile in this review, Montagua Polochic river system, p.

Demand: Water users in the urban areas located in the lower river basin: municipalities of San Jerónimo and Salamá). Users are organized under Urban Water Committee and the Association of Irrigation Users in San Jerónimo (AURSA); other users are landowners in the highlands and a hydroelectric plant (Tecnoguat).

Intermediary: Environmental Service Commission formed by representatives of the Municipality, the Urban Water Committee, the local development council in the upper river basin of San Isidro, AURSA and the environmental NGO Fundación Defensores de la Naturaleza (FDN)

Facilitators: NGO Fundación Defensores de la Naturaleza (FDN) and the German Cooperation Agency (GIZ), through its Municipal Decentralization and Development Program (DDM-GIZ). Research by FDN provided information on the value of the use of water for irrigation, hydroelectricity, rural drinking water services and the users willingness to pay. National Forest Institute (INAB) has also provided support to the initiative.

MARKET DESIGN

Service: water quantity and quality

Commodity: Improved Management Practices through forest management (covering about 60% of the area). Conservation and Protection of Existing Ecosystems. Reforestation for commercial plantations in priority reforestation areas (55ha, in 2005) under the Forest Conservation Incentives of the National Forest Institute (INAB) PINFOR programme.

Payment mechanism: Intermediary-based transactions and user fees: though this scheme, current water rates already incorporate the real costs of maintenance of the water supply system, and include the cost of the watershed management activities being implemented in San Isidro. A management plan was elaborated for about 300ha of the area administered by the community of San Isidro. This plan divides the area into zones of different degrees of protection (see map in http://www.gfa-group.de/publications/home_beitrag_1797132.html). We found no information on how the funds are managed and transferred to landowners.

Terms of payment: No information.

Funds involved: No information.

COST BENEFIT ANALYSIS

Economic: No information.

Environmental: Expected benefits include regulation of water flow, erosion control and improved water quality.

Social: Increased capacity-building: Rojas et al. (2005) consider that the process to set up this scheme required continuous consultation that permitted local actors to acquire the capacity and skills needed to conduct negotiations in an agreement process. Negotiations to set up the scheme led to the creation of a municipal development council (COMUDE) in San Jerónimo and with representation from the water users (urban water committee, AURSA and the Municipal Corporation).

Legislation issues: Due to the lack of national legislation and policies, PES needed to be implemented through regulations at the municipal level. Users (see above) were invited by the municipal government to participate in a broad discussion of the structure and content of the new municipal regulation on the sustainable management of water, which provides payment for environmental services and generic regulations for irrigation and industrial water users. These regulations are already in place. Rojas et al. 2005

Main Policy Lessons: Rojas et al. (2005) consider that the generation and dissemination of technical information on the use of water (volumes, quality, use of land, etc) raised awareness among the local users and served as a solid base for the decision-making process to agree on the water regulation. In addition, the authors highlight that this local experience has began influencing the national policies of national actors such as the National Forest Institute (INAB)

and the National Protected Area Council (CONAP).

Remark: data to be updated

Case No 18: Campamento – Honduras

Name of the initiative: Campamento PES scheme

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country/Region: Honduras

Summary: Honduras-Campamento Municipal Water Board Campamento-PASOLAC PASOLAC-supported local micro-watershed initiative. The PES was not fully operational in 2005 and faced funding problems, although negotiations and discussions have been encouraged between stakeholders. PASOLAC-Program for Sustainable Agriculture in Hillside of Central America (PASOLAC), financed by the Swiss International Cooperation (SDC/COSUDE)

Maturity of the initiative: New, ongoing but not fully implemented as per 2005.

Driver: NGO-driven (PASOLAC with international funds from SDC), with support from local municipalities. Their programmes are oriented to conservation and management of water sources, to reduce water scarcity in the region, especially in urban areas.

STAKEHOLDERS

Supply: 44 private farmers (mostly coffee producers) but not all are prepared to adopt the required Soil and Water Conservation techniques. While 15 are willing to enter agreements in exchange for incentives, 14 producers are mostly worried about their ability to meet the scheme requirements, 12 could make changes but do not wish to and 3 have not taken part in any meeting and their plots are abandoned.

Demand: Approximately 60% of the 7,000 inhabitants of Campamento depend on water generated in the watershed of Las Amayas. Water users are represented by the local water board (Junta Municipal de Agua de Campamento). Water is also used in the coffee production process. There is a water deficit of 253 m³/day. Because of the very low capacity to pay downstream there are not likely to be enough local funds to support the project. Studies showed that most water users had a positive willingness to pay for the hydrological service.

Intermediary: Direct negotiation between the farmers and the local water board.

Facilitator: The initiative is assisted by PASOLAC.

MARKET DESIGN

Service: Improved water flows and water quality.

Commodity:

- Improved management practices through: coffee mills with ecological practices, using less

water and water treatment basins;

- Organic manure production from coffee pulp processing with earthworm culture;

Reforestation for commercial plantations, with timber trees and perennial fruit species. There are many use-restrictions and several prohibitions including: logging without permits, polluting springs, any activity in areas designated as strategic (except protection, inspection, tourism and research), construction of buildings of any kind within 200m from each spring, or 150 m from rivers, agriculture on slopes > 30% gradient, extraction of sand or stones from rivers, slash-and-burn techniques, use of any chemical fertilizers, use of coffee varieties that are not shade coffee, use of drinking water for any other use apart from domestic. Even the wandering of domestic animals is prohibited.

Payment mechanism:

Trust Fund and user fees: In November 2002, the local water board set up a Fund for Environmental Services (FONSAM) for several micro-watersheds (including Las Amayas). The fund is kept with seed fund from PASOLAC and annual contributions from the municipality (not clear how much) include funds collected from: fines, 50% of funds from licences, permits and concessions for sustainable management of natural resources, products and rents from the funds invested any donations that the municipality receives and, in the future, revenues from the environmental users fees.

Terms of payment:

One-off payment from PASOLAC (as seed fund) and monthly installments from user fees (expected but not currently taking place). For upstream farmers the payments are in-kind, in the form of technical assistance, installation of latrines and other activities. Funds involved US\$4,000 seed capital from PASOLAC. Value and periodicity of installments from the municipality is unclear.

COST BENEFIT ANALYSIS

Economic: No information

Environmental: Present land use. The watershed (Las Amayas) is 876 hectares in area and is 3.5km long. Slopes are over 40% in 70% of the watershed. 90% of the total watershed is under coffee production owned by 53 farmers. 90% of the farmers (the larger ones) live in the town of Campamento so they are also beneficiaries. There are also a number of small farmers in the area. Farms are 7ha on average, with low levels of technological investment and poor yields. There are many abandoned farms because of the continual depression of the coffee industry. Main problems: The main problems of the watershed are: pollution from coffee processing and from fertilizers from agriculture, fecal matter in water (increased during coffee harvesting), reduced capacity of water flows, pollution from a pig farm in the watershed. There is also an obsolete and limited water piping system and a daily water flow deficit of 253 m³. Perceived effects: Reduced contamination from coffee mills' water waste and pulp; reduced water treatment costs and public health issues due to polluted water (Perez, 2005). However the improvement in water quality is small, and pollution will probably increase once coffee prices start to rise (Ardon and Barrantes, 2003). Social Farmers benefit from technical assistance and sanitation from installation of latrines.

LEGISLATION ISSUES: No information available.

MONITORING: No information available.

MAIN CONSTRAINTS: One of the main problems of this initiative is that current water service is deficient and users are not willing to pay for hydrological benefits if their current service is bad. In 2005 the board was negotiating ways to generate some payment capacity downstream.

MAIN POLICY LESSONS: The initiative had the political support of the town mayor), who prior to his election had been a member of the water board. This led to joint efforts between the water board and the municipality.

OTHER INFORMATION: This project is also complemented by another initiative by Fundacion BANHCAFE with funds from the European Union, which focuses on water user services and producers in the area

Remark: data to be updated

Case No 19: Jesus de Otoro – Honduras

Name of the initiative: Jesus de Otoro (PESCOLAC) PES Scheme

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves - 2006]

Country/Region: Honduras

Summary: PASOLAC-supported local micro-watershed initiative. The PES scheme in the town of Jesus de Otoro compensates upstream landholders for conserving forests and for adopting better environmental practices.

Maturity of the initiative: Launched in 2002.

DRIVER: Conflict resolution led by NGO (Pasolac). The creation of the local NGO Council for Administration of Water and Sewage Disposal (JAPOE) was a response to serious problems of in water access and quality that Jesus de Otoro faced at the beginning of 1990s. There were a lot of conflicts between downstream residents concerned pollution of drinking water supplies and upstream coffee producers. In 1996 the downstream community resorted to destruction with machetes of coffee seedbeds of upstream producers arguing that this activity was the main source of water pollution. In 2001, the Program for Sustainable Agriculture in Hillsides of Central America (PASOLAC), financed by Swiss international cooperation, proposed to the JAPOE the establishment of a payment scheme for environmental services in the watershed, and provided a seed fund of 4,000 US\$.

STAKEHOLDERS

Supply: *Private landowners* in the watershed of the Cumes River. Total area of the sub-basin is 9,180 ha (including downstream). Upstream target area is approx. 2,500 ha. Current land use: around 53% of the watershed is covered by forest, most of it pines and oaks. Part of the watershed is within the Montecillos Nature Reserve (protected area). Highest elevation is 2,200m above sea level. Current coverage of the PES scheme is 75.85 ha of private land, expected to rise to 200 ha. At the time the fieldwork by Kosoy et al was conducted in 2004, the scheme offered payments to only four providers and covered around 22 ha. Later, the coverage was expanded to eighteen providers and 74 ha. The properties under PES are small (range: 9.5-16 ha, average: 13 ha)

Demand: NGO managing water resources. The Cumes watershed supplies water to the town of Jesus de Otoro (with 5,200 inhabitants, 70% with piped connections and the rest using wells and rivers). Funds for the programme come from two sources: an additional fee on water bills charged by JAPOE to 1,269 households (in 2004 this was US\$ 0.06 or 1 Lempira per household per month). The Municipality is supposed to contribute 1% of its annual income to the PES fund (which until 2004 had not been made effective). Seed capital was facilitated by the Swiss Agency for Development and Cooperation (SDC) through their local representative PASOLAC for US\$4,000.

Willingness to pay. A survey among water users downstream (100 users) shows that the average income per household is \$275/month. 57% of them drink water directly from the tap. 43% of them are aware of the PES programme and 72% agree that the payment (1 lempira per household, or US\$0.06) is fair. Almost 80% of households believe that the quality of water has improved in the past two years. The survey did not examine if they thought it was because of the PES or not.

Intermediary NGO intermediary: The scheme is administered by the local NGO *Council for Administration of Water and Sewage Disposal* (JAPOE). The NGO was created in 1995 with support from the Catholic Relief Service (CRS), to manage water provision and sanitation in Jesus de Otoro. Before that the municipality was in charge, but serious difficulties in access and quality forced them to accept transfer of authority to JAPOE. The NGO is a decentralized and participatory institution for urban management of water and sanitation, and its members are elected in general assemblies in ten different areas of the town.

MARKET DESIGN

Service: *Water quality.* The scheme is meant to reduce water pollution, mainly by promoting the adoption of more environmentally friendly agricultural practices. Perceptions about the benefits from the forests in terms of water are strong. A survey of downstream water users revealed that 85% believe that increased forest area results in better water quality, 93% that this increases water quantity. 57% of households think that the main benefit from forests is water provision (and 8% more watershed protection). Interestingly nobody mentioned that the main benefit from forest is biodiversity protection or landscape beauty.

Commodity: *Improved management practices that include:* no burning before, during or after planting; use of vegetation fences, irrigation ditches and terraces; establishment of agro forestry systems; production of organic fertilizers; recycling of coffee pulp and management of wastes from coffee processing; implementation of organic agriculture; agroforestry systems; *Conservation of existing ecosystems: forests in good condition* JAPOE signs a contract with each of the providers. In these contracts, the amount of the payment and the commitments for upstream land use changes are set.

Payment mechanism: *Intermediary-based water fee.* JAPOE charges lempira/household/month (approximately US\$0.06). The municipality is supposed to pay 1% of its annual income.

The amount of the payment depends on the number of better practices adopted and on the type of forest protection. Payments are:

- Primary forest 5.52 Secondary forest 4.14 Young forest 2.76
- Short cycle crop (2 better practices adopted) 5.52 Short cycle crop (3 better practices adopted) 8.29 Short cycle crop (4+ better practices adopted) 11.05
- Permanent crop ((2 better practices adopted) 8.29 Permanent crop ((3 better practices adopted) 11.05 Permanent crop ((4+ better practices adopted) 13.81
- Agroforestry (2 better practices adopted) 11.05 Agroforestry (3 better practices adopted) 13.81 Agroforestry (4+ better practices adopted) 16.57

Terms of payment: Cash payment - continuous through contracts. Each contract is signed every year, and could be easily renewed if the supplier complies with the agreement. Payments are made at the end of the year. Users pay an (continuous) environmental fee. The actual fee for PES was only 3.6 % of the estimated willingness to pay among water users, and was decided politically at the JAPOE through voting of representatives from the different water sectors in town (Kosoy et al., 2004).

Funds involved: Unclear.

COST BENEFIT ANALYSIS

Economic: The study by Kosoy et al. (2004) of the original four farmers included in the PES scheme found that their average gross income (on-farm and off farm) is US\$8,350/year and net profits averaged US\$397.7/ha/. PES payments range from US\$5.52 to \$16.57 which means that their share of both profits and gross income is minuscule (0.4 to 1.2% of gross income). Participants consider a "fair PES" to be in the region of US\$30/ha/yr. Information from ten potential new participants shows an average gross annual income of US\$1,940, with a net farm income ranging from US\$190 to 1,078/ha/yr. Again, the payments are unlikely to have much impact on income.

Opportunity cost. The payments cover at most 12% of the opportunity costs of changes in upstream land practices and use under the PES agreement (Kosoy et al, 2005).

Transaction costs. The overall cost of design and initial implementation of the scheme was about US\$30,000.

Environmental: Total size of the watershed is 3,180 ha, with approximately 50% in uses other than forests. Until 2004 the proportion of the watershed covered by the programme was very small (22 hectares). Even if the programme scales up to 200 hectares (Kosoy et al, 2004), the impact will remain very small or even imperceptible. The project is unlikely to achieve threshold levels unless coverage is increased.

"The JAPOE has undertaken chemical analyses of water quality in Jesus de Otoro on an annual basis since 1999. Even though there has been an improvement in several indicators of water quality, in 2004 fecal coliforms and turbidity were still above the standards for drinking water" (Kosoy et al, 2005). However, it is difficult to see how protecting 22 hectares of forest in a 3,000 hectares watershed will have discernible impacts on water quality at the operational level.

Social: *Inclusion of small farmers.* Providers in Jesus de Otoro are traditional peasants, close to a subsistence economy. In Central America, peasant systems combine the production of traditional crops for self- consumption (typically maize and beans), with cash crops, such as coffee, banana, or pineapple, and other sources of off-farm income (usually commerce).

In-kind benefits. Other benefits such as capacity building and training in changing land use to other more socially acceptable forms of use are possibly the main reasons for upstream farmers to join the programme. PES reduces the pressure on the landholders to fully convert back to forestry, or lose their farms to protected areas if they do not adopt water-friendly land uses. Sanitation has improved livelihoods in upstream communities as well.

Conflict resolution. The PES scheme in Jesus de Otoro is useful for lessening conflict between downstream and upstream stakeholders produced by the deterioration of water quality. "This case suggests that PES schemes depend upon and may help to create appropriate institutional settings for easing downstream-upstream cooperation and promoting conflict resolution. The role of the institutions dealing with the functioning of PES in watershed management is a subject that deserves considerable further research". (Kosoy et al, 2004)

LEGISLATION ISSUES MONITORING: The Municipality is in charge of auditing the fund and has delegated an environmental technician to support monitoring and control activities of the PES scheme.

MAIN CONSTRAINTS: The size covered is too small to make any significant impact on the environmental service, discernible enough to convince downstream users that keeping up the payments is worthwhile. The level of the payment upstream is not high enough to compete with the opportunity cost of land.

MAIN POLICY LESSONS: *The impact of the PES scheme on the income of both providers and users is very low.* Having a small payment downstream has some important benefits for downstream users: 1) Users are keen to pay it and agree with the scheme (US\$0.06 per household/month and an average income of \$245/household/month; 2) The existing service's good reputation lends support to the scheme. 3) Because it is small it does not have negative effects reducing the demand of water. But a small payment for upstream users has potential limitations, mainly in the form of making the PES vulnerable to external factors (e.g. upward changes in prices of the locally produced agricultural products) and probably an ineffective tool for poverty alleviation or wealth redistribution.

Results of political negotiation may bear little relation to findings of technical studies. Technical studies providing "lip service rather than a real input" to the decision making process (Kosoy et al, 2005). The amount of the downstream fee and upstream payments finally agreed in our case studies were the result of a long, complex and political process, in which local institutions and leaderships played a significant role. The way technical issues, including economic valuations, are integrated into decision making on PES design is a subject that needs considerable further research". (Kosoy et al, 2005)

Unsustainability of the scheme. PES seems financially unsustainable in the long run, since current collection levels of user fees are only able to cover 70 ha of the 200 ha identified as priority areas One possibility is to convert this land into a reserve but the owners disagree. Kosoy et al, 2005.

Opportunity costs. The estimates of the opportunity costs differ considerably depending on the method used, and they do not coincide with the value of estimates of on-farm profits. As a result, most providers do not think that the amount they receive as payment for environmental services is "fair".

Strong perceptions that more forest leads to more and better water. The majority of users believe that a larger forest cover will lead to both better water quality and greater water availability. Most users think that water provision is the most important benefit from forests.

Lack of information. Most users are not aware of the existence of the PES scheme. However, when explained, most of them agree with the scheme and the amount of the payment.

Good existing service. A large majority of users think that the water service provided by the intermediary is good and reliable throughout the year.

Willingness to participate in the programme could arise from: 1) Providers feel they get an important benefit as in-kind payments, such as training and technical advice; 2) Social pressure for improved land use upstream that will benefit the commons: the incentive, although small in terms of impact on the household's economy, is effective (as a "tip") in creating incentives for the implementation of socially desirable activities, such as forest conservation or the adoption of better agricultural practices.

Latent threat of expropriation if they do not adopt more water-friendly land uses.

Monitoring (Kosoy et al, 2004) stress the importance of monitoring and communicating results particularly In those cases where PES schemes are meant to improve (instead of preventing the deterioration of) the condition of water resources, s, otherwise it would be unable to demonstrate a real impact on the condition of water resources. Local participation in water quality assessment increases community empowerment and might reduce considerably the logistic costs".

Remark: data to be updated

Case No 20: Coatepec – Mexico

Name of the initiative: Fidecoagua Trust Fund, Coatepec Veracruz PES

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves - 2006]

Name of the initiative: Fidecoagua Trust Fund, Coatepec Veracruz PES

Country/Region: Mexico

Summary: The trust fund Fidecoagua was set up to conserve the cloud forests of the Coatepec Municipality, Veracruz. The head of the municipal government initiated the scheme due to concerns about declining water availability and apparent links with increasing deforestation. Farmers in the area are poor with an average of 3.5 ha and very low levels of education. Payments are made to farmers who have signed contracts to conserve forest and reforest. The total area covered is 600 ha. Satellite imaging is used to detect infractions. The scheme is funded by a fee added to water charges, collected by the municipal utility company. As a warning to the reader, most of the information collected in this case profile is based on e-mail communication and project leaflets, and not in independent studies.

Maturity of the initiative: Negotiations began in 2001 and the trust fund was created at the end of 2002. Calls for applications were made and first payments made in December 2003.

DRIVER

Following a serious period of draught in 1998, the mayor of the city issued a petition for a voluntary contribution, from water users towards forest conservation. The local municipality was worried about deforestation in the cloud forests, soil erosion (loss of 200 tonnes of fertile soil/ha/yr) and reduction of river flows, which began to seriously affect water availability and quality downstream.

The request was for a contribution of MEX\$ 1 (about US\$ 0.09) per month, to be added to the water bill. Due to the recent problems with water scarcity, people's awareness for the problem translated into willingness to pay and the scheme went ahead with the creation of a trust fund.

STAKEHOLDERS

Supply: *Private and communal land* in strategic recharge and riparian areas of the Huehueyapan river, in the headwaters of Coatepec city, selected through satellite-reference photography and identified using georeferenced GIS mapping of the property. In the first year, 67 farmers in 500 ha with highest forest cover) were receiving payments. In 2004, 84 landowners were added (of 165 applications submitted), representing an additional 600ha. The same area was planned for 2005.

