Case Studies of Markets and Innovative Financial Mechanisms for Water Services from Forests

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Forest Trends

Forest Trends, a Washington, D.C. based non profit organization, was created in 1999 by a team of entrepreneurial individuals representing conservation organizations, forest product firms, research groups, multilateral development banks, private investment funds, and foundations. Its mission is to maintain and restore forest ecosystems by promoting incentives that diversify trade in the forest sector, moving beyond exclusive focus on lumber and fiber, to a broader range of products and services. To fulfil its mission Forest Trends performs three principal roles - convening market players to advance market transformations, generating and disseminating critical information to market players, and facilitating deals between different critical links in the value chains of new forestry.

Forest Trends is committed to supporting sustainable forestry - believing that only by preserving and expanding sustainable forests can the needs of a wide variety of stakeholders be met. Profitable businesses can provide for human wood and fiber needs, communities can share equitably in the benefits of a forest-based commerce, and healthy and diverse forests can be maintained today and into the future. Though many environmental services generated by forests are beneficial to society, Forest Trends has focused on those that are activating market interest: carbon storage, watershed protection and biodiversity conservation.

The Katoomba Group

The Katoomba Group is an international working group – or "skunkworks" –composed of leading experts from forest and energy industries, research institutions, the financial world, and environmental NGOs, all dedicated to advancing the development of markets for environmental services. The Group is dedicated to building collective understanding of how market-based instruments for environmental services are constructed and the conditions in which they can work, to facilitating strategic partnerships, and to providing technical support to pilot projects of broad relevance. The Group met for the first time in Katoomba, Australia in May 2000 and subsequent meetings have been held in Vancouver, British Columbia in October, 2000 and in Brazil in March 2001. Forest Trends serves as the secretariat for this group and co-ordinates inter-sessional work.

There is growing awareness of the many services forests provide, such as watershed protection, biodiversity conservation and carbon storage. There is also growing awareness of the costs to society when these services are degraded or lost. These costs may come from the local effects of degradation, such as floods and landslides, or more global effects, like global climate change. These impacts are drawing attention to the financial benefits of healthy forest ecosystems and the ecological services they provide - benefits of great social value but until recently of no great financial worth. This interest and the growing number of innovative investments around the world are moving markets for ecosystems services towards center stage in the debate about forest conservation.

One emerging ecological market is for hydrological services offered by natural forest and wetland ecosystems. Hydrological services, such as water quality and water flow, are among the most valuable ecological services that forests produce. Not only is the global market for water huge but investments in sustainable watershed management have been shown in several cases to be cheaper than investments in new water supply and treatment facilities. In order to advance the development of these markets it is important to capture lessons from the many innovative ecological markets around the world.

Case Studies of Markets and Innovative Financial Mechanisms for Water Services from Forests describes nine cases from around the world - the United States, Colombia, Brazil, Costa Rica, France, and Australia –selected to represent various types of financial mechanisms in various settings. After a global scoping we have chosen cases in which administrative and financial mechanisms capture the value of hydrological services provided by forests and are "innovative" in that they have only recently been either used or considered for use in the forestry sector. In most - if not all - of our cases it is not a question of either a market or a regulatory approach rather the mix of the two.

A companion paper, Developing markets for water services from forests, by Johnson, N., White, A. and Perrot-Maître, D. (2001) examines the cases presented in this paper, distills common issues and lessons, describes the basic types of financial incentive mechanisms, the common issues in developing these mechanisms and gives a conceptual framework to what is happening around the world in the emerging markets for hydrological services. It also offers guidance for the future use and development of market based instruments for such services. (The two papers can be found on the Forest Trends website: http://www.forest-trends.org.)

Both of these papers were developed as the result of the Forest Trends' workshop on Developing Markets for Environmental Services at the October 2000 meeting of the Katoomba Group in Vancouver, British Columbia. There have been many valuable inputs from Katoomba group members, some of whose innovations are described here.

Forest Tends is particularly fortunate to have Danièle Perrot-Maître, a French environmental economist, as a consultant to Forest Trends and a co-author of this report. The second author is Patsy Davis, a Forest Trends attorney.

We hope that the message of these papers will reach those stakeholders of forests - landowners, forest managers, investors and policy makers – who could benefit financially and practically from the valuing of hydrological services.