Demand: *Local domestic and commercial water users (about 11,000)*

Intermediary: *Trust Fund FIDECOAGUA (Fund for the Promotion, Preservation and Payment for Forest Environmental Services in the Mountain areas of Coatepec, Veracruz).* FIDECOAGUA is the organism responsible for engaging with the participants and managing the funds collected, through its technical committee. **Facilitator** CONAFOR provided funding and technical support with the preparation of baseline analysis for the assessment of forest cover on each property. It also assists with monitoring.²

MARKET DESIGN

Service: *Water quality and quantity.*

Commodity: *Conservation and Protection of Existing Ecosystems Reforestation for commercial plantations:* farmers are encouraged to reforest their lands- reforestation contracts should include at least 50 saplings per year.

Payment mechanism: User-fees and trust fund FIDECOAGUA.

The municipal water utility collects the monthly water bills and channels the funds to FIDECOAGUA, who then invests in targets strategic areas in the catchment. Participants sign a contract and are constantly monitored. Contracts are renewed every year, depending on the availability of funds. This length of contract is preferred because of uncertainty about future availability of funds. According to the availability of funds, a new call for applications is released every year (FIDECOAGUA has a target area of 4, 500ha).

Terms of payment: *Ongoing cash payments..* Payment in 2003 was MEX\$ 1,000 (about 90US\$) per ha. Unclear if this amount has changed over time. In some areas, participant landowners are also receiving payments from the national PSAH, whose payments are about three times lower. In these cases, FIDECOAGUA contributes with the remaining amount up to its standard payment.

Funds involved: Seed Fund of about US\$ 90,000 (Federal funds: MEX\$ 400,000; Coatepec Municipal Water Utility: MEX\$ 100,000; CONAFOR (through its PRODEFOR programme) MEX\$ 500,000). Contributions from users (MEX\$ 1/ month) yield about MEX\$ 120,000 a year (about US\$11,000/year). In the first year (2003), the budget allocated to for payments was MEX \$500,000. In the following year it was reduced to MEX\$ 300,000.

ANALYSIS OF COSTS AND BENEFITS

Economic: *Transaction costs are very high.* Significant level of initial investment was required, including equipment for office, transport, photography, computers, etc. for a total of MEX\$ 405,629 (about US\$37,000) (). Annual expenses include wages, insurance, and vehicle expenses, to a total of MEX\$ 303,000 (or approximately US\$28,000). Ongoing expenses such as rent, electricity, telephone and water are paid by the municipality, as the FIDECOAGUA's office is located in the municipality building. (Contreras, personal communication, 2005). Other costs such as opportunity costs have not been quantified, nor have the benefits for participants. However, it has been observed that many small, poor farmers have begun to invest in

reforestation and soil management, as well as investing in unused land.

PSAH provides additional funds to complement the income of small farmers and allow them to capture value for standing forests. With the funds from CONAFOR many small, poor farmers have begun to invest in reforestation and soil management, as well as investing in unused land.

Environmental: Mr. Contreras, the director of FIDECOAGUA, (personal communication, 2005) considers that there has been an improvement in water quality, due to a reduction in sedimentation, and an increase in water quantity, saving Coatepec from the severe water scarcity problems that have affected neighboring municipalities, with considerable productive losses in agriculture and ranching. They expect to be able to prove the positive results through studies about to be conducted by hydrologists from the Free University of Amsterdam and the Mexican Institute of Ecology. No studies supporting this are available. **Social Poverty impacts.** Potential impacts on poor are large. 90% of landowners in the area are illiterate and because of their limited options they had been cutting down forest to use land for agriculture and ranching with traditional methods and very low productivity. Payments from the scheme may considerably increase family income and reduce pressure on forest.

LEGISLATION ISSUES

FIDECOAGUA was created in 2002 before the General Law of Forest Development was passed, or the national PSAH programme was introduced. Today there are new processes where the law is changing and including forest development. The laws for supporting the expansion of the agricultural frontier (*desmonte*) have been eliminated. Expectations from carbon markets and international laws and agreements for carbon reduction also encourage reforestation projects.

MONITORING

Monitoring is done annually with satellite images provided by CONAFOR, who also set of procedures to use during the field visits for monitoring and provides the field supervision.

MAIN CONSTRAINTS

Although there are studies that recognise the economic importance of forest, intensive agriculture and ranching are still advancing rapidly in Mexico. Forest incentive programmes involve long and bureaucratic procedures and have a poor track record.

The programme began with little information and faced problems using the appropriate technology (learning GIS- based programmes, etc) without appropriate results until CONAFOR provided them with training. Today the INE has programmes and toolkits setting down procedures to follow in establishing PES, and there is a good degree of cumulative experience to support other nascent projects elsewhere. One of such tools, is a manual developed by INE, with step by step advice on how to set up a local PES scheme.

MAIN POLICY LESSONS

HOW TO GET FARMERS ON BOARD, Mr Contreras tells about the experience with FIDECOAGUA

Ignacio Contreras, the programme director has highlighted the following lessons:

- To be effective in the long-term , Payments for Environmental Services (PES, or PSA in Spanish) schemes must be accompanied by training, capacity building, technology and resources for viable projects that the communities accept and engage with.

“In the beginning of the project, when we identified the most problematic and critical areas, the poorest farmers feared that the programme would involve expropriation of their lands and demonstrated against it.

We then went to their communities. We explained with detail the objectives of the project we showed them the satellite pictures. They recognized the advanced deterioration of their lands and we all considered alternatives for real improvements in their communities, to stop cutting down the forest until they ended up “without trees and just as poor as before”.

After the meeting they began receiving the PSAH, and currently they receive saplings for reforestation, and we make constant visits to the area and they to the offices of FIDECOAGUA. We have excellent relations with most of them. Some farmers are not taking part in the project, and keep on cutting down trees, but the example from participants is strong and creates social pressure for a cultural change”. (Ignacio Contreras, FIDECOAGUA, personal communication, 2005)

Allocating funds to small projects can be effective in catalysing regional development. There is a long- way to go towards engaging the private sector and reducing dependence on scarce municipal resources. Industries with high water consumption have been approached, but without positive results.

Even the poorest of the poor are willing to make sacrifices for the future, especially of their children. But it is necessary to provide long-term alternatives.

Women are the key element in family livelihoods and are more willing to enter in projects that improve the chances of their children. It is necessary to create ways to reach them directly. However, cultural limitations in some areas do not allow women to own land, or take part in capacity building.

The PES is an excellent tool for working with communities in sustainable forest projects and can help communities out of extreme poverty.

“Nobody is too tight to understand. Even people of the lowest cultural groups can understand and look for better alternatives when they get the opportunities to improve their livelihoods. Especially when the most sensitive areas are concerned, such as the future of their children. However, from this emerges the commitment to bring to them alternatives for improvement. We consider that PES is a good start, but it is not enough to create the change to a sustainable culture. Women are the foundation of the family livelihoods. They hold the responsibility for family life. But unfortunately, in some places, women are not allowed to take part in capacity

building. It is necessary to have female trainers that can access other women in their own homes. Social management is not easy, but neither is it impossible. The tool of paying for conservation is an important incentive, but it is important to match it with other social tools". (Ignacio Contreras, FIDECOAGUA, personal communication, 2005)

Remark: data to be updated.

Case No 21: Saltillo – Mexico

Name of the initiative: Watersheds and Cities. A project for the watershed of Saltillo City. (Cuencas y Ciudades III un proyecto para la Cuenca hidrológica de Saltillo)

[Source: Email communication with Mr. Sergio C. Marines Gomez: marines@profauna.org.mx]

Country/Region: United States of Mexico, Coahuila state, Sierra de Zapalinamé (Zapalinamé Mountain)

Objective, size of the project: Involving Saltillo citizens in conservation of their main source of water, the Sierra de Zapalinamé.

Status of payment and activity implementation, duration: Ongoing since 2003. Voluntary fees from water users collected by water supply company and administrated by PROFAUNA A.C. to apply it on management, conservation and restoration of the natural protected area.

Costs (opportunity costs, monitoring, upfront costs): the total operation funding in 2010 was 481, 830 USD, of which 5.5% for Administration, 79.5% for Operation (conservation, restorations, management, use, environmental education and sensitization, diffusion, environmental interpretation, research, monitoring and planning), 15 % environmental services payments, average of 30 USD/ha, using the National Forestry Commission system. An extra benefit for the landowners, is that part of the economical resources of the operation was invested in conservation and restorations projects in their lands, incl. payment for their own work.

Funding sources: water users and state government donations; Project Watersheds and Cities of Fondo Mexicano para la Conservación de la Naturaleza (Mexican found for Conservation of the Nature) and Gonzalo Río Arronte foundation; federal government projects; Johnson Control project of Environmental Conservation; Youth Brigades and PROFAUNA funds.

Main partners: water users and land owners; municipal and state government; the federal agencies (National Forestry Commission, National Protected Areas Commission, INIFAP (National Institute of Forestry, Agriculture and Cattle Raising Research); Fondo Mexicano para la Conservación de la Naturaleza (Mexican found for Conservation of the Nature) and Gonzalo Río Arronte foundation); Johnson Controls Co.; water supply company AGSAL (Aguas de Saltillo – water of Saltillo); Citizens Committee that supports the Reserve and the Local Media.

Practices adopted: As a part of the Annual Operation Program, PROFAUNA developed 5 subprograms:

- Conservation and Restoration: projects of vigilance, fire management, land restoration, exotic species control, native plant production and forest health.

- Subprogram of Use and Management: projects of promotion of alternative low-impact projects, management and regulation of recreation and livestock management.
- Subprogram of Education for Environmental Conservation: projects of environmental education, communication and environmental sensitization.
- Subprogram of Research and Monitoring: projects of wildlife reintroductions and projects of monitoring about of black bear, birds, water springs, organic soil extractions sites, forest inventory, quarries, local pollution, flora and fauna.
- Subprogram of Administration: projects of funding; design and monitoring of annual operating program; emergency management and staff training.

Results so far: The result of this scheme can be measured by the social acceptance, the number of families participating in the project (more than 35,000 families of Saltillo) and the amounts raised.

The mountain's social recognition as supplier of environmental services for the Saltillo city, as can be clearly seen in the survey made at the beginning of the project, showed a poor knowledge (only 5% of the population knew about the location and importance of the Zapalinamé Mountain). But after 6 years, more than 70% of the population knows about the location, and about the mountain natural resources, flora, fauna, historical importance and recreation opportunities, the importance as the environmental services provider or some of the regulations applicable to the reserve.

Acceptance and cooperation of the land owners with PROFAUNA, A.C. as manager of the natural reserve, became evident, since all the rural communities are involved in at least one project, and some communities are involve in even more than ten projects at this time. Also three communities recruited inhabitants to build a brigade working full time in the reserve, to protect the natural resources, to help in emergencies and implement the annual operation program.

Remarks: PROFAUNA as a member of the national program of watersheds and Cities, also have the responsibility to participate in the learning community, including 10 Mexican Civil Society Organizations who develop the same kind of project in their states.

PROFAUNA, also have made arrangements with National Forest Commission to pay Hydrological Environmental Services, reversing to the land owners 50% of the total arrangements amount during a period of five years.

Case No 22: National PSAH Programme – Mexico

Name of the initiative: National Programme for Hydrological Environmental Services - PSAH

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country/Region: Mexico

Summary: Mexican countrywide PES scheme investing earmarked water use fees into conservation of forest cover in priority areas for enhancement of hydrological resources (PSAH, The programme is meant to catalyze the introduction of local schemes based on contributions from local water users that can be financially sustainable in the long term.

Acronyms: PSAH- National Programme for Hydrological Environmental Services; PSA-CABSA- Program to Develop Environmental Services Markets for Carbon Capture and Biodiversity and to Establish and Improve Agroforestry Systems; CONAFOR - Mexican Forestry Commission; CNA- National Water Commission; INE- National Institute of Ecology

Maturity of the initiative: *Ongoing since 2003.* In 2004, the Mexican government created a second national PES programme to support biodiversity conservation and carbon sequestration projects, particularly through agroforestry (PSA-CABSA).

Driver: Interest in curbing deforestation and, at the same time, protect aquifer recharge function of natural forestlands. Water scarcity is a serious problem in Mexico, as two-thirds of its aquifers are being exploited beyond their capacity. The PSAH scheme provides incentives for forest conservation with a share of revenues from existing water fees.

Stakeholders

Supply: Private or communal landowners well-preserved forest (with at least 80% forest cover) Priority areas (maximum area per participant is 4,000ha);

- Critical recharge areas for the over-exploited aquifers of the country (according to CNA classification);
- near streams, in regions with problems of water scarcity, poor water quality and high sediment loads and where hydrological natural disasters are more frequent;
- in areas that supply urban centers of more than 5,000 inhabitants;
- in priority mountain areas (designated by CONAFOR, IF they are also facing water problems).

The minimum size to be eligible in 2004 was 50 ha of forest (the smallest area that can be observed with satellite images) (Alix-Garcia et al 2005).

Participation: The PSAH programme began with 6 million ha of eligible land. In the first year (2003) from the 900 applications (600,000 ha), 271 were selected (127,000ha). In the following year, 352 new participants (and 180,000ha) were added to the programme. By 2005, the programme included already 477,756ha, covering most states) but mainly concentrated two northern states (Chihuahua and Durango) and two southern (Oaxaca and Chiapas).

Including CABSA, the total land area under the Mexican National PES schemes, by 2005, was already 535,206ha surpassing the 10-year old Costa Rican National Programme, in 2 years alone (2003-2005) and becoming the largest programme in Latin America.

For the first year of operation ejidos and indigenous communities holding forestland as common property, accounted for 47% of the contracts and for 93% of the area contracted. The remaining 7% of the area under PES belonged to private landowners (public land is not eligible for the programmes).

Demand: National government on behalf of water users, channels a share of the water use fees, to the PES programmes.

All drinking water users (domestic, commercial, industrial, urban public) and most bulk water users (irrigation, industry) pay for water consumption. Amounts vary according to the state. Actual collection of fees is very low (Alix-Garcia et al., 2005) and the largest water users (responsible for 80% of consumption), arable and livestock farmers, do not pay for water (Muñoz-Piña et al. 2005)

Intermediary: CONAFOR: National Forestry Commission, who also manages other commercial forestry programmes.

Facilitators: The PSAH programme took three years to set up and had the advantage of expert advice from Costa Rican National Forestry Fund (FONAFIFO, the Mexican National Institute of Ecology (INE), the Economic Research and Higher Education Centre (CIDE) and the University of California at Berkeley. Financial and technical support was also provided by the World Bank.

MARKET DESIGN

Service: Water quantity: interest in supporting watershed management to increase ground water recharge. Water quality and reduction of landslide risk are also mentioned.

Commodity: *Conservation and protection of existing ecosystems* through forest protection contracts, valid for 5 years. Contracts require participants to preserve the original forest cover by ensuring its protection (against forest fires). (In the case of CABSA, reforestation for commercial plantations and agroforestry are also possible options)

Payment mechanism

User fees and trust fund: PSAH funds originate from an earmarked share of the water use fees charged by the municipalities and then channelled to the National Water Commission (CNA). While initially this share was to be a percentage of the total revenues (2,5%), it was later changed to a fixed amount. It started at 200 million Mexican pesos (about US\$ 20 million) in

2003 and was increased to 300 million Mexican pesos (about US\$ 30 million) in 2005. This allocation of funds covers both PSAH and CABSA. (Ley Federal de Derechos 2005).

From the total budget allocated to each PES programme, 96% is allocated to direct payments to participants, in the case of PSAH and to support project elaboration and execution, in the case of CABSA. The remaining 4% should cover costs of operation, evaluation and monitoring. Funds are channel led through the Mexican Forest Fund, an instrument created to finance forest conservation and restoration projects, by pooling funds from different sources. As such, the fund also supports other programmes managed by CONAFOR.

Applications are submitted in July/August every year and results are released in November/December. Successful candidates receive an official letter and results are also posted on CONAFOR website.

Terms of payment: Direct cash payments to landowners. Primary forest owners receive \$300 pesos/ha/yr (about US\$27.) and cloud forests owners receive \$400 pesos/ha/year (US\$36) due to the perceived higher delivery of hydrological services associated with this type of forest (mainly due to their role in capturing water from horizontal rain in the dry season.) Payments are made on an annual basis, at the end of the year, once the absence of land use change has been confirmed (see monitoring).

Funds involved: According to CONAFOR (2006a), US\$ 88 million had been invested up to 2005 (including funds assigned to PSA-CABSA: about US\$ 10 million, 2004 and 2005). This amount originates from the share of the water fees, which amounted to approximately US\$ 20 million in 2003 and in 2004, and US\$ 30 million in 2005, (coming to a total of about US\$ 70 million).

A new input was added early this year, through a World Bank/GEF project for Forest Environmental Services. The project's aim is to consolidate the PSA-CABSA and strengthen the PSAH, particularly by creating local sustainable financing mechanisms. Overall project costs are US\$173 million, including a GEF grant of US\$15 million and a World Bank loan of US\$ 80 million. The largest share of the project's budget (82%), and 91% of the loan (90%) is to be invested in the fulfilment of payment commitments to participant landowners (GEF, 2006).

Project components and budget (% of a total of US\$ 180 million)

I. Developing Sustainable Financing Mechanisms for water, carbon and biodiversity	2% (9% of which is assigned to the development and capitalization of a Biodiversity Fund)
II. Developing and strengthening PES Delivery Mechanisms (capacity building, monitoring)	2%
III. Supporting Environmental Services Providers (access to the programmes and compliance)	1%
IV. Payments to Service Providers	82%
V. Project and Programme Management	1%

Source: GEF (2006)

Cost Benefit Analysis

Economic: Transaction costs are likely to amount to about US\$ 1 million per year, or US\$ 5.6 per ha (for a total of 535,206ha), considering the accumulated budget allocated to the PES programmes (PSAH and CABSA) since 2003 (about US\$ 88 million) and the set allowance of 4% for administration expenses.

For PSAH participants, in 2003, transaction costs amounted to \$237 pesos (about US\$ 20) for ejidos and communities and \$304 pesos for private owners. COLPOS 2004, cited in Alix-Garcia et al., 2005

Opportunity costs: given appropriate soil and water conditions, alternative land uses could generate higher average returns per hectare than the payments received: corn- US\$ 37/ha/yr and livestock production US\$66 (Jaramillo, 2002 cited in Muñoz-Piña et al. 2005). However, in many places, conditions for farming or ranching are not promising and so the compensation offered might have been higher than the opportunity cost. This might explain the high number of applications.

"The land in many parts of the reserve [Sierra Gorda Biosphere Reserve] is not suitable for most forms of agriculture or ranching. It just isn't productive enough." So when Pedraza and his colleagues told some of the local farmers that the Mexican government might be willing to pay them as much as 400 pesos (\$40) per hectare per year to leave their forests alone, most jumped at the opportunity. "It took some education," explains Pedraza, "but not much convincing." (...) farming and ranching in these parts is difficult business. They'd be lucky to maintain one head of cattle on 10 hectares, so the 300 or 400 pesos per hectare per year more than makes up for the loss of their grazing opportunities." (Roberto Pedraza, Director of the Sierra Gorda Ecological Group, cited in Bayon, 2004

Environmental: Additionality: In the first two years of the PSAH programme there seems to have been little effect on reducing the risk of deforestation since 64% of enrolled land is under low or very low deforestation risk. Much of PSAH's 2005 budget was invested in natural protected areas or priority mountains, which were not necessarily areas that had water-related crises- 90% of the land under PSAH in 2004 corresponded to not yet overexploited aquifers). (Muñoz-Piña et al, 2005, Alix-Garcia et al, 2005)

Social: Poverty impacts: The largest share of the PSAH payments has been assigned to areas of high or very high marginality (72% of enrolled hectares in 2003 and 83% in 2004). However, Alix-Garcia et al. (2005) highlights that this has not been an intentional poverty alleviation strategy, but a consequence of the fact that 80% of the forest in Mexico is held by ejidos and indigenous communities, and that 86% of the forest is located in communities with high or very high marginality. According to CONAFOR (2006a) the national PSAH scheme is reaching rural areas that other government programmes haven't been able to.

Legislation Issues: According CONAFOR (2006a) a very important step to implement the PSAH was to create clear enabling legislation for investment in environmental services. This was one of the recommendations from the Costa Rican advisors, right in the beginning of the process. CONAFOR began by incorporating provisions for the PSAH in the federal forestry law,

and then proceeded to do the same at the state level.