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Case Studies of Markets and Innovative Financial Mechanisms for Water Services from Forests

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Introduction

Well-envisioned and instituted management practices can help provide and enhance hydrological services of forests. These services chiefly include increased water quality, increase in minimum flow during dry season (base flow), regulation of groundwater and surface flow and increased aquatic productivity (See, Johnson, White and Perrot-Maître 2001)**.** Though such hydrological services are among the most valuable of the many ecological services offered by forests, they have, until recently, been considered "external" to market frameworks and provided for "free" by forest landholders.

Traditional strategies to encourage the maintenance and development of such services have been based on voluntary codes, legislative designation of protected areas, and regulation of land use. Because such methods have often been found to be inefficient, arduous to enforce and difficult to fund both the public and the private sectors have searched for new, lower cost approaches to deliver high quality water and other environmental services. A parallel development has been the growing realization that a wide variety of hydrological services are of real financial value to society. It is often cheaper and more efficient from society's standpoint to protect a service from the ecosystem, such as water purification or flood control, than building and maintaining artificial structures such as purification plants and flood control structures. Markets for hydrological services from forests are developing that attempt to capture "externalities' and internalize them into positive incentives for forest landowners ---making ecosystem management a financially attractive alternative to degradation and deforestation. But all forestry problems are not solvable by "the Market" and some form of government involvement – if only to ensure enforceability of contracts – is necessary.

This paper has been written to examine existing markets and financial mechanisms that are being used to provide hydrological services from watersheds and to assist forest owners and policymakers in assessing the advisability and feasibility of using such mechanisms.

After a global scoping of innovative cases of financial mechanisms we have chosen to describe nine illustrative cases. These nine cases come from around the world - the United States, Colombia, Brazil, Costa Rica, France, and Australia – and have been selected to represent various types of financial mechanisms in various settings. We have chosen cases in which administrative and financial mechanisms capture the value of hydrological services provided by forests and are "innovative" in that they have only recently been either used or considered for use in the forestry sector. In most - if not all - of our cases it is not a question of either a market or a regulatory approach rather the mix of the two.

In contrast with the sequestration and storage of carbon that assist in the global climate control, the existence, extent and value of the hydrological services offered by watersheds vary with individual catchment circumstances. Transactions in these services will, therefore, be site specific

and will depend upon local physical, social and environmental characteristics. Although financial mechanisms are applicable at the watershed, the regional, state, national, or international level, in practice they are most commonly used at the small watershed or sub basin level.

Annex 1 at the end of this paper presents a condensation of some of the key features from each of the cases. The companion paper, "Developing markets for water services from forests" (Johnson, White and Perrot-Maître 2001) presents a broad overview of the findings from these cases.

To facilitate analysis each case study is presented according to the following common set of questions:

- What ecosystem service is being financed?
- Who is supplying the service?
- Who is paying for it?
- What instruments are being used?
- What is the legal context?
- What is the role of the public sector?
- What are the equity concerns?
- What is the intended impact on forests?
- What are the lessons for designing similar systems?

Overview of Cases

We have adopted the typology of financial mechanisms used by Powell and White (2001) to describe the wide variety of mechanisms in practice (Annex 1). This typology organizes the incentive mechanisms into three indicative categories, separated by the degree of government intervention in the administration of the mechanism. These three categories include self-organized private deals, trading schemes, and public payment schemes. In reality, of course, there is continuum of mechanisms between the private and public sectors with each playing a wide variety of roles. In most of our cases various mechanisms are used in interrelated ways. A brief description of these mechanisms and some examples are described below.

The first category encompasses **self-organized private deals** that require little or no government involvement. In these cases payments are made voluntarily by members of the private sector, such as private companies or associations of water users. For example, Perrier-Vittel, a French company that sells bottled water, pays upstream landowners to use best management practices on their land to ensure that the company has a supply of quality water. In Costa Rica a utility company pays into a fund that pays private upstream landholders to increase forest cover to provide regularity of water flow for hydroelectricity generation. In the Cauca Valley, Colombia, associations of irrigators pay additional fees to a regional agency for land and forest activities to obtain a sufficient supply of water for crops.

Trading schemes, the second category, usually occur where government sets either a very strict water quality standard or a cap on total pollution emissions. Most of the trading schemes are still at the experimental stage and found primarily in developed countries. In the United States under nutrient trading a polluter with a nitrogen or phosphorus discharge level lower than the required standard may exchange this 'water quality credit' with a polluter with a 'water quality deficit'. Companies and landowners can decide whether it is cheaper to change their own processes to meet regulatory limitations or to buy credits from others that have been able to lower their emission below the established standard. In New South Wales, Australia, a farmers' cooperative buys 'transpiration credits' from State Forests of New South Wales. State Forests earns such

credits by reforesting upstream lands – a process expected to result in reduction of water salinity downstream. Trading usually takes place within watersheds or sub-basins. Credits exchanged are attributed a specific exchange value and are then traded on a market. Credit values are highly site-specific and, at least in principle, eventually will vary with supply and demand for the ecological service.

Public payment schemes, by far the most common mechanism, are established when a municipality, a state, or a national government decides to finance upstream activities such as land retirement or reforestation. In return the government entity expects improvement in hydrological services downstream - for example provision of drinking water, regularity of flow stream or water purification. The program budget is not necessarily proportional to the value of the expected benefits from the ecosystem service. In many cases no valuation of the expected benefits has been done. The financing can come from various sources including general tax revenues, bond issues, or user fees. Often public authorities – particularly when faced with budgetary crisis - require stakeholders benefiting from the ecosystem services of the resource to participate in watershed protection. This is the case in Colombia where hydroelectric and water utilities are required by law to allocate a fixed percentage of their revenues to an ecosystem fund. In Brazil a few States have pioneered a new tax allocation system where a percentage of the state tax goes directly to those municipalities that protect hydrologically sensitive areas. Funds can also be raised issuing bonds – one of the methods used by New York City for its watershed project. The Conservation Reserve Program (CRP), a nationwide, voluntary, long-term retirement cropland program of the United States Department of Agriculture, is financed by general tax revenue. CRP gives various forms of incentive payments to farmers and forest landholders for land retirement and conservation practices to reduce soil erosion and improve water quality, regularity of stream flow and wildlife habitat.

CASE 1 - FRANCE: PERRIER VITTEL'S PAYMENTS FOR WATER QUALITY

Summary

What water-related ecological service is being financed? Quality drinking water.

Who is supplying the service? Upstream dairy farmers and forest landholders.

Who is paying for it? A bottler of natural mineral water.

What instruments are being used?

- **Property acquisition:** A company's purchase of hydrologically sensitive land.
- **Compensation for services:** Long term contracts between the company and landholders surrounding the springs for improvement of agriculture practices and reforestation of sensitive infiltration zones.

What are the intended impacts on forests? Reforestation but limited impact because program focuses on agriculture.

BACKGROUND

As water quality declines all over the world, the demand for bottled water is increasing dramatically and is expected to continue into the future. For those companies that sell bottled water profitability depends not only on demand but also, and perhaps more critically so, on their ability to ensure spring water quality at reasonable cost. Companies have typically exploited water sources and moved on to new ones when water quality deteriorated. But some companies, such as Perrier Vittel S.A., the world's largest bottler of natural mineral water, have come to realize that protection of water sources is more cost effective than building filtration plants or moving continuously to new sources. In France in the late 1980s Vittel decided to embark on an aggressive management program.

What service is being financed?

Vittel designed and implemented its program in order to improve water quality by reducing nitrates and pesticides and restoring natural water purification in a sub-basin of the Rhin-Meuse watershed in northeastern France. Though the program activities include watershed reforestation and control of non-point source pollution from commercial activities, its major focus is on agriculture and is based on the assumption that improvement of farming activities can restore water quality to desired levels. The technological farm package includes pasture-based dairy farming, improved animal waste management, and elimination of corn cultivation and agro-chemicals. The company has succeeded in reducing non-point pollution - something that the government water agencies has done with only limited effectiveness. But water quality monitoring before and after program implementation will establish whether the total program is effective enough to meet Vittel's needs for water of high quality.

Who is supplying the service?

Upstream dairy farmers and forest landholders

Who is paying for it?

Vittel has paid for the program at a total cost over the first seven years of approximately US$24.5 million. (Agence de l'Eau, 1999). The French National Agronomic Institute (INRA) financed 20% of the research and the French Water Agencies pays for 30% of the expenses for building modern barns to improve animal waste management and for monitoring the appropriate use of these buildings.

What instruments are being used?

- **Property acquisition:** For an estimated US$9 million Vittel purchased 1,500 hectares of agricultural land around the Vittel springs. It enticed landowners to sell their lands by offering prices higher than the market price and by offering to give back to those farmers willing to improve their management practices a free usufruct of the land.