Monitoring: PSAH monitoring is done once a year, through the comparison of satellite images of the original forest cover and of the present condition; this can also be complemented by random visits to the plots. Compliance levels are very high and loss in forest cover is often unintentional and due to forest fires or timber theft. (Muñoz-Piña et al. 2005)

However, the fact that the programme monitors only the maintenance of forest cover, allows other threats to prevail. This is the case of livestock being allowed to remain in the forest damaging the undergrowth and creating other negative impacts for water resources related to soil compaction and organic matter deposition. (Bayon, 2004)

Main Constraints

Barriers to participation remain especially for the most marginal groups who have less access to information and capacity to formalize applications (often related to lack of complete documentation in relation to land register) and less lobbying power with the local CONAFOR office. (Muñoz-Piña et al, 2005)

Absence of local intermediates and facilitators: The PSAH operates without local intermediaries and it is only where NGOs are already active that the local farmers have real support in learning about the programme and applying for it. The case of Sierra Gorda Biosphere Reserve, mentioned by Bayon (2004) illustrates this situation.

Main Policy Lessons

Political influences: Due to a combination of political negotiations, legal impediments and lack of technical information and capacity, the final version adopted of the PSAH was considerably less targeted with respect to environmental and social goals than in the initial design of the programme which had contemplated starting with a pilot phase. (Alix-Garcia et al., 2005)

Choice of Intermediary: Since the real mandate of CONAFOR is commercial forestry projects some authors (Alix-Garcia et al., 2005) have argued that this influenced the way the PSAH programme was implemented, particularly in terms of the distribution of contracts to forest-holders with commercially viable forest operations and to those with land in target areas of other CONAFOR programmes. This might contribute to explain the lack of environmental additionality of the programme (see environmental impacts above). However, the same authors consider that CONAFOR's experience and lobbying power was key in securing funding for the programme. Muñoz-Piña et al (2005) highlights the importance of the political support provided by CONAFOR's General Director " first giving his agency's full support to the development of the idea, and later providing the political backing it needed to pass through the Congress and the agricultural lobbying groups."

Accountability of the National Scheme and Potential for Local Take-over: Since users are not paying an extra fee to cover the PSAH investment, pressure for the programme to comply with its goals and be accountable for the investment might be too weak to justify the current budget allocation.

Remark: data to be updated

II. b Asia

Case No 23: National PES Programme – China

Name of the initiative: Local Watershed Protection Schemes - China

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country/Region: China

Summary: Over the past decade, while the central government was developing a national Forest Ecological Compensation structure. Several local initiatives were also developing throughout China, led by local governments' interest in protection of water quality and quantity. These are mainly provincial or county level initiatives using earmarked shares of water-based revenues or creation of watershed protection fees as mechanisms for funds collection. It is unclear how funds are transferred to upstream landowners, but this is likely to be through local-government supported land use agreements, involving mainly forest management. As water user fees appear to be mandatory in some cases and as it is unclear how funds are transferred to landowners, these schemes can be considered as "borderline" PES.

Although several studies mention the existence of these local initiatives (Changjin Sun and Xiaoqian Chen .2002; China Agricultural University, 2004; Changjin Sun and Chen Liqiao, 2005; Liu Can et al. 2005 in Lu Wenming *et al.*, 2002), their current status is unclear. Municipal, county and provincial government authorities are the drivers of this initiative.

Driver: The service provided is water quality (pollution and siltation control) and landscape beauty.

STAKEHOLDERS

Supply: The service providers are the landowners upstream of drinking water reservoirs, hydroelectric dams and industry water intakes.

Demand: Local or provincial government, water utilities and other industries with high water use, hydropower producing companies and agricultural producers represent the demand side of this scheme.

Intermediary: Local government authorities negotiate directly with landowners on supply side and with other water users on demand side.

Facilitator: In some cases forestry department is facilitating the scheme.

MARKET DESIGN

Commodity unclear but likely to involve: Improved management practices for soil and water

conservation, Rehabilitation of existing ecosystems for conservation (mainly through reforestation of erosion-prone degraded lands) Reforestation for commercial plantations.

Payment mechanism: Most common mechanisms for collection of the funds are earmarked shares of water-based revenues or creation of watershed protection fees. It is unclear how funds are transferred to upstream landowners.

EXAMPLES

In **Liaoning Province** (Northeast China), a fee is charged to mining companies, paper mills, and other large industrial water users to support watershed forest management. Fees vary according to the user. Urban water supply companies, industrial and mining enterprises pay the highest fees (US\$0.0012/tonne of water used); agricultural water users pay US\$0.0001/tonne. Hydropower producers pay US\$0.0012 per kilowatt-hour and inland water transport enterprises contribute with US\$0.0001 per tonne transported. In addition, forest scenic beauty areas must contribute with 20% of admission tickets sales. Approximately 13 million Yuan are collected annually (about US\$1.6 million), amounting to 47million Yuan until 2002 (US\$6 million). (Lu Wenming *et al.*, 2002).

In **Shanxi Province** (East China), *Yao County* assigns 10% of the revenue from a water fees to the Forestry Department to protect critical watersheds. (Lu Wenming *et al.*, 2002). With the same aim, *Hubei Province* earmarks a share of the fees collected from drinking water, hydropower, scenic tourism, river transportation, mining in timberlands and economic forest products. (Changjin Sun and Xiaoqian Chen. 2002)

Miyun Reservoir and water supply for the cities of Beijing and Tianjin (East China)

Direct negotiations between the *Beijing and Tianjin municipalities* and the farmers in Chengde, Fengning County (*Hebei Province*) have led to the creation of an Environmental Forest Compensation Fund to secure the quality of the water stored in the Miyun reservoir. The reservoir supplies 80% of Beijing's water and 56% of water flowing into the Miyun Reservoir comes from the Chao, Bai and Chaobai Rivers which originate in Chengde Prefecture. In order to reduce siltation into the reservoir (soil erosion is 1200 -1600 tons /km²) and control agro- chemical pollution runoff, the two municipalities have agreed to provide compensation for improved land use and forest management. Beijing municipality has agreed to pay 1 million Yuan/year (about US\$ 126,000) and Tianjin 400,000 Yuan/year (about US\$ 50,000). In addition to these donations, 0.2 Yuan (US\$0.02) per cubic metre of water consumed is earmarked for investment in forest protection (this amount is equivalent to about 12% of total revenue from water charges). (Lu Wenming *et al.*, 2002).

The central government has also invested in the protection of the watersheds supplying Beijing city, by channeling 8 billion Yuan (US\$ 1 billion), for the period 2001-2005, to soil and water conservation measures in Hebei and Shanxi Provinces (unclear if through the Eco fund, or through a different programme). In 2004, the province of Hebei has implemented soil conservation measures in 96,100 ha and developed water-saving irrigation on 47,000 ha of farmland. (China Agricultural University, 2004).

Zhejiang Province (Southeast China) is also working on the local take-over of the national Forest Ecological Compensation Programme and has established that all levels of government within the province will work towards the establishment of a provincial forest ecological service compensation fund, by: i) gradually increasing the size of compensation fund and ensure matching support from county level governments; ii) strengthening the collection and management of various resource use fees and raise fund use efficiency; and iii) introducing and explore market based ecological compensation mechanisms such as pollution rights trading and resource trading markets; They have so far invested about 200 million Yuan (about US\$ 25 million) and compensation is set at 8 Yuan/mu (or US\$ 15/ha). (Changjin Sun and Chen Liqiao, 2005)

In **Jiangxi Province** (*South China*) *Xingguo County* due to serious soil erosion (which affects 85% of county's land) the County created a scheme to provide households with financial support to plant and manage trees for soil conservation. 96% of the forestlands in the area were (by 2002) contracted under the Household Responsibility System. Funding originates in an imposed watershed protection fee: chemical and metallurgy industries pay a share of their sales revenue of 3 and 0.5% respectively; coal industry pays 0.1 Yuan per ton produced, and hydropower producers pay 0.001 Yuan/kWh. (China Agricultural University, 2004). Very positive results in terms of area affected by soil erosion, have been reported by Lu Wenming *et al.* (2002).

In **Guangdong Province** (*South China*), 30% of total annual forestry finance is assigned for ecological forestry (unclear how this is defined) and additional funds shall be collected from water user fees and government funds on soil erosion control. The compensation rate for forest owners in the scheme is 2.5 Yuan/mu/year. (Changjin Sun and Xiaoqian Chen .2002 and Lu Wenming *et al.*, 2002). The Qujiang County government, for example, charges water supply 0.01 Yuan (US\$0.001), per tone of water and hydro-electricity producers 0.005 Yuan/kW (US\$0.0005). In the city of *Guangzhou*, a similar scheme has been ongoing since 1998 when the payment was 5 Yuan/mu/year; by 2001 the payment level had doubled. (Changjin Sun and Chen Liqiao, 2005).

Xinjiang Autonomous Region established its own compensations scheme already in 1997. Funds have been collected from monthly salaries of employees in government departments, institutions and enterprises. Starting from the wage category 300-700 Yuan/month, 1 Yuan/month would be collected. The rate would increase quickly to 40 Yuan when monthly salary reaches 4,000 Yuan or above. Additional funds have been collected from crude oil, nonferrous minerals, scenic zones and forest parks. (Changjin Sun and Xiaoqian Chen, 2002).

In **Guangxi Zhuang Autonomous Region**, hydropower companies are required to contribute with 1 Yuan /kW amounting to 1 million Yuan (US\$ 120,000) per year, to finance forest planting and management in the region. (Lu Wenming *et al.*, 2002).

In **Inner Mongolia Autonomous Region**, farmers in *Linhe County* are charged 0.5-1 Yuan/mu to invest in forest planting and management. (Lu Wenming *et al.*, 2002).

Remark: data to be updated.

Case No 24: Lombok - Indonesia

Name of the initiative: Lombok PES scheme

[Source: WWF; www.yale.edu/istf/files/prasetyo.pdf]

Country/Region: Indonesia

Summary: Lombok is a small island (463 243 ha). In 2003 its population was approximately 3 million. More than 600 000 of its inhabitants live in the area around Mt Rinjani. The Rinjani catchment area plays an important role in supplying water to the people in Mataram District. The supply comprises 85 springs on 10 watersheds and 5 sub watersheds. As by 2003, 40% of the springs had disappeared as a result of land-use change for agriculture and forest degradation in the Rinjani area, resulting in the scarcity of water supplies.

The Lombok PES scheme is one of the most advanced PES scheme to date, where WWF is working to conserve the forests of Mt. Rinjani. The forests here are vital to the \$50 million per year agricultural sector of the region, and supply domestic water worth \$14 million. They also bring tourist dollars into the economy, as well as water for local industry. The idea behind the PES scheme is that the funds collected will help pay for conserving the watershed forests at the head of the Segara River and improve social conditions in neighboring communities.

The study of Willingness To Pay (WTP) showed that at the community level most customers (95%) were aware of the water-supply crisis and willing to pay Rp. 1000–5000 (US\$ 0.1–0.6) per month per customer to conserve the springs (an average of Rp. 50/m³= US\$ 0.005/m³) with national average income/year in 2006 = US \$ 900. The results of the study stimulated the local government to begin work on a District Regulation on Payment for Environmental Services. The dissemination process, supported by a model of land use and water supply, was developed in collaboration with CIFOR.

Remark: data to be updated.

Case No 25: Chandigarh – India

Name of the initiative: Chandigarh PES Scheme

[Source: Markets for Watershed Services - Country Profile Ina Porras and Nanete Neves – 2006]

Country/Region: India

Type of PES: Community watershed management

Summary: Case ongoing since the 1970s. Due to the sedimentation problem of the lake serving the downstream town of Chandigarh, the CSWCRTI¹² constructed soil conservation structures that, apart from reducing siltation of the lake, also stored rainwater for irrigation for the upstream village (purchased with water rights and later user fees). Other in-kind compensation was organized to provide additional incentives for villagers to give up free grazing and tree felling in the hills.

Maturity of the initiative: Mature - initiated in mid-1970s.

Driver: The PES component of this watershed management scheme arose from the need to create compensation/incentives for landless and more marginal farmers to participate in the watershed protection activities. Since not all of the villagers were benefiting from the improved water resources (which led to better agriculture production and even fish farming in the dams), benefit sharing arrangements (or PES) were set up to share the water resource more fairly (including non land owners) and provide incentives for all to take up the protection measures required.

The Problem: The degradation of their agricultural lands was forcing the villagers to bring more hill slopes under agriculture, but their indiscriminate practices of free grazing, land clearance and tree-felling were also creating a vicious cycle of unending land degradation and poverty. Under these circumstances, it was soon realized that no amount of technical soil conservation measures and watershed development could prevent the flow of silt to Sukhna Lake, unless the villagers could first be motivated to give up free grazing and tree felling in the hills. (Sengupta, S et al, 2003)

Stakeholders

Supply: Private landowners at Sukhomajri village (small landholdings), Haryana's Punchkula district. Water services were supplied by regeneration of vegetation cover and protection of upslope areas. Villagers had to refrain from allowing their animals to graze on the watershed hills (in order to maintain vegetation cover for soil protection). As compensation, deals were made with the forest department for villagers to access *bhabbar* grass (that allows them to

¹² Centre for Soil and Water Conservation Research and Training Institute

better feed their buffalos and even sell the extra milk).

Demand: Private (small) landowners at Sukhomajri village (who also benefit from improved water supplies). Inhabitants of the downstream settlement of Chandigarh (this was the initial driver of the watershed management scheme). Chandigarh's water supply (and recreation) depends on Lake Sukhna, which was threatened by sedimentation, 80-90% arriving from around Sukhomajri. The lake is fed by a seasonal stream carrying high sediment loads.

Intermediary: Water users association (later called Hill Resource Management Society -HRMS) managed the water allocation.

Facilitator: Supported by the Centre for Soil and Water Conservation Research and Training Institute (CSWCRTI) and the Ford Foundation.

MARKET DESIGN

Service: Water quality: sedimentation reduction (to maintain the lake's storage capacity) and management of water flows.

Commodity: Best management practices: through participatory integrated watershed management projects, especially in rain-fed agricultural areas; water harvesting and soil and water conservation techniques on farmland.

Conservation and protection of existing ecosystems, through protection of forestland from grazing.

Payment Mechanism: NGO intermediary-based transaction & (tradable) water rights/user fees - to ensure compensation to households that are excluded from reforested areas, Sukhomajri first allocated tradable water rights to every household so all have an interest in maintaining water flows.

Irregularity in water flows led to replacement of this system by a user fee system whereby the Hill Resource Management Society (HRMS) collects fees for water use and distributes the revenue to all villagers.

The Society also distributes revenue from extraction of *babbahr* grass and, in future, timber from common areas to all villagers.

Terms of Payment: In kind and one-off: Construction of rain water collection dams that improved water supply to the village and allocation of water use rights to all households within the village. Also access to other grazing areas.

Funds Involved: Water rights: Rs. 16 per hour (from which Rs. 4 per hour are channelled to cover HRMS's administrative expenses).

Cost Benefit Analysis

Economic: Initially water use rights were allocated to all villagers for buying and selling, then this system was later abandoned in favour of a less competitive system of user fees.

Agricultural productivity increase: Improved watershed protection has generated high returns in

the form of improved agricultural productivity due to greater water availability in the check dam and reduced soil erosion. Between 1977 and 1986, agricultural productivity increased 500% for wheat yields, 400% for maize, 30% for milk production. From 1979 to 1984, household income went up from about Rs. 10,000 to Rs. 15,000, with villagers earning about Rs. 350,000¹³ from milk sales and another Rs. 100,000¹⁴ or so from the collective sale of bhabbar grass (Agarwal & Narain, 1999).

In the 1990s the forest yielded nearly US\$3,000 worth of grass annually. However, this led to a steep increase in government charges for the extraction of babbahr grass from public forests. Avoided costs: siltation in Sukhna Lake fell by 95%, saving the city of Chandigarh about US\$200,000 annually in dredging and related costs. Vegetation cover on the hillside increased from thirteen trees per hectare to 1,292 trees per hectare, raising the value of the forest to an estimated US\$20 million capable of generating at least US\$700,000 per annum.

Environmental: Reduced siltation and increased tree cover (see above for avoided costs).

Social: Improved living conditions (see multiplier effects summarised in economic benefits section above). Investment in social capital and building cooperative institutions (the Hill Resources Management Society). Sukhomajri has strong social institutions, which have provided a basis for setting up a system of benefit sharing. The Forestry Department has also provided support to ensure support for watershed protection.

As compensation for foregone benefits previously drawn from using the common lands for grazing and Non-Timber Forestry Products, farmers were able to profit from the sale of water rights and access to increased fodder from public lands (owned by the forest department). Equity issues: families without land (or with small plots) who did not use up all of their water entitlement, could sell it to those who needed more.

"This market-like mechanism de-linked water rights from land rights and allowed the landless and the land poor to capitalize on their share of the water by selling them to the larger landowners, thereby not only providing the former with a direct incentive to participate in watershed protection activities and financially compensating them for their loss of access to traditional grazing lands, but also solving the problem of inequity in benefit sharing." Sengupta, S et al 2003.

Legislation Issues:

Peer-pressure: owners of cattle found grazing in the hills would lose their water rights.

Main Constraints

There have been reports of reduction in water availability and shifting to other more individualized sources of water:

"The sale of water from the dam is drying up, with people shifting to digging tube wells to irrigate their fields. Four such wells have come up over the last couple of years (Down to Earth, 2002). These wells are privately owned and water extracted from them is sold at a Rs. 30 per hour, the

¹³ This figure is tentatively, as the source does not provide a clear number here

¹⁴ This figure is tentatively, as the source does not provide a clear number here

double of that from the dam, and this is slowly leading to cultivation of water intensive crops like paddy and sugarcane (ibid). However, even though the rules of common property resource are gradually being eroded, water from the earthen dam is still distributed as per the requirement of the farmers and, more importantly, the landless still have access to and rights over this water." Sengupta, S et al 2003

Main Policy Lessons

Although the payment was one-off, it shows the providers how useful their own actions are: the suppliers also see the benefits of their actions to the initial demand pool (the city downstream) because their own rainwater reservoirs benefit from their erosion reduction measures: "If the villagers wanted water to keep collecting in the dams, they would have to prevent the dams from silting up, and this could happen only if they protected the vegetation of the surrounding catchment areas and hills. (...) once the dams were constructed they saw immediate benefits of maintaining it for themselves and hence started protecting the catchments. This in turn benefited the Sukhna Lake downstream and the inhabitants of Chandigarh as well." Sengupta, S et al 2003

Remark: data to be updated

Case No 26: Bhopal - India

Name of the initiative: Bhoj Wetlands PES Scheme

[Source: "Fair Deals for watershed services in India" IIED (2007)]

Country/Region: India

Summary: The Bhoj Wetlands around Bhopal city in MP are recognized as wetlands of international importance and are a Ramsar Site. They consist of two man-made reservoirs, the Upper Lake and the Lower Lake. Constructed in the 11th century by King Bhoj of Dhar, the Upper Lake was created by building an earthen dam across the Kolans River. It has a catchment area of 361 km² and water spread of 31 km². Although it includes parts of the city, the catchment is predominantly rural. Created in 1794, the smaller Lower Lake has a catchment area of 9.6 km² and water spread of 1.29 km². It receives water from the Upper Lake through seepage as well as from its mainly urban catchment area. The wetlands support a wide variety of flora and fauna. Over 160 species of birds and 14 rare macrophytes have been reported in the area (personal communication, Nandi 2005).

The Bhoj Wetlands are an important source of drinking water and recreation for the 1.8 million residents of Bhopal. The Upper Lake provides about 40% of the city's drinking water, about 29 million gallons per day. There are boating and water sports facilities on both lakes. Further, livelihoods of many people are directly linked to the wetlands. A fishermen's cooperative of about 250 fishermen holds fishing rights on long lease. Some people grow water-chestnuts in the wetlands, for sale locally. Local washermen who washed on the banks were recently shifted to another site to reduce pollution from detergent.

Objective: Conservation of nature and water

Driver: The Bhoj Wetlands are facing twin problems of poor water quality and reduction in storage capacity due to siltation. The water quality is being affected by several factors such as inflow of sewage and solid waste from the urban areas and runoff from agriculture fields in the peri-urban/rural catchment. In recent years, several steps have been taken to control pollution from sewage and solid waste generated mainly in the urban areas. The problems related to agriculture runoff, on the other hand, have not been addressed substantially so far, although they have been acknowledged as problems in official documents. There are 55 complete villages and lands of 87 villages in the catchment of the Upper Lake in the Bhopal and Sehore districts; the major part of the catchment is under agriculture. Use of chemical fertilizers for wheat and soybean and inadequate soil management lead to nutrient runoff (mainly nitrate and phosphate). This affects the Upper Lake by increasing its productivity, leading to increased production of algae, which ends up affecting the filters in the water treatment plants. Although comprehensive monitoring of the nutrient load according to (rural or urban) source is not available, desk estimates suggest that the rural catchment is a significant source of nitrates (Misra 2006).

Buyers: On the urban side, this project focused on sensitizing and mobilizing organizations and communities that benefit from the lake.

Suppliers: In the rural catchment, eight villages along two drainage channels that flow into the lake were selected on a pilot basis. These were villages of Gora and Sewania Gaur along the Gora Nala and Mungaliachhap, Bhilkheda, Bishenkhedhi, Barkhedanathu, Rolukhedhi and Malikhedi villages along Neeljhi Nadi.

All eight villages are well connected to the city of Bhopal through pucca or semi-pucca roads. The villages have access to electricity and telephone connections. Most of the catchment's population belongs to the Scheduled castes and General Category. (Average literacy rate in these villages is 67.45%, marginally higher than the MP state average of 63.7%). Though household asset ownership was reported to be quite high in villages with a higher population belonging to the General Category, at the other end of the spectrum were villages comprising mostly of religious and socioeconomic minorities that had fewer movable assets, smaller landholdings and poorer housing conditions.

Agriculture is the major livelihood activity in the area, with almost 75% of the population sampled during the baseline study accessing irrigation facilities for agriculture. Agriculture was the primary income source in all sampled villages except for Sewania. Given the proximity of these to Bhopal, migration to the city for labour and 'service' was also prevalent.

The baseline study revealed a skewed pattern of ownership of cultivable land. Those people belonging to Scheduled castes and tribes had a negligible share of land ownership (6.7% and 0.6% respectively), whereas those belonging to Other Backward castes had a share of total land ownership (43.7%) that was almost the same as for those from the General Category (48.9%) – and that too concentrated within a few households. Most (64%) of the sampled population were marginal farmers. Soil quality was reported to be average; and agriculture is chemical intensive in nature. High expenditure on agriculture inputs, mainly fertilizer and pesticides, was reported across the sample population.

Stakeholders: WII's partner for the Bhoj Wetlands study is the Lake Conservation Authority (LCA). The LCA was created in 2004 by the Government of MP to sustain the Japanese-supported Bhoj Wetlands Project efforts and to initiate holistic conservation and management of other lakes in the state. The LCA develops conservation projects for other lakes, monitors the Bhoj Wetlands, provides advice on impacts on lakes and water bodies on demand and engages in awareness raising. It does not have regulatory powers, which rest mostly with the owner of the lake, the Bhopal Municipal Corporation, as well as with the State Pollution Control Board.

Remark: data to be updated

Case No 27: Kanla-on Spring Water Plant - Philippines

Name of the initiative: Kanla-on Spring Water Plant PES Scheme

[Source: Markets for Watershed Services - Country Profile Ina Porras and Nanete Neves – 2006]

Country/Region: Philippines

Summary: The Kanla-on Spring Water Plant supports the farmers within the Mt. Kanla-on Natural Park in implementing sustainable agroforestry activities in order to protect the quality of its bottled water.

Maturity of the initiative: Ongoing since 1997

Driver: The source of the water used by the Kanla-on Spring Water Plant (KSWP) can be traced to the innermost strict protection zone of the park. The company's business therefore depends on the maintenance of the watershed function of the forest. The forest is continually degraded by migrants and indigenous people who are economically and culturally dependent on the forest.

Stakeholders

Supply: Landowners within the natural park, in the infiltration area of the spring/groundwater reservoir the company is exploiting. Mt Kanla-on was declared a protected area in 1997 and it serves as headwater catchment for three major river systems.

Demand: The Kanla-on Spring Water Plant (KSWP), owned by La Tondena Distillers Inc., is located some 8km away from the park but draws the source of the spring water it used is located within the park.

Intermediary: La Tondena Foundation carried out the project in collaboration with the Philippine Business for Social Progress (an NGO). **Facilitator** Major funds for parallel livelihood projects, park protection and conservation activities came from GEF-WB. Other bodies involved include the Department of Environment and Natural Resources (DENR) and National Integrated Protected Areas Systems (NIPAS).

MARKET DESIGN

Service: Water quality protection.

Commodity: Improved Management Practices, through sustainable agroforestry aimed at stabilization of riverbanks and soil conservation measures. Rehabilitation of existing ecosystems for protection, also through reforestation.

Payment Mechanism: Unclear. Intermediary-managed. Funds are used alongside parallel funds from GEF-WB in the area.

Terms of Payment: In-kind payments: i) tree saplings- the buyer has also established two nurseries and 100,000 fruit trees were planted along with some forest trees. ii) Technical training: 51 local farmers receive technical assistance to adopt sustainable agroforestry practices such as SALT (multi-storey planting, rock walling and use of organic fertilizers). (Rosales and de los Angeles, 2001, cited in Arocena-Francisco, 2003)

Funds Involved: In 1997, about twenty-eight upland farmers were involved in the process of reforestation and rehabilitation of the land, with a budget of P200, 000 (about US\$ 3,700 at current rates).

Cost Benefit Analysis

Economic: Short-term income benefits from labor.

Environmental: 20 hectares were reforested and 80 hectares of forestland were rehabilitated. According to the requirements of the Environmental Compliance Certificate issued by Department of Environment and Natural Resources, the Spring Water Company was also required to undertake additional environmental protection activities. (Arocena-Francisco, H. 2003)

Social: In addition to forest rehabilitation activities the company also invests in social development projects: - provides the host community with spring boxes (ground water collection devices) benefiting 50 households - 1-2 km-access road - a 2-room school building - free medical clinics - nourishment programs - and cash donations - it has assisted the organization of the Ilijan Development Organization (IUDO)— a community group of 98 farm families contracted to do reforestation and provided with livelihood enhancement programs. (Arocena-Francisco, H. 2003)

Legislation Issues

Legal basis for collection of fees for environmental services is defined in the National Integrated Protected Area System Act (*NIPAS*, RA 7586) which creates the Integrated Protected Area Fund (IPAF) where funds for resource protection and management can be channelled.

Main Constraints: Benefits to livelihood projects took a long time because of the long process of community preparatory work, unclear guidelines on the use of the livelihood fund, and a lengthy learning process on the approval procedures. Arocena-Francisco, H. 2003

Remark: data to be updated

Case No 28: Iloilo - Philippines

Name of the initiative: Maasin Watershed Rehabilitation Project

[Source: Markets for Watershed Services - Country Profile *Ina Porras and Nanete Neves- 2006*]

Country/Region: Iloilo Province, Panay Island, Philippines

Maturity of the initiative: Ongoing. Rehabilitation work has been going on for decades, always with some degree of user-provider agreement.

Driver: Iloilo city government had great interest in preserving the main source of water for the city and the Maasin municipality wanted support to manage the watershed reserve. Degradation of the watershed is seen as the cause of increasing water scarcity and frequent floods. In the early 90s, management of the watershed passed into the hands of a multi-sectoral task force under the authority of the provincial and local government. A feasibility plan was designed, in collaboration with the local NGO KSPFI that recommended social-agroforestry as a means of adequately managing the watershed, while allowing the farmers to remain in the reserve. After several phases of reforestation and continuing degradation of the watershed, the Department of Environment and Natural Resources (DENR) created a forestry sector subproject, active between 1998 and 2003, to rehabilitate the Maasin watershed.

Stakeholders

Supply: The Tigum-Aganan river watershed was designated a reserve in 1923 to protect the water supply of the city of Iloilo. In 1923 the government purchased 7,000ha (corresponding to 30% of the total area of the Maasin municipality). Over the years the watershed suffered several stages of degradation through slash-and-burn farming expansion and firewood collection. Currently 30% of the watershed is being farmed.

The providers are the farmers living within (or farming in) the watershed reserve, organized into the Maasin people federation (KAPAWA).

Demand: Metro Iloilo Water District (semi-private water utility) is responsible for water supply to Iloilo city, Maasin and three other towns; plus 2,900ha of irrigation. Currently only 35% of the household water requirements of Iloilo City are met by the Maasin watershed, with the remaining water requirements sourced from Guimaras Island and nearby districts (Jabatan, 2004).

Intermediary: NGO KSPFI and the Tigum-Aganan watershed management council.

Facilitator: Iloilo watershed management council, Department of Environment and Natural Resources (DENR) and other government bodies; funding has also been provided by the Japanese cooperation (OECF).

MARKET DESIGN

Service: Flow regulation (due to floods in the wet season and water scarcity in the summer).

Water scarcity: i) Lack of rainfall (particularly serious during the El Niño year 2002-2003 has led authorities offer incentives for rainwater harvesting and to consider cloud seeding (Iloilo News, April 2004). At the same time, farmers have been adapting to water scarcity by switching from rice production into short-term crops that do not need much water. (ibid, March 2005)

ii) In association with lack of rainfall, growing water demand of “a bustling metropolis” has already led to water rationing, and to complaints from consumers over the lack of supply and parallel increases in water price. (Iloilo News, March 2006)

Water regulation: iii) In 1995, 1996, 2002 and 2003 the Aganan River was responsible for floods submerging more than one half of Iloilo City, displacing over 100,000 inhabitants (Iloilo News, September 2003).

Commodity: *Improved Management Practices* through agroforestry. *Reforestation for commercial plantations* (with mahogany and *gmelina*). *Rehabilitation of degraded ecosystems* by allowing natural regeneration and promoting other vegetative measures

Payment Mechanism: *Intermediary-based transactions (local government), and user fees.* The local governments (both from Iloilo and from Maasin) have managed to pool funds from different sources: i) budget allocations from within the Department of Environment and Natural Resources and the National Economic and Development Authority, including domestic and international cooperation funds; ii) user-fees from by Metro Iloilo water district and sporadic donations(from civil society groups and provincial government) *Currently there are negotiations to establish a long-term user-provider agreement, being led by Iloilo watershed council and the NGO KSPFI.*

Terms of Payment: In cash, one-off: communities organized as People’s Organization Federations (KAPAWA) were paid for reforestation labour costs and in-kind: through a Community Based Forest Management Agreement that recognizes them as stewards of the land (for 25 years, renewable for another 25). (However, this may not have been fully realised, see social costs and benefits for details).

Funds Involved

A large amount of funds were pooled from different sources, coming to a total of about US\$ 1.4 million (at current exchange rate 1US\$=51.6PhP) broken down as follows:

- Donations from civil society groups: PHP0.5 million,
- Provincial government: PHP0.5 million,
- DENR: i) National Government: PHP9.5millionfor rehabilitation of 1,070ha and PHP2.5 million for community organizing; ii) Japanese Cooperation: PHP44.3 million for community site development activities in 2,685ha and PHP4.8 million for community organizing, and PHP2.6 million for monitoring and evaluation and loan of PHP1.9 million covering 100ha and PHP0.4 million for the establishment of 20,000 sqm of vegetative strips; iii) Asian Development Bank: PHP1.8 million for Survey, Mapping and Planning; Metro Iloilo water district: PHP1million as

contribution for watershed protection activities and National Economic and Development Authority: allocated PHP3.7million for the construction of 2,850 cum of structural measures (GABION) and provided PHP1.4million to undertake three research studies. It has also provided PHP0.6million for the establishment of 53,900 sqm of vegetative erosion control measures. (Arocena-Francisco, 2003) Private businesses also contributed creating "tree parks" and providing training in organic production.

COST BENEFIT ANALYSIS

Economic: Economic costs, see "funds involved".

Environmental: Reforestation (mahogany, gmelina): 1,050ha Agroforestry: 1049ha Assisted natural regeneration: 300ha Bamboo plantation: 249ha Rattan plantation: 94ha Riverbank stabilization: 330ha Vegetative measures in 20,000sq.m (from OECF loan and GoP investment) Protective infrastructures: 85 km trails; 700 m fire lines; 77 units of nursery, lookout tower of 7 units, 14 Gabion, and 6 units of concrete dam.

Perceptions: In 2002 (3 years after the DENR-JBIC reforestation project), dry season flows were exceptionally low and that led to debate on the project's impacts. While those responsible for the DENR- JBIC reforestation project advocated that "the trees gave clean water and more water", the local NGO (KSPFI) considered that the lower flows could be a result of the planting of exotic fast growing species which were newly established and needed more water." Salas, 2004.

Local news media appeared to support the reforestation project arguing that "a basin should have at least 50 percent of its slopes covered with vegetation to store sufficient water and replenish aquifers in the lowland" and the reduction of old growth forest to only 10% of the watershed area was "the main reason why its streams overflowed during heavy rains and died in summer. In five years, it recovered its greenery". (Iloilo News, September, 2003)

Leakage: To make way for the reforestation project, farmers were relocated to other parts of the watershed, where they caused heavy silting, part of which affected the water utility company's reservoir resulting in high additional expenses for the company.

Social: Increased institutional capacity. New institutions were created to ensure the long-term integrated management of the watershed: i) Tigum- Aganan watershed management council- an agreement between Iloilo city and eight other towns, signed in 2001, and ii) Iloilo watershed management council involving 13 watersheds in the province.

Work in Maasin has led to the organization of the upland communities into a People's Organization Federation (KAPAWA), facilitating access to capacity building programmes and to assistance in establishing 17 livelihood projects. Social surveys conducted as baseline information for the rehabilitation plans have also led to a better understanding of the livelihood dynamics in the area. Tenure security was granted via the community-based forest management agreement (CBFMA) [we could not confirm the extent to which this has actually happened as, according to Arocena-Francisco, 2003, Maasin municipality imposed too many land use restrictions, forbidding open cultivation farming and the presence of cattle- allowing

only fruit trees, bananas and bamboos. This led to abandonment of the land by many of the farmers who could not see in this a high enough source of income enough to support them. *Social costs:* in different stages of intervention in the watershed there have been serious social costs associated with unpaid land purchases, evictions and, more recently relocations of farmers to adjacent watersheds.

Legislation issues: *According to the Republic Act 7160 of 1991, the local government is entitled to 1% of gross revenues of the water distributed by the water district.*

Existing legislation to support charging/investing in watershed services: National Integrated Protected Area System Act (NIPAS, RA 7586), which allows for the creation of Integrated Protected Area Funds with user fees (mostly from ecotourism), grants, donations, etc.

Department of Energy Act (DOE, RA 7638) and Electric Power Industry Reform Act (*EPIRA*, RA 9136, 2001) created three development funds for the area hosting energy projects, one of which is named Reforestation, Watershed Management, Health and/or Environment Enhancement Fund (*RWMHEEF*)

Executive Order 318 (2004) on Promoting *Sustainable Forest Management* “provides for proper valuation and pricing of forestry resources and collection of fees for use of environmental services of forests and watersheds. It also provides for a plough-back mechanism that ensures service providers are properly compensated.”

Monitoring: The project assigned a large proportion of the funds to infrastructure for management and monitoring of the watershed reserve (bunk house, lookout towers, trails, fire lines).

Main Constraints: “Members of KAPAWA [Federation of People’s Organizations] recalled how difficult it was to implement a project when most of the people were unwilling to cooperate.” Jabatan, 2004

Main Policy Lessons: Raise awareness and WTP: following the assessment for the rehabilitation of the Maasin watershed, the governor of the city initiated a large information, education and communication campaign in print, radio, and television to generate public awareness and support for the Watershed situation; “ the Metro Iloilo Water Department put up boards in the City of Iloilo with the message, ‘Year 2000, wala tubig sa ciudad sang Iloilo’ (Year 2000, No more water for the City of Iloilo.)”

Supply system problems: The water district has also had serious problems in terms of its water supply system, which led to the recent take over by the Local Water Utilities Administration (LWUA) because of slow implementation of an expansion project and poor service to its concessionaires” (Manila Times, January 2006) The Development Bank of the Philippines and Philippine National Bank have extended a term loan amounting to P984.8 million to Metro Iloilo Water District (MIWD) to finance the rehabilitation, expansion and improvement of the water supply system of MIWD and also refinance its various loans with the Local Water Utilities Administration (LWUA).

Remark: data to be updated

III. c Africa

Case No 29: Kigali – Rwanda

Name of the initiative: Kigali PES Scheme

[Source: <http://www.care.org/>; email communication with Mark Ellis-Jones markellisjones@gmail.com]

Country/Region: Rwanda

CARE Rwanda is currently not active in PES, yet the NGO undertook an appraisal of PES potential for catchment management (2008/2009) in East Africa under its Poverty, Environment and Climate Change Network 57. The area of research in Rwanda was focused on the Yanze catchment an important area for the water supply in Kigali situated located in the districts of Rulindo (Ngoma and Shyorongi Sector), Nyarugenge (Kanyinya Sector) and Gasabo (Jari Sector). The final report could not be written as the water company there accidentally deleted the records of water treatment costs. As such, CARE was not able to undertake a financial proposition for watershed investment - critical to such studies. Promoted SLM technologies and land-use systems envisioned included terracing, bamboo and tree planting, agroforestry, and the creation of buffer zones.

Status of the PES scheme: Due to technical complications and a lack of funding this project was not pursued and no current plans for PES exist.

Case No 30: Dar es Salaam - Tanzania

Name of the initiative: Equitable payments for watershed Services Dar es Salaam (Phase II: Facilitating Service Delivery)

[Source: Personal communication with Mr. Dosteus Lopa, May 2011. Dosteus.Lopa@co.care.org]

Country/Region: Uluguru Mountains & Ruvu River, Morogoro, Tanzania

Summary: Ruvu River is the principal source of water to the City of Dar es Salaam, an economic hub for Tanzania, and indeed other towns such as Morogoro, Kibaha, Mlandizi and Bagamoyo. The programme is being implemented in the Uluguru Mountains range which is part of eastern Arc mountains range located in Tanzania. Specific focus is on the Ruvu River and its tributaries. The programme seeks to address the growing problem of watershed degradation for the Ruvu River and its consequences for downstream users e.g. in Dar es Salaam. Within Ulugurus the program is being piloted in four villages (**Kibungo, Lanzi, Nyingwa and Dimilo**) in Kibungo sub-catchment of the Ruvu River. The area of Kibungo Juu sub-catchment is about 150km². The programme is targeting high-risk areas: about 2000ha which involve valleys, steep slopes and water bodies. The aim of this scheme is to establish long term financial investment in modifying land use to conserve and improve “watersheds” for reliable flow and quality of water.

Service provided: Delivering sustainable natural resource management and improved livelihood of rural poor with social justice and equity.

Programme Goal

Delivering sustainable natural resource management and improved livelihood of rural poor with social justice and equity; objectives:

- To establish long term financial investment in modifying land use to conserve and improve “watersheds” for reliable flow and quality of water.
- To improve quality of life of the communities

Size and location of the project

The programme is being implemented in the Uluguru Mountains range which is part of eastern Arc mountains range located in Tanzania. Specific focus is on the Ruvu River and its tributaries. The programme seeks to address the growing problem of watershed degradation for the Ruvu River and its consequences for downstream users e.g. in Dar es Salaam. Ruvu River is the principal source of water to the City of Dar es Salaam, an economic hub for Tanzania, and indeed other towns such as Morogoro, Kibaha, Mlandizi and Bagamoyo. Within Ulugurus the program is being piloted in four villages (**Kibungo, Lanzi, Nyingwa and Dimilo**) in Kibungo sub-catchment of the Ruvu River. (Area of Kibungo Juu sub-catchment : about 150km² , the

programme targeting high risk areas : about 2000ha which involve valleys, steep slopes and water bodies).

MARKET DESIGN

Payment mechanism:

- The payments are provided to individual farmers as basically the payment has to be paid to the farm owner.
- The payments are paid to farm owners based on land size and technology applied by him or her. Farmers are applying soil and water conservation methods including “fanya juu”/ “Fanya chini” and bench terraces, agroforestry, reforestation, grass stripping and riparian zones restoration.
- The prices for these technologies are determined by labour inputs and opportunity costs (for loss of production).
- Payments are made once for investing efforts in changing land use practices. However, there is consideration of providing payments for some few years ahead (think of 5 years) for maintenance costs, which the farmer will be incurring.
- Duration: January 2008 – Dec. 2012.
- Village council as legal local Government authority enrol all farmers engaging in sustainable land use change implementation.
- Participatory assessment for all converted farms into improved land use practices are conducted to measure and map using GPS and GIS to verify the land sizes and method/s applied.
- For successful provisioning of the payments to farmers, CARE and WWF facilitates the linkages and transfer of money. Intrinsically, CARE&WWF are acting as the mediator and bridge between the buyers and the sellers.
- Status of payment: So far some 134 farmers and institutions have already received
- Payments from the buyers. The payments are made as per land size and technology applied.
- Therefore, payments to farmers vary largely, there are farmers who received more than \$100 while others received less than \$10.

Opportunity costs: As per our calculation which is based on local situation in terms of land productivity and its expected loss. The opportunity cost is equal to \$150 per hectare.

Monitoring costs: Costs for monitoring involve conducting studies to identify core problems, hotspots and sites to fixing hydrological & weather monitoring stations, procuring and fixing equipment, conducting trainings, paying data collectors and analysis. In total monitoring of hydrological status costs about \$ 75,000 over 5 years of project implementation period.

Upfront costs: The upfront cost is about US\$ 1,400,000 which has been provided by DANIDA to facilitate implementation of this initiative.

The sources are:

DANIDA about 1,360,000 €

DAWASCO¹⁵/Coca Cola KLtd about \$ 300,000

Stakeholders:

International Partners and their roles:

- CARE International in Denmark
- Regional programme management
 - Facilitate system for information sharing
 - Facilitate exchange annual progress and financial reports.
 - Liaise with the Donor

National Partners

- WWF Tanzania Country Office
- Co-implementer/facilitator of the programme
 - Spearheading the Programme Intermediary Group (IG) formation and operationalization in the
 - Undertaking policy analysis and advocacy on EPWS
 - Mandated to over the management of the Wami-Ruvu Water Basin
- Wami Ruvu Basin Water Office*
- Supervising water policies and laws
 - Providing technical support on hydrological monitoring
- Uluguru Nature Reserve Conservation Office*
- Providing technical support on natural resource conservation
 - Conducting training on tree nursery preparation and planting
 - Train farmers on various technologies on managing trees
- including agroforestry and reforestation

¹⁵ DAWASCO Des es Salam Water Supply Company

Local Government Authorities: Supervision of local authorities; Support all extension services especially agriculture.

Local Communities: Main implementers & beneficiaries of sustainable land use practices in Kibungo, and providers of labor force.

Buyers (DAWASCO and Coca Cola KLtd) - providing financial rewards to farmers for adoption of sustainable land use practices in Kibungo juu

SLM practices

- Fanya juu/chini and bench terrace application
- Agroforestry and reforestation
- Grass stripping
- Riparian zone restoration

Results so far:

- The project has been able to conduct practical training to over 450 farmers on soil and water conservation techniques as well as appropriate agronomic practices. The trainings involved both women and men. About 32.5% and the rest were men
- All trained farmers received support in terms of inputs (such as seeds and manure) and implements (like hoes, bush knives, spade and polytubes) to enable them implement successfully soil and water conservation techniques and increase crop production per unit area
- The farmers are responsible for the establishment, implementation and management of the proposed soil and water conservation measures.
- It has been possible to boost farm productivity by three times through the implementation of recommended techniques.
- Although the EPWS initiative has not come to an end, the earlier successes and benefits realized on farm and through sharing lessons have already influenced many other farmers within and outside project villages to engage in improving their land use practices. Higher level policies are also gradually being influenced by the initiative. The local farmers have been facilitated to form groups to support each farmers to strengthen their effective engagement in improving land use practices and production.
- Some 134 farmers received payments from DAWASCO as rewards for changing their unsustainable land use practices to ensure reliable flow of quality water. The money received has been used by farmers for various purposes including buying iron sheets for roofing their houses, improved seeds, better clothes and medicines.
- It is too early to notice the improved water quality or quantity. This usually takes time to be realized, but with appropriate implementation of land use change this will eventually realized

in future.

- Local farmers are now seen to be very effective and showing enthusiasm to implement the programme initiative for their sustainable livelihoods.
- The scheme is being appreciated by various people, institutions and organization in and outside the country. These institutions include Government of TANZANIA, Katoomba Group, FAO, ICRAF, TerrAfrica, IUCN, and WCST as to mention the few.

Case No 31: National PES Project - South Africa

Name of the initiative: South African pro-poor watershed rehabilitation projects

[Source: Markets for watershed Services – Country Profile, I. Porras and N. Neves -2006]

Country/Region: South Africa

Summary: This is a Government-led programme that seeks to provide environmental externalities while directly tackling poverty issues. This South African Government programme aims to alleviate poverty through the provision of temporary work and skills development on watershed enhancement projects involving mainly the removal of invasive alien plants. Environmental benefits have been confirmed and although most of the funding comes from the government's poverty relief fund, water users also contribute either through the government's water management fees or through individual regular donations.

Maturity of the initiative: Programme launched in 1995 and administered by the Department of Water Affairs and Forestry.

DRIVER

Water scarcity due to low rainfall (65% of South Africa receives less than 500mm annual average rainfall) and stream flow reduction due to the growth and spread of the rapidly spreading Invasive Alien Plants (IAP's) that consume large quantities of water. These invasive plants also cause other environmental problems: increased flooding, fires, erosion, siltation and strain on indigenous species.

"A national review of potential stream-flow reduction by invading alien plants, conducted by the CSIR and funded by the Water Research Commission, found in 1997 that a total area of about 10.1 million hectares (6.8%) of South Africa and Lesotho had already become invaded to varying degrees of density. These invasions were estimated to be reducing the national mean annual runoff by about 3300 million m³ (6.7% of national runoff)"

"If we do not clear invading alien plants in 10 to 20 years we will lose 30% of our run-off to rivers. In 20 to 40 years 74% will be lost. (Working for Water Annual Report 2001/2"

Working for Water website

Beyond these environmental goals, the main driver of this programme is really poverty

alleviation through the creation of employment in the programme's plant removal projects- "workfare" (DWAf, 2006)

STAKEHOLDERS

Supply: *Private, communal and public land in priority mountain area catchments. Local rural contractors, funded by the programme, carry out work in 300 project sites. Unclear whether, when in private land, the landowner is involved.* In total, 10 million hectares have been identified for clearing over 20 years.

Demand: *National government, local municipalities and public/private water supply companies* The Department of Water Affairs- annual contribution to the WfW programme amounts to about R58 million. The water price charged to its users (33,000 domestic, industrial, agriculture and forestry water users), includes a "water resource management fee". This fee covers clearing of alien invasive plants as well as planning and implementation, pollution control, demand management, water allocation and water use control).

The public company TCTA, the specialized liability management body for bulk water supply has also contributed R8 million to the WfW programme (over three years).

Some *Local governments*, interested in preserving or increasing water supply contribute to the programme with regular annual donations to fund the removal of AIPs in the catchment areas from "A national review of potential stream-flow reduction by invading alien plants, conducted by the CSIR and funded by the Water Research Commission, found in 1997 that a total area of about 10.1 million hectares (6.8%) of South

Africa and Lesotho had already become invaded to varying degrees of density. These invasions were estimated to be reducing the national mean annual runoff by about 3300 million m³ (6.7% of national runoff)"

"If we do not clear invading alien plants in 10 to 20 years we will lose 30% of our run-off to rivers. In 20 to 40 years 74% will be lost. (Working for Water Annual Report 2001/2".

Working for Water website where they derive their water. In the Hermanus municipality, for example, a block rate tariff was introduced to control high water use and a significant percentage of the revenues collected are transferred to the WfW programme. Similarly, Georges Municipality has committed R400 000 per year to the programme as a parallel investment to the new augmentation scheme to supplement the capacity of its Garden Route Dam.

Intermediary: The Government directly administers the programme.

Facilitator: The Department of Water Affairs and Forestry, Department of Environmental Affairs and Tourism and the National Department of Agriculture

MARKET DESIGN

Service: Water quantity, flow regulation and erosion control

Commodity: *Rehabilitation of degraded ecosystems: removal of invasive trees, like pine and*

eucalyptus or acacia bushes, through physical felling or uprooting, biocontrol, controlled burning or herbicides. Where appropriate, removed plants are replaced by native species (many of the areas being cleaned were originally grasslands and trees are not replanted).

Payment Mechanism: Direct negotiation (government); user fees and pooled transaction Working for Water Programme (WfW) (Department of Water Affairs and Forestry) receives funding from several government sources and commissions local contractors to carry out the plant-clearing work.

Terms of Payment: *Users* contribute with cash payments; *Providers*, considered here as the owners of the land where the clearing works are carried out. Unclear whether private or communal landowners contribute to the works in any way, as it is in their own interest to collaborate since it helps them comply with legislation requirements. (see legislation issues)

Funds Involved: The annual budget is currently half a billion Rand (about US\$66 million), nearly all coming from the Government's Poverty Relief Programme (R 414 million in 2003/4), while the water users contribute with R58 million a year. Turpie, 2004

Cost Benefit Analysis

Programme costs are: 10% in management fees, 30% in materials and transport and 60% salaries.

Benefits generated include:

- revenues from timber processing (some of the timber from larger trees is exported to Japan for the pulp industry);
- creation of secondary industries in poor rural communities in the vicinity of the projects, including charcoal making and furniture manufacturing;
- restoration of the productive potential of the land (particularly in relation to pasture lands, that due to the invasion of alien species, considerably lose their grazing value).

Avoided costs: savings for the respective water boards through reduced water management and rehabilitation costs

Environmental: About 1 million ha of invasive alien plants was cleared over the past seven years, which has yielded an estimated release of 48 –56 million cubic metres of additional water per annum. (DWAF, 2006)

- Reduction in mean annual runoff and particularly dry season low flows
- Reduction in utilizable yield from dams
- Alteration of these key hydrological cues that define the nature of stream biota
- Increases in catchment sediment supply, through the effects of "hot fires"
- Reach- and biome-specific alteration in geomorphologic processes, with resulting effects on channel geometry and instream habitat quality
- Reduction in riparian and wetland plant biodiversity, through competitive displacement, shading and changes in fire regime

- Changes in the supply and timing of food sources, water chemistry and fire regime in aquatic ecosystems
- Threats to aquatic fauna and biodiversity through the combined effects of the above on the extent, distribution and quality of micro and macro habitats comprising freshwater ecosystems. It is also known that IAP's increase the intensity of fires and exacerbates environmental damage due to its high fuel load.

Social: Employment benefits: the project engages mainly with the groups most affected by poverty and unemployment, focusing on women, youth and disabled individuals. It provides work for up to 24 months worth of work over a 5-year period- being the average employment period is four to eight months in every year. According to DWAF (2006), the programme has generated the following social benefits: more than 20,000 beneficiaries, previously unemployed, received gainful employment and training through the programme annually. Over 15 million person-days of employment have been generated by WfW. Costs per "job" created are also the most efficient of all of the poverty relief programmes of national government.

LEGISLATION ISSUES: Although there is legislation attributing responsibility for management of AIPs to the landowners (Conservation of Agricultural Resources Act -CARA), in practice this but this is not rigorously enforced.

MONITORING: Monitoring is done through a database (WaterWorks) set up by WfW to collect data on and manage and control its in-field operations.

A Monitoring & Evaluation Unit is developing an overall M&E framework to assess performance in the achievement of the six WfW goal areas: ecological, hydrological, agricultural, institutional development, economic development and social-economic empowerment.

MAIN CONSTRAINTS: One of the main constraints of the programme is securing sustained control of invasive alien plants in cleared areas. This requires on-going follow-up or handover of land to landowners- its unclear whether, once the land has been cleared, the landowners is in any greater obligation to maintain these plants away. (DWAF, 2006)

Given that the programme is in the national government machine, bureaucracy often results in delays in payments and contract approvals, which can be especially harmful for the vulnerable groups with which the programme works. (DWAF, 2006)

MAIN POLICY LESSONS

Extensive research on the environmental impacts of alien invasive plants has provided the base for the work developed by the Working for Water programme, and real improvements in water quantity have already been realized.

In addition, the programme aims at fulfilling its environmental goals, through the provision of social benefits to the most vulnerable groups, and the combination of both has earned the programme wide

- Reduction in mean annual runoff and particularly dry season low flows
- Reduction in utilisable yield from dams

- Alteration of these key hydrological cues that define the nature of stream biota
- Increases in catchment sediment supply, through the effects of “hot fires”
- Reach- and biome-specific alteration in geomorphological processes, with resulting effects on channel geometry and instream habitat quality
- Reduction in riparian and wetland plant biodiversity, through competitive displacement, shading and changes in fire regime
- Changes in the supply and timing of food sources, water chemistry and fire regime in aquatic ecosystems
- Threats to aquatic fauna and biodiversity through the combined effects of the above on the extent, distribution and quality of micro and macro habitats comprising freshwater ecosystems.

It is also known that IAP's increase the intensity of fires and exacerbates environmental damage due to its high fuel load. (DWAF, 2006)

Remark: data to be updated

II.d Europe

Case No 32: Munich – Germany

Name of the initiative: Water Provision for Munich

[Sources: Rainer List, SWM, Munich; « La forêt, un outil de gestion des eaux? » Ed. CEMAGREF

<http://www.swm.de/english.html> Contact: Mr Rainer LIST, Manager SWM, list.rainer@swm.de]

Country and region: Germany, Bavaria

Summary: The city of Munich secures its water provision through sustainable management of its own forest and support to organic agriculture; water quantity is satisfactory (110 millions m³/year), water quality is excellent, no water treatment. Very low cost for environmental service (total water cost for city consumer: 1.58€/m³ +1.56 €/m³ for sewage water).

Maturity of the initiative: since 1993, on going.

Driver: Water quantity and water quality; the city decided to exploit the resources from Mangfall valley already in the 19th century, to secure its clean water provision. The provisioning watershed is located at 40 km in the S-E of Munich, at higher altitude: water flow comes per gravity.

Stakeholders:

Supply: The current coverage of the PES area is 6,000 ha of Munich Water supply (SWM) owned and private land, of which:

- City forest: the city owns 1,600ha, in the immediate neighbourhood of the collection points, and maintains its own forestry service. 1,300 ha private forest owners (total forest area: 2,900 ha)
- Farmers: 2,300 ha agricultural land, organic farming: 2,000 ha cultivated by 110 farmers+ 300ha conventional agriculture
- 850 ha other areas (infrastructure and settlements)

Demand: Munich Water supply (SWM), special agency of the city of Munich (1.3 million inhabitants, water consumption: 110 millions m³ /year). SWM manages alone the freshwater system, the sewage water division is a separate agency, the city of Munich owns 1,600 ha forest land and may occasionally buy land.

Intermediary:

- Forests management is certified according to Forest Stewardship Council specification and Naturland.
- Organic producers' association / independent agencies control agricultural production (Demeter, Bioland, Naturland)

MARKET DESIGN

Service: The scheme is meant to secure water quality, and in fact no treatment is necessary before delivery to city dwellers: no filtration, no chlorination. Nitrate level in the drinking water of Munich is at 7.6 mg/l at the moment (2011).

Commodity: improved management practices

- Forestry: the aim of the city's forestry service is to maintain or improve the water quality. Practices: organic forestry: no chemical substances. Creation of undisturbed reference plots, preservation of dead wood and hollow trees. No clear cutting and harvesting on small scales, natural regeneration and silvicultural thinning on 5 or 6 years rotational basis, mixed species (spruce, beech, fir, maple, ash). Forest works are made in winter, when the soil is frozen in order to reduce soil perturbation by engines.
- Agriculture: The basis for the payments to the farmers is a contract with the SWM including the following requirements:

1. Contract with a certifying agency that controls the compliance with the requirements of the contract
2. Membership within an organic farming association (for full members)
3. No use of pesticides or herbicides nor mineral fertilizer
4. Restricted fertilization in regards to amount per application and application period
5. Low stocking rate and limited purchase of feed and manure from outside the farm
6. No ploughing of grassland
7. Farmers take part in the program voluntarily and are able to withdraw from the contract each year.

The SWM on the other hand is bound to the whole contract period (18 years for contracts until 2010, 15 years for contracts from 2011 on).

Payment mechanism: SWM charges usual distribution costs (1.48 €/m³ net prices before taxes) and sewage water costs (1.56 €/m³). The total budget of the ecological farming project in 16 years 1993-2008 amounted 7,8 Millions €, allotted as follows:

- Payments to the farmers: 95,2%
- Payments for soil monitoring (starting 2004): 1,5 %

- Marketing promotion of the farmers products (several projects): 1,5%
- Benefits for certification costs (only for certain farmers): 1,34% Annotation: The control costs are normally paid up to a certain limit by the state of Bavaria, if farmers are members of the organic agriculture scheme of the KULAP1
- Other (advisory services, cooperation partners meetings, benefits for membership fees in the organic agriculture associations): 0,44 %
-

According to activity:

- Forestry: no payment, since the City owns the forest (but payment of forestry corps, maintenance of machines...)
- Agriculture: each farmer becomes between 250 - 310 €/ha /year if organic agriculture, regardless of EU payments, or others. A contract is exchanged between the farmers and SWM.

The budget 2011 has been increased to 700,000 €, since the activity area has been extended with additional 2,400 ha.

Cost benefits analysis:

Economic: Sometimes, additional price can be realized when marketing the organic wood, depending on the demand for certified wood and the negotiating skills. But the additional income does not cover the additional costs of the organic management.

The agricultural payments of this scheme are significant regarding EU payments (KULAP¹⁶ contract: 285 €/ha/year in the 1st 2 years, then 200 €/ha/year in following years). The farmers benefit additional prices for organic products: e.g. in March 2011 farmers were paid 41,9 c/kg for organically produced milk compared to 33,8 c/kg for conventionally produced milk. For meat, the additional price in the region amounted to 25c/kg in average by 2009 (but this additional price can be realized only if the animals are well-fattened and the demand for organic meat is sufficient, otherwise, they have to sell their meat as conventionally produced meat and to a lower price).

SWM has no treatment cost.

Terms of payment: Direct payments to bank account of the farmers, at the beginning of the following year.

Environmental: The quality of water has improved. The trend to increase nitrate contents could be stopped and reversed. E.g. in the most affected catchment's nitrate content fell from 15mg/l in average at the end of the 80s to 11mg/l average in 2009. There are no pesticides in the water.

¹⁶ Kulturlandschaftsprogramm, co funded by Germany and the EU

Social: The number of farms within the project did hardly decline since the beginning. If farmers give up farming, there are many others willing to lease their plots. From the initial 111 farmers, only 1 returned to conventional farming; the other 110 keep going on organic farming.

Monitoring: SWM monitors water quality <http://www.swm.de/english/m-wasser.html> and communicates brightly. (1200 samples / month)

5% of the farmers receiving KULAP-payments are controlled each year by the state. If they did not comply with the requirements, they would have to pay back the payments of the last years in the worst case.

Farmers contracting with a certification agency for organic agriculture are controlled at least once a year. In the worst case they lose their certification resulting in the loss of the additional price they can realize with organic products.

Legislation issues: The present state of law is sufficient in Bavaria. Water suppliers are able to contract with the farmers directly under private law. Beneficial for this project is also the comparably high payment to organic farmers in Bavaria and the well-established structures of the organic farming associations and the required certification process.

Main lesson: The water catchment of Munich, the natural surrounding, the social and legal framework this project is embedded in, are unique. Thus such a scheme can hardly be implemented in other cities, as each water supplier has to find a solution individually adapted to the specific circumstances.

Case No 33: Vittel – France

Name of the initiative: Vittel PES, “Agriculture-Environment-Vittel” (AGREV)

[Source: The Vittel payments for ecosystem services: a “perfect” PES case? Danièle Perrot-Maître, and email communication with the author Daniele.Perrotmaitre@gmail.com, Daniele.Perrot-Maitre@unep.org]

Country/Region: Vosges region, France

Background: In the early 80s, the de la Motte family, then owners of the Vittel brand, realized that the intensification of agriculture in the Vittel catchment posed a risk to the nitrate and pesticides level in Grande Source and consequently to the Vittel brand. The artesian spring for Vittel’s Grande Source is located in the thermal park and all farms in the catchment are located upstream from the spring. In the Vittel catchment, as in many places in France and in Europe, the traditional hay-based cattle ranching system had been replaced by a maize-based system. Free range was limited while stocking rates increased. The increased nitrate rate was caused primarily by the heavy leaching of fertilizers from the maize fields in the winter when fields are barren, overstocking, and poor management of animal waste. In 1988, Vittel proposed to farmers with land in the protection perimeter that they transform their land into grassland, a solution outlined by a group of experts in the French Committee for the Reduction of Water Pollution by Nitrates. Farmers felt the proposal was not adapted to their production system and rejected it (Déprés et al. 2005).

Objective, size of the project: at first, to reduce nitrates pollution in aquifers located near the town of Vittel to ensure the quality of mineral waters. Aquifers provide mineral water on which highly profitable company business is based. Later the company had also to address urban sources of pollution.

This scheme makes sense because other alternatives were not an option. In France mineral water legislation is very strict and water quality must be reached naturally. Water treatment is not allowed to qualify as “natural mineral water” and business is at risk if this cannot be achieved.

The project involves transforming farming systems in the watershed, shifting from intensive, corn-based and highly polluting cattle ranching activities to an extensive, hay-based system. The change has to be voluntary.

Size of project: 37 farmers (26 at the end as some farmers sold their farms), About 4000hectares of farm land.

practices adopted: note: changes introduced are labor intensive and require massive investments when labor and capital are the main constraints to farmers in the area.

Practices:

1. Give up maize cultivation for animal feed (land under maize production has high nitrates rates at the root level)
2. Adopt extensive cattle ranching including pasture management (hay and alfalfa rotation)
3. Reduce carrying capacity to a maximum of one cattle head per ha.
4. Compost animal waste and apply optimal levels in the fields
5. Give up agrochemicals (no pesticides, chemical fertilizer replaced with composted manure)
6. Balance animal rations to reach optimal milk productivity and farm profitability
7. Modernize farm buildings for optimal waste management and storing

Status of payment and activity implementation, duration: project started in 1988. By 2006, all 26 farms which remained in activity had entered the incentive scheme.

Incentive package:

1. Long term security through 18-30 years contracts between the farmers and Vittel during which farmers undertake investments and changes in farming practices necessary to reduce nitrate pollution.
2. Abolition of debt linked to land acquisition, and land acquired by Vittel left in usufruct for up to 30 years in exchange to adoption of best farming practices
3. Subsidy of, on average, about 200 euros per ha over 5 years to ensure guaranteed income during transition period and reimburse the debt contracted before entering the programme for the acquisition of farm equipment.
4. Up to 150,000 euros per farm to cover the costs of all new farm equipment and building modernisation.
5. Free labor to apply compost in farmers' fields.
6. Free technical assistance. This is particularly important as giving up the intensive agricultural system alienated farmers from traditional farming networks and support organizations

Funding sources, payment by water user:

Four-year Action Research programme paid for by the French National Agronomic Institute (INRA), a public institution.

All other expenses paid for by Nestle Waters (incentive package to farmers, land acquisition, monitoring, costs linked to intermediary institution between farmers and Vittel-AGRIVAIR).

Extent to which these costs were ultimately passed on to the consumers of bottled mineral water is unclear.

Services providers and payment to service providers:
see incentive package.

Costs: Information on costs is limited and provides a lower estimate (cost information is not public knowledge).

Costs shared between Nestle Waters, INRA, Rhine Meuse River Basin Agency.

Estimate of total cost for first seven years for Nestlé Waters: 24.25 million euros (or 980 EUR/ha/year). Equivalent to 1.52 euros per cubic meter of bottled water produced. Of which 9.14 millions euros were spent on land acquisition (later given in free usufruct to farmers in return for adopting best farming practices), 3.81 million on investment in farm equipment and 11.3 million in farm financial compensation

Cost estimates do not include the 4 year action research programme implemented by the National Agronomic Institute which established a dialogue between researchers and farmers to jointly identify optimal and acceptable farming practices for every farm in the watershed. Nor do they include transaction costs for Nestle Waters, transaction and learning costs for farmers and the cost of establishing and running AGRIVAIR, the intermediary institution established to develop and implement the scheme with farmers, and eventually address other sources of pollution in the area.

Cost of monitoring practices not incorporated here either. The Rhin Meuse Water Agency paid 30% of the building monitoring expenses (but expenses not known).

Other main partners: Rhin Meuse Water Agency (semi public institution): river basin agency for Northeastern France (Rhin-Meuse river basin)

INRA (public research institution): National Agronomic research institute which identified best farming practices that would lead to acceptable nitrate levels

AGRIVAIR (private intermediary created by Nestle Waters. It is interesting to note that AGRIVAIR not only implemented the initiative with farmers but it is now addressing other sources of pollution and working with urban area. It has also developed a strategy to increase its financial sustainability by selling services that ensure best farming practices are used. See IIED report).

Results so far: (regarding water flow & water quality, environmental quality, livelihoods, agricultural productivity): Nitrates levels in water have been reduced and the initiative has been successful. Livelihoods of farmers have not been reduced. Indeed one of the fundamental principles underlying the development of this PES scheme, and one of the reasons for its success, is that farmers income had to be protected at all time.

The scheme led to a concentration of the farms (which may have happened anyway given the level of debt in the area). Seven farms decided to stop farming and the farms were purchased by the other 26 that remained in farming and changed their farming systems.

Agricultural productivity: depending on how this is measured the results may vary. Since the stocking rate has been limited to one animal per hectare, one could say that productivity per unit

of land has declined. But if one takes into account the reduction in externalities (especially on Vittel springs and the implications for employment in the area) the implications are not so clear. In the short run, productivity probably declined but in the mid and long run. It increased. Again it depends against what is productivity measured and whether externalities and time are introduced in the analysis)

If there was a market for organic products, some farms could sell their milk on this market and get a higher return. However it is not possible to market this milk independently and farmers have not been able to take advantage of this niche market, which reduces the profitability of this farming system.

Important to notice here that profitability and productivity of the farms must be analyzed jointly with profitability and productivity for Vittel. Analyzing them independently makes little sense.

The following table summarizes the costs and benefits to Vittel and the farmers.

Costs and benefits of the programme

PES SCHEME PARTICIPANTS	COSTS	BENEFITS
Farmers	No direct financial cost but high transaction costs: cost of learning new practices and participating in identification and testing of practices and incentive system, and negotiations.	Secured long term farming (30 years). Cancelling of short-term and long-term debt. Additional land.
Vittel-Nestlé Waters	First seven years: Land acquisition: 1.14 million euros Farm equipment: 3,81 million euros Farm financial compensation: 11.3 million euros. Does not include cost linked to establishing and operating Agrivair (which is at least partially self- financed).	Eliminated business risk (business of one billion bottles a year).

The question of whether or not the investment was economically justifiable was raised early in the process. The French National Agronomic Institute demonstrated that under the assumption that one hectare of well-managed pasture produced 3000m³ of mineral water every year the scheme was economically feasible (INRA 1997).

Remarks: Although not foreseen at the beginning, the scheme, through its practices, has resulted in improving biodiversity in the area. AGRIVAIR is increasingly actively involved in protecting wildlife populations and habitats, especially bird, foxes and insects for pest control (re-establishing hedgerows, bird houses and refuges, planting wildflowers, breeding ladybirds).

Part of the land has been converted to organic production (apple orchard for baby food, organic dairy) and plans for the future are to expand organic production.

Note: The PEs scheme is sustainable but the sustainability of the results is more questionable as more sources of pollution have appeared which require supplementary action (not necessarily of a PES nature). It is important to note the temporal nature of results achieved. PES can be successful now and yet no longer be successful because of external factors. The same conclusion applies to the New York City PES scheme in the Catskill watershed. Hence PES scheme need to be constantly monitored, evaluated and adapted to new context. Here farmers may follow best practices for 30 years, as stipulated in their contracts, nitrate levels may be maintained at an acceptable level, but the spring water may become contaminated by other pollutants which control will require new strategy.

Case No 34: National PES scheme - Switzerland

Name of the initiative: Nitrate strategy of Switzerland

[Source: UNCE: Recommendations on Payments for Ecosystem Services in Integrated Water Resources Management]

Country and region: Switzerland

Type of PES: Public payment scheme (national scheme)

Summary: In Switzerland, precipitation generates drinking water to the value of about € 3,500 per hectare of agricultural land. As intensive farming not adapted to local conditions is the main cause of groundwater nitrate pollution, further measures were needed in addition to strong legislation on water protection and agriculture; these include voluntary programmes promoting extensification.

The objective of the PES scheme was to change management practice in order to decrease nitrate pollution in groundwater, with an emphasis on groundwater used for drinking water. As stipulated by the Federal Water Protection Ordinance of 28 October 1998, authorities are required to initiate measures if the maximum level of 25 mg NO₃/l is exceeded in groundwater used for drinking water or intended as such. Based on article 62 (a) of the Federal Law on the Protection of Waters, farmers taking part in a coordinated nitrate- reduction project within the area of contribution of a contaminated drinking-water well are compensated for the additional costs following contractually fixed water protection measures which go beyond legal requirements and good agricultural practice and are sufficient to lower the nitrate concentration below 25 mg/l (see below). The Federal State establishes the conditions for compensation, while the cantons enforce the relevant measures (contracts with farmers, payments and control/evaluation).

Compensation can be given in case of restrictions of exploitation and in case of new/required investments or disinvestments, including income reduction due to the change of agricultural practice, provided the measures go beyond legal requirements and good agricultural practice. Financial support is allocated by a contract and a one-time payment per year during a maximum of six years, after which the project is evaluated and required follow-up activities/funding are examined.

PES scheme outline

Significant water management problem: Pollution of groundwater aquifers with nitrates, with priority focus on groundwater used for drinking-water supply

Water-related ecosystem service: Reduction of nitrate charges in groundwater and consequently of nitrate input into the North Sea via the river Rhine; provision of high-quality drinking water

Purpose of the project: Change of management practice in agriculture beyond legal requirements and good agricultural practice

Supplier: Farmers

Buyer: Federal Government, cantons and water supplier

Type(s) of instruments: Compensation for contractually fixed changes in agricultural practice beyond legal requirements and good agricultural practice

Source of funding: Federal government, cantons and water supplier

Amount of payment: From € 130 per hectare and year for measures in open cultures to € 1,250 for enhancing the meadow's surface

Laws/regulations: Federal Law on the Protection of Water, Water Protection Ordinance and Federal Law on Agriculture. The Federal State establishes the conditions for compensation, while the cantons enforce the relevant measures (contracts with farmers, payments and control/evaluation).

Role of the public sector: Launching an information campaign "ActionN – Fewer Nitrates in Water", contacting all relevant institutions, holding farmers' lobbies, issuing newsletters and creating a website (www.nitrat.ch)

Equity concerns: Apply to farmers located within the area of contribution of a contaminated drinking water well, who need to take water protection measures which go beyond legal requirements and good agricultural practice.

Lessons learned for designing similar systems: At present, some 20 "local" projects are under way in a number of Swiss cantons for a total of 3,000 hectares of agricultural land. Similar projects could be carried out in Switzerland for a total of an estimated 50,000 hectares. More projects are in preparation.

II.e North America

Case No 35: New York City – USA

Name of the initiative: The New York City (NYC) watershed protection PES scheme

[Source: *Watershed protection: Capturing the benefits of nature's water supply services*

Sandra L. Postel and Barton H. Thompson, Jr. 2005]

Country/Region: New York City, USA.

Summary: NYC PES scheme is by far the largest scheme in the world putting into effect direct payments by a beneficiary of hydrological services to the service providers. The case of NYC demonstrates that watershed protection can be a highly cost-effective alternative to technological treatment in meeting specific water quality standards. It also demonstrates that an inclusive negotiated partnership between upstream and downstream parties can result in expanded benefits for both from a working rural landscape. By creating a unique link between ecosystem-service providers and beneficiaries, New York City has negotiated partnerships with upstream landowners and communities in the watershed where its drinking water originates, to ensure a pure and safe supply.

Driver: The main driver for New York City's decision to invest in watershed protection was a requirement, under the US Safe Drinking Water Act, that water suppliers must filter their drinking water unless they can demonstrate that they are protecting their watershed sufficiently to satisfy water quality standards. New York City is the largest city in the United States to choose watershed protection instead of a filtration plant.

Stakeholders: The hallmark of New York City's watershed protection programme is a memorandum of agreement (MOA) signed in 1997, after many years of negotiation, by a diverse set of interests, including state and federal officials, environmental organizations, and some 70 watershed towns and villages in the Catskill-Delaware watershed, which supplies 90% of the City's drinking water (NRC, 2000).

MARKET DESIGN

Service: water quality protection

Commodity: New York City actively works with partner organizations in the watershed to administer and implement various programme elements. In light of the diverse and numerous landowners in the watershed, these groups serve as important intermediaries for the

programme's implementation. In addition to land acquisition, other key initiatives include:

- i. A watershed agricultural programme to reduce polluted runoff from farming practices;
- ii. A forestry programme, involving a partnership with landowners, loggers, and timber companies to better manage forests;
- iii. A stream management programme, through which the City works with watershed communities and landowners to curb stream-bank erosion and riparian habitat degradation;
- iv. Upgrades to wastewater infrastructure (treatment plants and septic systems) to reduce pollutants entering rivers and streams;
- v. Construction of an ultraviolet disinfection plant to inactivate certain waterborne pathogens; and
- vi. New regulation and enforcement mechanisms to ensure that the development and use of watershed lands is consistent with water quality protection.

Cost benefit analysis: The MOA commits the City to invest approximately \$1.5 billion over 10 years to restore and protect the watershed, as well as to implement financial and other measures that improve the local economies and quality of life of watershed residents. More than three-quarters of the Catskill-Delaware watershed is covered by forest, three-quarters of which is in private ownership. Consequently, land acquisition is an important component of NYC's programme. Watershed lands have been divided into five different priority zones according to the land's importance for water quality protection.

As of early 2004, NYC had invested more than \$1 billion in the watershed protection programme (Ward, 2004). Financing comes from additional taxes on residents' water bills and from bonds issued by the City. A review of the programme's first five years found sufficient progress in watershed protection to justify an extension of the Environmental Protection Agency's waiver of the filtration requirement. City residents enjoy high-quality water at a lower cost than would be the case with construction of the filtration plant. In return for providing water quality services to the City, landowners in the watershed gain additional income, healthier streams and habitats, more recreational opportunities, and new economic investments, including a \$60 million trust fund (financed by the City) that provides loans and grants for environmentally sustainable economic development projects in watershed communities.

Within the first five years of the programme, New York City solicited sales of about 104,700 ha and signed 477 purchase contracts for 13,940 ha — roughly doubling the area of protected buffer land surrounding the eight reservoirs in the Catskills/Delaware watershed. The purchase price of these lands totals some \$94 million, an average of about \$6,745 per ha. To provide additional benefits to watershed residents and towns, the City has opened more than 2,800 ha of its newly acquired watershed lands to public recreational uses that are deemed compatible with water quality protection, such as regulated fishing, hunting, and hiking. In addition, the City has either acquired or contracted for 960 ha of conservation easements: in exchange for the property owners' commitment to preserve the land, the City pays fair market value for the development rights as well as a portion of the property taxes in perpetuity (NYCDEP, 2002). Faced with estimated capital costs of \$6 billion and annual operation and maintenance costs of at least \$300 million for the filtration plant, the City opted for the filtration requirement of the US Safe Drinking Water Act, by investing in this comprehensive watershed protection programme: this decision happens to be profitable.

Legislation issues: The City purchases land only from willing sellers — focusing on the highest-priority zones first — and pays full market price for it. In doing so, the City is choosing to incur additional costs, because under New York State’s health codes it is legally entitled to take land in the watershed by eminent domain. However, as part of the agreement, NYC vowed not to do this, and buys land at market conditions. In addition, to prevent its land acquisition from eroding local town revenues, NYC is also paying property taxes on the watershed lands it owns now and will do the same on all new land and conservation easements it acquires.

Main lessons: New York City’s watershed protection programme demonstrates the value of an inclusive negotiated agreement that lays out the responsibilities of all the parties; provides fair compensation to the service providers; uses an appropriate mix of financial incentives, regulations, land acquisitions, and other mechanisms; and makes improved livelihoods in the watershed an explicit goal along with water quality protection. Modified versions of this model may be especially important in watersheds of developing countries that are facing strong demographic pressures and are already supporting agricultural, forestry, and other economic activities. Unless watershed protection is undertaken with an explicit goal of equitably distributing the gains, there is a risk of benefiting urban-industrial enterprises at the expense of rural communities and the poor — and worsening social inequities.

Case No 36: Santa Fe - USA

Name of the initiative: Santa Fe Municipal Water Plan

[Source: *Santa Fe Municipal Water Plan 2010-2019, February 18, 2009*]

Country/Region: New Mexico, USA

Summary: To ensure long lasting forest protection, and taking account of funding restrictions affecting Forest Service, the city of Santa Fe is launching a PES scheme: water consumer fees will support Forest Service, and contribute to protecting Santa Fe National Forest, first of all from fire risks and correlated soil erosion, invasive plants and water siltation.

Context: Like many cities throughout the western United States, Santa Fe's water supply is dependent upon forest health and protection from catastrophic wildfire. The loss of forest cover decreases a watershed's capacity to regulate flow and control soil erosion. Crown fire within the watershed could degrade the storage capacity of the water supply reservoirs and cause irreparable damage to the forested areas of the watershed.

The Santa Fe Municipal Watershed provides water for approximately 30,000 households and businesses within the City of Santa Fe and surrounding communities. The municipal watershed comprises the upper 7,000 ha of the Santa Fe river basin. Two reservoirs hold approximately 5 million cubic meters, which is about one-third of the water used annually in the Santa Fe water system. The upper 4,000 ha of the municipal watershed are contained within the Pecos Wilderness Area. The lower 3,000 ha of the municipal watershed is dominated by ponderosa pine and piñon pine-juniper woodlands. The challenge has been how to provide a framework and funding mechanism for long term maintenance, including protection from catastrophic fire, soil erosion, and invasive plants.

Proposed Solution: The city has developed a master plan that provides a framework and recommendations for long-term management, outreach, and funding for the Santa Fe Municipal Watershed. The plan addresses four areas critical to the maintenance of the watershed: (i) vegetation management and fire use; (ii) water management; (iii) public awareness and outreach; and (iv) financial management based on Payment for Ecosystem Services.

MARKET DESIGN

Service: Fire prevention.

Commodity: The focus of the water management plan is to provide sustainable water yields from the watershed, improve water quality, and protect the longevity of Nichols and McClure watersheds. The water management plan provides a framework for long term monitoring that addresses three critical objectives for water management:

1) Maintain a Reliable Water Supply; 2) Maintain a High Quality of Water; and 3) Enhance Wildlife Habitat and Ecosystem Function

Source of funding: The present plan was funded from the USDA Forest Service Collaborative Forest Restoration Program with a collaborative grant that included the Española Ranger District of the Santa Fe National Forest, the Santa Fe Watershed Association, the City of Santa Fe Water Division, City of Santa Fe Fire Department and the Nature Conservancy. Congress has allocated more than \$7 million in federal earmarks for planning and restoration of forest conditions in the watershed, between 2003 and 2006. In addition, the Santa Fe National Forest has allocated a portion of its budget for watershed restoration before and since these appropriations. Annual maintenance with prescribed fire is needed to keep fuels at the reduced level.

While federal funding has supported hazardous fuel reduction through earmarks and Forest Service appropriations, much of the Forest Service's budget has been and likely will increasingly be focused on fire suppression. As funding declines, cost-share agreements that leverage federal funding by providing matching funds will become more important. A Payment for Ecosystem Services agreement between the City of Santa Fe and the Santa Fe National Forest would more likely ensure that the Forest Service will be able to continue its management activities at a higher rate within the watershed than might be possible otherwise, even as funding declines in the region.

The cost to retain the restored forest condition is estimated at an average of \$200,000 per year. In contrast, the avoided cost that would result from a 3,000 ha fire in the watershed is estimated at \$22 million. The likelihood of such a fire is 1 in 5 in any given year. The avoided cost includes full-scale fire suppression and dredging of ash-laden sediment from the two reservoirs.

Payment Mechanism: The City of Santa Fe has instituted a five-year utility service rate increase in order to pay for construction of the PES Project. Because gaining public support for an additional rate increase associated with Watershed Management Plan, PES would be difficult at this time, the watershed management partners are pursuing New Mexico Finance Authority, Water Trust Board funding, to cover the City's PES obligations for the first five years of project implementation. Within this initial five-year period, outreach and education efforts will be focused on building public approval for PES and acceptance of the nominal rate increase associated with the Watershed Management Plan that would go into effect in 2014, when the PES Project will be complete.

Stakeholders: Water Trust Board (WTB) , US Forest Service (USFS) , the City of Santa Fe, Santa Fe Watershed Association (SFWA) , New Mexico Finance Authority.

Santa Fe PES scheme has been divided into two phases:

Phase 1: New Mexico Water Trust Board pays for ecosystem services during the first 5 years of the plan

Phase 2: After the rate increases cease, assess a fee to each water consumer based on use, projected at \$0.13 per 1,000 gallons per month (3,780 litres/month).

The fees would be listed as a separate item on the water bill. The fee would be listed after initial outreach in Year 1. Beginning in Year 2, the fee would be listed within the water bill. While ecosystem services are paid for with Water Trust Board funding, the PES fee would appear as a

matter of record on consumers' bills. In Phase 2 of the plan, the fee would be a real fee based on water use. Listing the fee as a credit during Phase 1 would allow four years for consumers to become familiar with the plan and the benefits and costs associated with implementing the PES plan.

The recommend fees are based on water use, rather than a flat fee for all users, so that low-income and conservative water users are charged equitably. Based on the projected cost for watershed maintenance, this fee would be \$0.13 per 1,000 gallons of water per month. An average household uses approximately 50,000 gallons of water per year (190 cubic m/year), which would result in an annual fee of \$6.50, or a monthly fee of \$0.54.

Costs: The total cost associated with implementation during Phase 1 (Years 1-5) of the Santa Fe Watershed Management Plan is estimated to be \$2,518,705. Income sources for this phase include the Water Trust Board(WTB) (47%), the US Forest Service (USFS)(40%), the City of Santa Fe (12%), and the Santa Fe Watershed Association (SFWA) (1%). This money will be allocated to vegetation management and monitoring (78% of 5-year budget), water management and monitoring (13%), and education and outreach (9%).

The total investment in watershed maintenance over 20 years will be \$6.3 million (See Table 1). Of this, just under \$3 million will be generated by the Payment for Ecosystem Services (through the WTB in Phase 1, or through consumer fees in Phase 2). PES fees will contribute 46% of all costs, with the Forest Service contributing 36%, the City 16%, and the Santa Fe Watershed Association 2%.

Note: In addition to these two, other US cities such as Seattle, San Francisco, Boston, and Denver have already adopted the PES model for the capital outlay and annual operating costs associated with the provision of clean drinking water. In Denver, Colorado the model was scaled up to include five watersheds encompassing two forests in 2010. Denver Water, the utility company, and the Forest Service entered into a 5-year \$ 33 million partnership to implement projects to reduce the risk of wildfire, restoring wild areas and, minimize erosion and sedimentation of reservoirs.

Table 1. Total Projected Investments over the 20-Year Period

ACTIVITIES	Total Projected Costs over 20 Years Per Investor			
	WTB	USFS	City	SFWA
Outreach and Education	\$606,900	\$43,000	\$68,000	\$125,400
Water Management	\$120,000 ¹⁷	\$30,000	\$965,270	-
Vegetation Management	\$2,162,860 ¹⁸	\$2,162,860	-	-
<i>Total per Investor:</i>	\$2,889,760	\$2,205,860	\$1,043,270	\$125,400
TOTAL COSTS:	\$6,264,290			

17 PES

18 PES

III. CONCLUSION

There are a number of criteria to be met in order to design a successful PES scheme. PES can be effectively designed around providing sellers with financial incentives that would improve or maintain ecosystem services to the buyer at a lower cost than the available alternatives. Once the stakeholders are aware of the critical and sensitive areas of a watershed, creation and implementation of an effective PES program would require the following:¹⁹

1. Calculate the economic value of water and other ecosystem services provided by the watershed to consumers, as well as the cost to landowners and land users for future watershed maintenance;
2. Negotiate contracts for long-term enhanced management of sensitive areas;
3. Conduct a program to educate stakeholders about both the economic benefits and costs of any proposed watershed-management plan;
4. Build an extensive watershed-monitoring program that involves citizen groups, and make the results available to the public (water users and overall public);
5. Evaluate monitoring results frequently and use them as part of an adaptive management strategy;
6. Establish the preferred funding mechanism(s) (tax, bond, user fees), considering the legal and political implications of each. In particular, convince water users to pay for watershed management service, in order to design a sustainable program
7. Chose mechanisms that fit within existing institutional conditions and seek additional sources of funding if necessary;
8. Maintain public trust by making all PES transactions transparent and explicit, by monitoring results and communicating;
9. Share experiences of the PES program early and often, especially with decision makers and stakeholders.

On the other hand the typical obstacles to implementing a successful PES scheme include:

- lack of start-up funding, resulting in reliance on external resources;
- lack of awareness of the benefits of improved watershed management;
- lack of technical capacity to assess feasibility and design of the market mechanisms;
- lack of legal and institutional frameworks that can facilitate the required partnerships and

¹⁹ Based on T. Greenwalt and D. McGrath

funds transfer;

- unclear use and property rights over land;
- poverty and risk awareness from stakeholders
- and difficulties in monetizing economic values of improved provisioning.
- Information asymmetry between stakeholders, incl. weak groups (indigenous people, minorities, pots, women).

The present inventory shows that:

- such PES schemes are manageable, and each concrete case is unique in a way
- cities throughout the world (mainly in Latin America) have been successfully securing their water provision,
- water users generally agree to pay a fee for PES,
- in many cases, water fees are not sufficient to make the scheme sustainable, and Public Funds or Donors are still necessary.

Further research in Asia, Africa or developed countries would undoubtedly lead to identification of new concrete cases: Seattle, Denver, Boston, San Francisco in Northern America, Evian, Volvic, Zurich in Europe are the probable examples.

Yet, the actual impact of forest management on water quality/supply is less clear than that of agricultural good practices (change of land use).

In the future, such Water schemes might be more profitable if they are interlinked with other environmental services, like C sequestration (as being considered in Tanzania for example).

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Juillet 2011

BERTOYE François-André

Master Mondialisation et Dynamique Spatiale dans les Territoires du Sud

Université de la Sorbonne, Paris IV

Sous la direction de Jean Gault, NRL division.

10 Concrete cases

Saint-Etienne/ France

Source: Figuepron J. *Enquête : cas où la Forêt a été mise à contribution pour la ressource eau*, INRA et IDF, 2007, Nancy.

<http://life-semeau.eu/>

Contact : Valerie Chassignol, 0477486552, valeriechassignol@saint-etienne.fr

Summary: Saint-Etienne is a (former) coal mining city of about 300,000 inhabitants and is located in the Rhone-Alps region, France. The watershed of Furan is the most trustful used for water supply because it is the less polluted compared to the others , it supplies more than 60,000 persons. It is composed of a 1200-ha catchment area, and a reservoir of about 2500 ha. They have respectively an afforestation rate of 100% and 75%.

Many agricultural drains have been fixed since 1996 for implementing the water potential; the city is now protecting them against pollution.

Driver: the main issue is the water quality in terms of phosphorus concentration and risk of eutrophication.

Market Design: actions consist in 4 main purposes:

- Reforestation of the watershed in terms of area (650 ha) and biodiversity. The pine plantations are used for timber industry with an 8-year rotation, and they include from 25% to 30% of broad-leaved trees.
- Land purchasing, with a renewal of the Public Utility Declaration (DUP)
- Biodegradable oil saws for timber industry
- Drains proximity surveillance.

Stakeholders: the city of Saint-Etienne is leading the project, in consultation with the *Stephanoise des eaux* company (held by Veolia and Suez); the ONF (Office National des Forêts, National Forest Office) is partner for technical survey and sensitisation of public and forest owners. The ONF is also enabled to settle specific rules and enforce them by forest owners' timber companies. Partnerships have been created with hunter associations and the Departmental Direction for Sanitary and Social Affairs, for maintaining a clean zone.

Cost benefit analysis: the city of Saint-Etienne pays 2000 €/ year to the ONF and the *Stephanoise des eaux* company pays 20,000€/year to the ONF. Forest owners benefit the sale of the wood.

There is no increase on the water price and the timber industry is maintained and developed in a sustainable way.

Results : drains and forests are well kept, and the water quality increases while treatment costs decrease.

Melbourne- Australia

Source: Running Pure, <http://assets.panda.org/downloads/runningpurereport.pdf>

Contact: +61396589658

Summary: Melbourne is the capital of Victoria State and is located in the south-eastern part of Australia. The city is located on the banks of the Yarra River beside Port Phillip Bay. Melbourne has a population of over 3 million people and is the second most populous city in Australia after Sydney. Over the next 30 years, Melbourne's population is predicted to increase by more than 1 million people. 90% of Melbourne's water supply comes from uninhabited mountainous catchments in the north and east of the city. About 49% of the catchments fall within National Parks, with much of the remaining area being in State forests.

Driver: the consumption of water will increase by 0.7 % per annum up to 2020. In the same time Australia is facing increasing drought (the last one lasted seven years, 1996-2002) and significant decreasing in rainfall. The last drought caused a reduction of 29% of water stocks which will not be re-filled before a 30 years period.

Market Design: Melbourne Water, which is owned by the State Government of Victoria, is responsible for the management of Melbourne's water supply catchments, supplying 500 Million m³ per year, regarded as high quality drinking water, due to purity of sources: 90% of Melbourne's water supply comes from uninhabited mountain water catchments, 49 % of these catchments falling within national parks (sp. Yarra national park). Melbourne Water manages some catchments closely with the Department of Sustainability and Environment and Parks, and National Parks (incl. Yarra Ranges, 76,000 ha, and is recognised for its botanically significant old growth forest and Cool Temperate Rainforest).

Studies of rainfall and runoff data concluded that the amount of water yield from forest catchments is related to forest age: this is because evapotranspiration from older forest is lower per unit area than from younger forests. The implication is that forest disturbance, by fire or logging, reduces water yields in the short to medium term (except in the few years after forest disturbance) . For instance in the Thomson catchment, a research study suggests that no timber harvesting combined with the natural regrowth of the forest (burned in 1939) would lead to an increase of 17 M cubic metres/year, thus 3% of the total water use in Melbourne. Despite this evidence, State Forests are available for timber harvesting, and long term contracts are in place, but using an average of 0.2 % of the total water supply catchment area each year.

The Department of Primary Industries manages the harvesting operations (in consultation with Melbourne water) with the objective of ensuring that the timing, intensity and extent of

operations are compatible with protection of water yield and quality. The main action consists in protecting forest within National Parks such as the Yarra Ranges National Park (created in 1995) or also the Kinglake National Park (firstly protected in 1928 and reshaped in 1995).

Stakeholders: In this case study, catchments are located in uninhabited regions, and the water scheme is managed by public entities.

There are 4 different actors:

- ❖ Melbourne Water, which employs fire-fighters over the summer period to try to ensure that any fires that occur do not take hold.
- ❖ In respect of the *Victorian Code of Forest Practices for Timber Production*, the Department of Primary Industries manages the harvesting operations (in consultation with Melbourne Water) with the objective of ensuring that the timing, intensity and extent of operations are compatible with protection of water yield and quality.
- ❖ Department of Sustainability and Environment and Parks
- ❖ National Parks

The result is that the city enjoys high quality water at a competitive price.

Critics: WWF (co author of source paper: "Running Pure") has reservations about continued logging of Melbourne's catchments. Forest areas with high conservation value are not adequately protected.

Masevaux- France

Source: Fiquepron, Gauthier, *une demande croissante d'évaluation économique des services rendus par la forêt : exemple de l'eau potable*, Forêt entreprise n°187, Juillet 2009.

Contact : Fabrice Maillard, Technicien AEP et Assainissement, 0033 389 384 546, fabrice.maillard@masevaux.fr; Guillaume Petit, Directeur des services techniques, 0033 389 824 014, guillaume.petit@masevaux.fr

Summary: Masevaux is a French commune located in the Haut-Rhin department, in the valley of the Doller. It is a commune with a 1253 ha big forest with about 5000 persons. Each year 262,000 m³ of water are supplied by 2 wells in alluvial sheet, and 10 spring catchments providing 80% of the total volume required. Nowadays, 180 ha of communal forests are protected under the PPC (Catchment Perimeter Protection) reglementation.

Driver: the city of Masevaux wishes to obtain pure water with less treatment possible. However catchments in forests are not deep in the soil thus they are very vulnerable to pollution.

Market Design: they are two main actions:

- ❖ A proper management of forests and land protection
- ❖ A shift toward environmental practices in timber industry (biodegradable oil saw and cable skidding).

Stakeholders: the city of Masevaux manages its own water supply in a local government control, without external service providers. However the National Forest Office (ONF) has been asked for involvement in management; local timber companies are now bounded to the program, and have adapted their practices.

Cost benefit analysis: catchment management costs to the city 5900€ a year, added to the current 8900€, thus 0.027€/m³. The ONF spends 1230€/year in forest survey, thus 0.006€/m³, and the cost for timber shifting represents 0.001€/m³. Finally catchment management price rises to 0.103€/m³. This management cost is still inferior of 70% to well management cost estimated at a 0.175€/m³ level due to expenses for energy and maintenance.

Rennes-France

Source: <http://brgm.fr/brgm/fichiers/captages.pdf>; Fiquepron, Gauthier, *une demande croissante d'évaluation économique des services rendus par la forêt : exemple de l'eau potable*, Forêt entreprise n°187, Juillet 2009.

Contact : Daniel Helle (Syndicat Mixte de Protection du Bassin Rennais, SMPBR), 0033 223 621 141, protection.ressource@smpbr.fr

Summary : the water catchment drain area of Rennes 1 is deserving 70,000 persons, and delivers on average 2.7 million m³/year. 80% of the water flow comes from agricultural drains, it is very sensitive to pollution because drain pipes are not deep in the soil due to the presence of a granitic layer. The city of Rennes decided to increase the protection of water quality, in 1994 it obtained the Public Utility Declaration necessary for having public funds, and in 1996 started the program for reducing pollution.

Driver: nitrate concentration exceeds by far the legal threshold of 50mg/l, and is unceasingly increasing for one main reason: farming activities (and gathered and dispersed household).

Legal tools already exist such as the Nitrate Directive which aims to reduce nitrate concentration and also such as Catchment Protection Perimeters, but they are insufficient to fight against pollution.

Market Design: there are two simultaneous actions:

- ❖ Creation of partnerships upon farming practices
- ❖ Land purchasing and reforestation. Actually 150 ha have already been purchased thus 90% of sensible perimeters, and about the half (71.5 ha) has been reforested.

Results: the nitrate rate began to fall down with the partnership with local farmers, who have reduced the quantities of manure and fertilisers on the fields, and also with reforestation beginning between 2000 and 2003, by this time the rate was higher than 65 mg/l. In 2008-2009 the nitrate level passed under the hedge of 50 mg/l.

Stakeholders: the city of Rennes launched the program and ran it till 2003 ; then the SMPBR (Syndicat Mixte de Protection du Bassin Rennais) has taken the lead . Partnerships have been settled with local farmers to improve farming processes.

Cost benefit analysis: the action has been financed through the Brittany Pure Water Program. Many actors have participated:

- ❖ The European Union, through the FEOGA
- ❖ French State
- ❖ The Brittany Regional Council
- ❖ The Ille-et-Villaine General Council
- ❖ The Loire-Brittany Water Agency

The total amount 2,870,000€ covered a ten-year period (1996-2006), composed of 1,090,000 for reforestation and land purchasing and 1,780,000 for farming conversion. Whereas a 41,150,000-€ spent should have been required to build another water treatment plant. Using an environmental approach, the city has saved ten times the price it should have spent for water treatment.

Syndicat des Eaux d'Ile-de-France (SEDIF)- France

Source : answer to the questionnaire

Contact : Caroline Lucas-Leblanc, Ingénieur protection de la ressource, Syndicat des Eaux d'Ile-de-France, 0033 158 0123 24, c.lucas-leblanc@sedif.com

Summary: the SEDIF is the largest Water Public Service in France , providing 800,000m³/day, to 144 communes around Paris, and 4.3 millions people. The SEDIF has set up two schemes

- ❖ One regulatory through creation of Catchment Protected areas.
- ❖ And another contractual, with an encouragement program for the management of green spaces in cities, and also with a pollution-linked risk awareness program for industrials.

Driver: the main purpose consists in limiting point and diffuse pollution along fresh water streams.

Market Design: actions are mainly based on three ways :

- ❖ Protection areas: protecting areas through a set of legal authorizations. Thanks to a Public Utility Declaration the SEDIF is enabled for granted catchment permission.
- ❖ In order to protect green spaces in cities in Ile-de-France, the SEDIF created the Phyt'eaux program. This program has three components. First an audit of the need of each city member of the programme, then a formation of technical public services, and finally a support for launching an efficient green space differentiated management scheme.
- ❖ The PRERI program (PREvention des RIsques et protection des prises d'eau de surface de l'agglomération parisienne) aims to sensitise industrialists over pollution risk matters, by awareness rising and driving technical information campaign (link: http://www.sedif.com/imageprovider.aspx?private_resource=1443&fn=bilan_recherches_et_developpement.pdf)

Stakeholders: the French State in link with the European Union is responsible of the legal side. The SEDIF drives the program Phyt'eaux Cités whereas the company Lyonnaise des Eaux is in charge of the program PRERI.

Main funds providers are the Region Ile-de-France and the Agence de l'Eau (Water Agency), but the SEDIF is also participating to funding, reversing costs to water producers.

Results: there is a decrease in the number of accidental pollution near catchment, a decrease in phytosanitary product concentration within the water, and a better awareness regarding water supply.

ICMS ecologico (ecological marketplace)- Brazil

Source: Stoloton et Dudley *Gérer les forêts pour fournir de l'eau plus propre aux populations urbaines* in unasyva 229, vol 58, 2007.

<http://www.fas.usda.gov/pecad2/highlights/2000/12/BRSTATES.fif>

Summary: the ICMS ecologico is a tax-revenue proportioning scheme to protect land in order to improve water quality and biodiversity. It is a nationwide program set up in 1992, fund by taxes that are overall fixed on sales of goods and services. (ICMS acronym can loosely be interpreted as a tax on revenue of goods and services)

Driver: traditionally local communities had been reluctant to set aside these lands or effectively comply with restrictions on their use because it limited possibilities for revenue generation and economic growth; thus the creation of this fund for an integrated management of land and water.

Market design/ stakeholders: in this case, both market design and stakeholders are closely weaved. It is a three-tier approach: the federal government which collects the taxes re-allocated to states who equitably distribute them to the cities; the amount of tax-money dispersed was determined by a unique "ecological index" determined for each county, based on the total amount of land registered and legally defined as protected as a portion of the total area.

The state of Parana included a new dimension in its system of evaluation focusing on the evaluation of the protected biodiversity, and other states followed: the initial evaluation has switched from a zoning process to a quality approach .

Cost benefits analysis: the program led to mentalities changes in 2 ways: first understanding that conservation is paying, second perceiving conservation of land not as an obstacle to economic development. Local communities do consider it a source of revenue and recognize the need to manage ecological services in such a way as to maintain revenue flow. As example, the state of Minas Gerais has perceived in 1996 \$3.8million shared between 97 municipalities.

Results: ICMS ecologico effects on water quality appear to have been significant, but so far no precise data are available, and water conservation measures in these municipalities have increased by two third.

Evian and Volvic – France

Contact: Patrick Lachassagne Responsable Environnement et Ressources en Eau Evian -
Volvic Sources -- Danone Eaux France BP 87 –
11 Av. Général Dupas 74503 Evian Cedex - France
Tel : 33-4 50 84 86 25
Fax : 33-4 50 84 86 00
Mob : 33-6 03 85 15 71
patrick.lachassagne@danone.com

Visit: <http://www.life-semeau.eu/>

Further link: <http://www.eaumineralnaturelle.fr/developpement-durable/preservation-eau.html>

Name of the initiative: Association for the Protection of the Evian Natural Mineral Water Impluvium (APIEME in French) and Environment Committee for the Protection of the Volvic Natural Mineral Water Impluvium (CEPIV in French)

Country/Region: Rhône-Alpes (Haute-Savoie, Evian) and Auvergne (Puy-de-Dôme, Volvic) regions, France

Background: Evian and Volvic are two major brands of bottled Natural Mineral Water (NMW) native from preserved French areas, and sold in France and also, for more than half of the volumes, worldwide (respectively in about 130 and 65 countries). The Evian bottling factory is one of the most important bottling plants in the world.

The main characteristics of NMW are: (i) their groundwater origin, (ii) their geological natural protection, (iii) the absence of any chemical treatment, and of any additive, disinfectant or conservator addition, (iv) their purity, and the stability of their mineral content.

The stability of the mineral content of a NWR is above all the result of the inertia of its aquifer system, thus of its hydrogeological characteristics. For instance, in Evian (Blavoux et al., 2011), the mean transit time of the NMW is more than 15 years in fine glacial sands interbedded with silty layers; in Volvic, the volcanic is aquifer is characterized by a thick vadose zone reaching more than 200 m (Rouquet et al., 2011) with low transit times.

However, as NMW are renewable resources, which means that their aquifers are replenished by the infiltration of rainfall or snow-melt, their purity (Devier et al., 2011) and the long-term stability of their mineral content is also the result of the land-use, and thus of the human activities on their hydrogeological catchment area or impluvium (synonym). Consequently, Danone Waters France has been implementing for more than 20 years water “participative protection policies” on the impluvium of its NMW springs, among which Evian and Volvic. The main principles of these protection policies are being implemented all over the world (Indonesia (Water “AQUA”), China (Water “LongMen”) , Argentina, Spain, etc.) on the Danone Waters NMW impluviums (Lachassagne et al., 2011).

Objective, size, and description of the project: The main objective of these long term and still running NMW protection policies projects is to maintain the purity of the NMW and the long-term stability of its mineral content. The Volvic and Evian projects are very similar in their principles

and also in their geographical (catchment surface area, elevation, climate...) and land-use contexts; consequently, the Evian case study will mainly be presented hereunder.

The about 16 km² Evian spring area, where the water outflows from the mineral aquifer, benefits from a very efficient natural geological protection with a several decameters thick impermeable moraine (drift) layer that avoids any infiltration from surface water. In the spring area, the mineral aquifer thus benefits from a 3-fold protection: (i) natural geological protection, (ii) legal protection (the “Declaration of Public Interest” – DIP) that is mostly conceived to maintain the integrity of the impermeable cover of the aquifer, and (iii) technical protection (design and protection of the spring catchwork).

Consequently, the “participative water protection policies” mostly deal with the Evian catchment/impluvium area. The impluvium surface area is about 35 km²; located on the Gavot Plateau in Haute-Savoie, at an elevation ranging from 800 to 1200 m; consequently, it exhibits a middle mountain climate. This climate is a major constraint with regards to the agricultural activities. Its land-use/landcover is about 20% forest, 10% wetlands (recognized of International Ecological Importance by the RAMSAR convention), 10% villages, roads and infrastructure, a few thousands of people living there, and about 60% agriculture (55 farms), among which 51% of meadows and less than 10% of cultures (local market gardening, orchards, a few maize for the cattle, etc.). The major agricultural activity is dairy cow breeding for typical local (Abondance and Reblochon) “Appellation d’Origine Controlée” (AOC or protected designation of origin: PDO) cheese production.

Based on this context, the main principles of the participative protection policies that were designed and are implemented on the impluvium are the following:

1. the protection policies must both favor the protection of the NMW resource and the local development (both economic and well-being aspects). They must as far as possible rely on win-win actions;
2. the bottling company does not undertake any land acquisition;
3. the protection policies are multi-sectorially targeted: agriculture, but also forest, villages (waste waters, road salting, urbanization...), natural spaces, etc.;
4. the protection policies only involve collective projects: no direct subsidy (“hectare allowance”) to farmers for instance.

The scheme for implementing such participative water protection policies is the following (Figure 1). It takes into account the French still active XIXth century Regulation on NMW that instituted a specific NMW tax (“taxe de col” or neck-fee) on the bottled NMW. This tax benefits to the municipalities where the NMW spring is emerging (Evian, Publier, Neuvecelle, and Maxilly city and villages in the Evian case) but not to the municipalities belonging to the catchment area of the NMW spring.

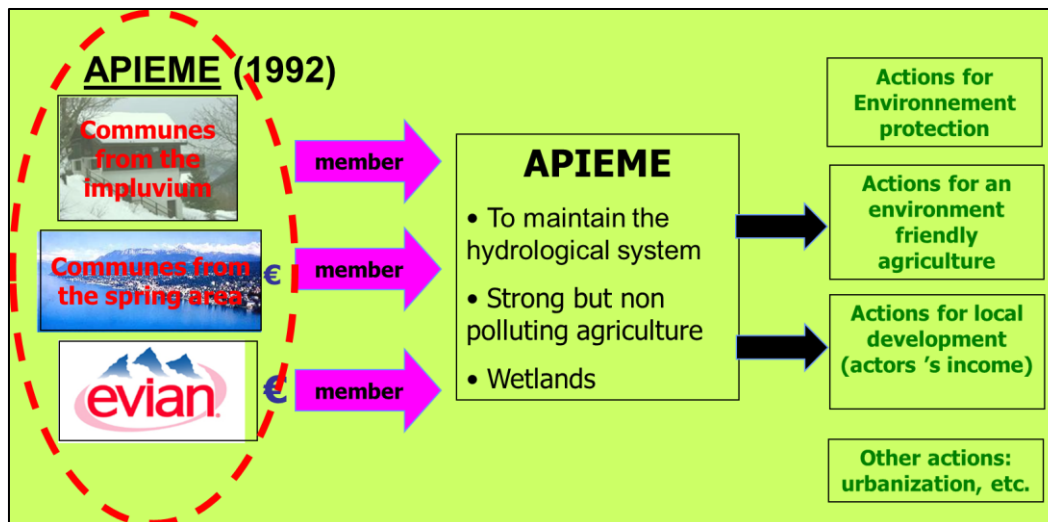


Figure 1

An association, the APIEME (Association pour la Protection de l'Impluvium de l'Eau Minérale d'Evian) (Figure 1), has been constituted in 1992 under the impulse of the Evian bottling company. It gathers:

- the 4 municipalities of the spring area that benefit from the NMW tax. These municipalities fund the association with about 10% of their NMW tax income. This contribution is one third of the APIEME annual budget;
- the 9 municipalities belonging to the impluvium, that do not benefit from this tax, and consequently do not fund the APIEME;
- the Evian (Danone Waters) bottling company. Evian funds the association and contributes to the two thirds of the APIEME budget remaining. It also contributes (pay in kind) through a dedicated manpower to the administrative management of the association and the technical definition and implementation of the funded projects. For instance, Evian's engineers moderate meetings, design proposals, implement field projects (for example field composting).

The association acts as a "local water parliament" with a representative of each of its members (the mayors of the 13 municipalities, and two Evian representatives). It formerly meets about 10 times a year. It also interacts with other structures, such as the "Communauté de Communes du Pays d'Evian" an intercity structure to which all municipalities from the spring and impluvium area belong, the Plateau de Gavot farmers' association (SICA), the "Chambre d'Agriculture", research institutes (INRA, BRGM, Universities), consulting firms, etc..

The APIEME funds multi-sectorial policy projects.

In the late eighties and the nineties, the first projects in the field of villages' policy were mostly dealing with improving the waste water network and treatment devices. The APIEME's funding, added to the existing national and regional fundings, allowed tackling wastewater' stream contamination issues much more faster than in the other villages of the neighborhood. The Gavot Plateau wetlands, covering about 10% of its surface area, constituting a regional importance biodiversity reserve and playing an important role for the surface waters quality, were studied and a preservation management plan defined and implemented (see for instance

Dorioz et al., 1996). This plan includes preservation actions but also local population sensitization to wetland protect and touristic activities development in order to favor the local development. These actions were labeled RAMSAR in 2008. Subsidies were also targeted to private individuals in order to replace old simple envelope buried fuel tanks (fuel being used for house heating) with new double envelope non buried tanks with the objectives of environment protection and suppression of any leakage cost. Nowadays, in coherence with the Geneva Lake protection policies, an action plan focuses on reducing the amount of de-icing and de-snowing salt spread on the roads (both department - Haute-Savoie - and municipal roads), without decreasing their winter viability. The objective is both to protect the environment (and particularly the wetlands neighboring the roads) and to reduce de-snowing costs.

Converging interest between the farmers (that want to maintain the agricultural soils surface) and the protection of the NMW (fighting the reduction of the soils hydraulic conductivity linked to the building of new roads, parkings and buildings, and consequently the reduction of the infiltration towards the aquifers) lead to the sensitization of the municipal representatives to villages growth and peri-villages urbanization. Consequently, the Plateau de Gavot villages' development plans are taking into account such constraints and, even if submitted to the Geneva and Lausanne (Switzerland) conurbations pressures, were built on a reasonable forecast of the increase of the population and suitable schemes.

In the field of agricultural policies, at the beginning of the APIEME's activity, the association's policy was grounded on the following principles and actions:

1. discussion and consultation with the farmers and their representatives (SICA); only incentive collective projects without any individual contracting; no land acquisition policy;
2. the high quality of the NMW at that time (eighties) was interpreted as a positive consequence of the actual agricultural practices. Consequently, the APIEME agricultural policy was mainly oriented towards the preservation of this agricultural model: production of AOC cheeses, thus naturally limiting the number of dairy cows on the impluvium only fed with the local hay, small to medium-size farms, no regrouping of land and thus hedges disappearance, etc.. These actions avoided any shifting to intensive, highly polluting cattle ranching activities;
3. the main APIEME's projects were defined in order to preserve this model:
 - study and diagnosis of the agricultural model, and action plans and projects based on this technical knowledge (see for instance Cristofini et al., 1994);
 - subsidies aiming at both protecting the environment and favoring agriculture. For instance impermeabilization and coverage with a roof of manure farm dunghills and increase storage facilities in order both to preserve surface and groundwater from point source pollution and to keep this natural fertilizer for its spreading on the pastures during the spring and summer time (less mineral fertilizers costs for the farmer);
 - subsidies aiming at helping the farmer to maintain his activity or better to raise his income. The subsidies were mainly targeted towards helping small to medium farms (the smallest of them being not helped by European subsidies) to follow the European sanitary norms evolution (particularly for cow milking and milk processing workshops) and consequently to favor close loops (cheese making and selling at the farm) and a higher income. As a consequence, the number of farms on the impluvium remained almost unchanged during the last 20 years.

Smallest projects deal for instance with the prevention of any leakage of the pesticides spread on the few maize plots of the plateau. Technical studies implemented with the farmers allowed elaborating an adapted methodology. The resulting protocol does not ban pesticide use, and helps farmers to adopt environment friendly practices (slight plowing between the maize rows and light herbicide application on the rows). The Gavot Plateau surface and shallow aquifers water observatory allows checking the efficiency of such practices.

The present day projects aims at improving this model. For instance, the drawback of this policy (preservation of small to medium farms, no regrouping of land) may lead to an overspreading of manure on the nearest plots to the farms, the farmers not having time enough to spread the manure on the far plots, and consequently may lead to nitrogen losses. Thus, a dedicated project is now under implementation. A small company will be created that will:

- i. collect all the farms cows effluents (manure, liquid manure);
- ii. process them through dedicated methanization and composting facilities, and consequently produce and sell heat (to heat the Gavot Plateau college gymnasium), and energy (electricity and gas);
- iii. spread the green fertilizer produced by these units on all the farmers' Gavot Plateau plots, and apply the optimal fertilizing level, without any risk of nitrogen leaching.

This project will be fund by the APIEME (investment) and the farmers will pay the service (running costs).

The security of the water quality will increase, the CH₄ and CO₂ emissions will be reduced, a valuation of carbon credits may be included in the future; and the farmers will have several benefits: savings in money (no more mineral fertilizer purchase, less investment in agricultural machines) and time, easier use of this new kind a fertilizer (the cows can come back earlier to eat the hay from the fertilized plot), better relationships with neighborhood (no odors), etc.. Farmers will also have some guarantees; for instance, the traceability will be ensured during the whole process, among others to respect the AOC rules (no manure coming from outside the area).

On the Gavot Plateau, wetlands (that constitute 10% of the land-cover) are the richest areas in terms of biodiversity. Nevertheless, a project is now being implemented on the whole plateau in order (i) to check the potential impacts of the various practices and policies (agriculture, forest, etc.), and (ii) if necessary, to adapt them in order to make them biodiversity-friendly.

Size of agriculture projects: 55 farmers, about 2'100hectares of farm land.

Status of payment and activity implementation: there is no real payment for environmental services. In addition no economic assessment of this model was ever performed.

The yearly total budget of the APIEME (for all policy sectors: agriculture, waste management, studies, communication) is about 200 to 300 €/ha, free technical assistance from Evian's engineers not included. This budget includes the above mentioned NMW tax, plus occasional additional funds. It is mainly allocated to projects related to APIEME's purpose.

Duration: the APIEME was created in 1992,and is still operating.

Funding sources: spring area municipalities, Evian SA + some additional public funds depending upon the project; municipalities, farmers, and private individuals co-fundings.

Partners: above mentioned funding sources and farmers' associations, agricultural chamber, research institutes, consulting firms... In the future, the National Forest Agency (Office National des Forêts, ONF) and Forest Owners' Union (Centre Régional de la Propriété Forestière, CRPF) will be included, since forest is also present in the catchment area.

Results so far:

No discernable evolution of the NMW quality, and particularly no nitrate increase during the last 20 years. Livelihoods of farmers have not been reduced. Detailed studies would probably show that their income has been raised. The scheme did not lead to a concentration of the farms (which must have surely happened as a consequence of the European policies). This programme has therefore a significant social impact.

Agricultural productivity:

No significant change as the preexisting scheme has been maintained.

Contact: Patrick Lachassagne Responsable Environnement et Ressources en Eau Evian -
Volvic Sources -- Danone Eaux France BP 87 –
11 Av. Général Dupas 74503 Evian Cedex - France
Tel : 33-4 50 84 86 25
Fax : 33-4 50 84 86 00
Mob : 33-6 03 85 15 71
patrick.lachassagne@danone.com

Visit: <http://www.life-semeau.eu/>

Further link: <http://www.eaumineralnaturelle.fr/developpement-durable/preservation-eau.html>

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Syndicat Intercommunal des Eaux des Moises

Sources : <http://www.eaux-moises.com/>, documentation ; contact : Nicolas WILHELM, nwilhelm@eaux-moises.com

Country/ Region : France, département Haute Savoie (south of Léman Lake)

Summary : 15 communes on the Southern bank of Léman lake have merged their water provision system in a specific union (SIEM) ; they collect 2.7 millions cubic meters / year for ~30,000 persons. Considering that water from the lake is expensive because of treatments, and that sustainable forest management provides cheaper water with minimal treatment and with high quality, SIEM is testing with Office National des Forêts (ONF) concrete management methods. In the future, according to lessons learned by the project, a PES scheme will be designed and proposed to private forest owners.

Driver: The Syndicat Intercommunal des Eaux des Moises (SIEM) is located on the Southern bank of lake Léman, South West Thonon (1hour away from Genève). It has been founded in 1949, to coordinate water provision to the member cities; it collects water from forest watersheds , that provide high quality water, which is distributed to consumers only with chlorination; it collects also water from the lake, that is much more expensive, since it has to be collected deep in the lake, and then treated. SIEM is therefore aiming at developing the part of the net which is provisioning water from forest water sheds.

Supplier: 110 ha forest upward the spring Moises, provide 0.9 million m³/year; a part is public property (managed by French forest service: Office National des Forêts, ONF), the main part belongs to private owners: often small parcels, whose owner doesn't even know the exact boundaries, and who lives sometimes far away. (Elsewhere in the supplying area, other forest springs provide 1.1 million m³/year; pumping lake and ground water brings the rest: 0.7 million m³/year).

Demand: Water consumers are between 28,000 and 35,000 inhabitants according to season. There is a consumption peaks in summer: the water pumping station on the lake provides the necessary quantity.

Facilitator: ONF is currently testing different methods to protect water quality through sustainable forest management: skidding with horse or by cable, to reduce mechanical pollution; tree species diversification; no clear cutting; avoiding soil disturbance (and mud production, which leads to siltation) .

The project is part of Alpeau, a French-Swiss initiative, aiming at demonstrate and strengthen forests'role to provide drinking water in peri alpine regions in Switzerland and France. It is supported by NGO, different sub national entities (cities of Lausanne, Neuchâtel, La Chaux de

Fonds, Chambéry; cantons de Vaud, Fribourg, Neuchâtel; département de Haute Savoie), by public entities (Swiss Environment Office, Agence de l'eau Rhône Méditerranée Corse) and by the European Union (Interreg).

Objectives:

- Test methods to protect water quality through sustainable forest management: skidding with horse or by cable, reducing mechanical pollution; tree species diversification; no clear cutting; avoiding soil disturbance (and mud production, which leads to siltation) .
- Enhance by communities and consumers the perception of forests'roles regarding water provision
- Design PES schemes between public SIEM and private forest owners
- Facilitate bundling of private forest owners, in order to reduce transaction costs

Output: guidelines for sustainable forest management, to protect water provision.

Cost Benefit analysis:

Economic: Water from forests costs 0.07 €/m³ at the spring, water leaving the treatment station on the Léman bank (Yvoire) costs 0.22 €/m³. It is sold 1.2 €/m³, plus sewage water treatment costs: SIEM turnover amounts 3.8 Millions €/year. State subsidies for investment, loans, other incomes make additional 6.2 millions € together.

On the other hand, according to studies by CRPF forestry activities dedicated to drinking water preservation add about 33€/ha/year (clearing brush above water catchment area + cable logging of wind thrown trees + biodegradable chainsaw oil + more use of cables for felling+ "woodsman kit" to deal with accidental pollution) ; if cable logging is systematic in protection areas around water catchments, this supplementary cost increases to 75€/ha/year. This would mean, that in the most conservative hypothesis, SIEM would have to pay in the Moises area (110 ha) 8200€/year to secure water quality. (from: Julien Fiquepron & Olivier Picard, Institut pour le développement forestier , <http://www.foretpriveefrancaise.com/>, also in English)

Environmental : Project Alpeau aims at sensitise forest owners , water providers, public institutions, general public to the importance of forests towards water provision. The water catchment is not far from Évian water catchment: this activity should benefit also to the environmental management of the whole area.

Social: Private forest owners will be encouraged by Institut pour le développement forestier to:

- Form a union
- Precisely check their property rights (and correlated potential PES rights)

- Adopt adequate practices
- Agree with SIEM on PES scheme modalities

Legislation issues:

The present EU legislation allows only payments for opportunity costs; any supplementary payment would be perceived as illegal subsidy. Nevertheless, within this frame, private forest owners should be interested by a PES proposal. As per ONF, this public institution is so far not allowed to perceive any payments other than resulting from wood sells.

Main constraints:

The exact distribution of forest owners, their identity and addresses are not known: a preliminary enquiry will be necessary, to establish a list (with their potential rights) and mapping, and then contact them.

Main policy lessons from this project will be useful for other cities in the alpine region, and outside.

New Mexico Watershed Management Program (WMP)- United States of America

Source: Fleming W., *Volunteer Watershed Health Monitoring by Local Stakeholders: New Mexico Watershed Watch*, the journal of Environmental Education, 2003;

Summary: this is a nation-wide program which aims on watching watersheds evolution through a volunteer approach, thus it is an almost-cost-free program. It started 1988 in 14 states and is now reaching 700 programs involving 400,000 local stakeholders in more than 32 states. Here the focus is on New Mexico watershed program led by students. Volunteer watershed monitors are private citizens, including students, who analyze water quality, evaluate riparian health and involve themselves in watershed planning at the grass-roots level.

Driver: watershed plans are formulated to improve water quality and restore degraded riparian and uplands sites.

Aims:

- To involve secondary school students in hands-on field projects to assess watershed health and water quality with spectrophotometers and other equipment.
- To encourage an interdisciplinary approach to watershed planning which identifies impacts of land use on water quality.
- To develop scientifically credible field methods to create long-term databases on watershed health for use by state and federal agencies.

Stakeholders: the students evaluate watersheds by collecting monthly data on stream flow, pH, turbidity, nitrate, phosphorous, total dissolved solids, ammonia and selected heavy metals of special significance to aquatic life, such aluminum and zinc. 20 schools are linked to a watershed. The State Department of Game and Fish (GFD) supports the program providing funds. Middle and high-school teachers are the nerves of the program, because they follow year after year the implementation.

Evaluation: in 1996 14 teachers qualified it as an excellent program. In 2001, 25 teachers gave 25 good reasons to participate.

Positive aspects:

- Access to sophisticated water quality equipment provided by the GFD grant
- Teaching expertise by highly qualified aquatic scientists
- The opportunity to conduct meaningful field ecology studies that had implication beyond the classroom, it is an opportunity to participate in real science.

Problems:

- Inadequate transportation
- Insufficient time

Tools: maps of land use, land ownership, soil stability, topography and human impacts are used in an overlay format to identify priority problems area.

Cost benefit analysis: WMP are inexpensive. Nearly one fifth (19%) of the programs surveyed have annual budgets of \$100 or less, with 44% costing \$1,000 or less. The median annual budget was \$2,000, with 45% of the funding sources coming from state government.

The actual impact on water quality and water flow to cities in New Mexico is so far not measured.