- **Compensation for services:** Vittel signed 18 to 30 year contracts with farmers who agreed to switch to less intensive dairy farming technology and pasture management. Such agreements cover about 40 farms consisting of over 10,000 hectares of farmland. Vittel does not make payments based on the relationship between pollutant contents and water quality but rather compensates farmers for the risk and the reduced profitability associated with the transition to the new technology. Vittel pays each farm about US$230 per hectare per year for seven years. The company spent an average of US$155,000 for agricultural investment per farm or a total of US$3.8 million. Provision of income support for such a long period of time is very unusual. European Union subsidies are allocated a year at a time. The level of subsidy is also unusually high. On average subsidies account for 75% of the farms' disposable income (INRA 1997). The company also provides the farmers with free technical assistance and pays for new farm equipment and the modernization and construction of farm buildings. In exchange, Vittel owns buildings and equipment for the period of the contract and has the right to monitor their adequate use.

What is the legal context?

Because of the pre-existence of water quality standards and a formal enforcement agency no new laws were necessary to support this initiative (1964 Water Act). Water in France is managed through six water agencies that roughly correspond to its six major watersheds.

What is the role of the public sector?

Though no formal partnership was established between the private and public sector, the public sector had a fundamental role in setting up a regulatory framework - providing a strong legal system to assure the enforceability of contracts and granting some limited financial aid.

What are the equity concerns?

Unlike French public sector programs under which only large farms are eligible for subsidies Vittel's program benefits farms of all sizes.

What are the intended impacts on forests?

Some reforestation has taken place but the impact of the program on forests remains limited because of its focus on agriculture.

What are the lessons for designing similar systems?

When Vittel purchased Perrier and Contrexeville, it exported the approach to these companies. The Contrexeville Springs are close to Vittel in northeast France and the model was easily expanded. The Perrier springs are located in southern France in an area of vineyards and intensive wheat cultivation where phosphates and herbicides are the main sources of water pollution. There, Perrier successfully introduced biological agriculture to 20 farms that cultivate approximately 350 hectares of cereals and 200 hectares of vineyards and regularly monitors over 900 hectares of land. The highly favorable market conditions for organic produce made significant contribution to the rapid adoption of improved farming practices around the Perrier springs. Other French bottlers - Evian and Volvic - have considered using Vittel's experience as a model.

Several issues may affect the potential for transferability:

- **Scale**: The Vittel model may be difficult to use in a larger geographic area or in an area with a greater number of farmers.

- **Timing**: If quality drinking water is needed immediately, Vittel's agricultural and forestry practices may not be able to achieve water quality targets rapidly enough to avoid the need for purification plants.

- **Private sector profitability**: Given the level of investment required, the Vittel model would, absent significant public sector financial support, appear to be restricted to highly profitable industries or industries with a rapidly growing demand for their product.

- **Cost benefit analysis based on cost of alternatives to pasture management:** Whether such a program would be economically justifiable must be examined case by case. In the Vittel case INRA conducted a cost-benefit analysis comparing the cost of water filtration through filtration plants and through pasture management. Based on the assumption that one hectare of well-managed pasture produces an estimated 3,000 m3 of drinkable water per year, the study concluded that the program was economically justifiable (INRA 1997).

REFERENCES

Agence de l'Eau Rhin-Meuse. 1999. Programme AGREV, Agriculture-environnement-Vittel, *Les Etudes des Agences de l'Eau* No. 69.

Brossier J., Director, SAD Unit, INRA. 2000. Personal communication. September 11 and 12, 2000.

Cadène, J., Director, Perrier Program. 2000. Personal communication**.** September 7, 2000.

Institut National de la Recherche Agronomique. 1997. *Les dossiers de l'environnement de l'INRA* No. 14.

Pierre, Director, Vittel-Contrex Program. 2000. Personal communication. September 6, 2000.

Ramon, S., Rhin-Meuse Water Agency. 2000. Personal communication. September 11, 2000.

Teysseyre, Former Director, Vittel Program. 2000. Personal communication. September 8, 2000.

CASE 2 - COSTA RICA: HYDROELECTRIC UTILITIES' FINANCING OF UPSTREAM REFORESTATION

Summary

What water-related ecological service is being financed? Regularity of water flow for hydroelectricity generation; protection of biodiversity.

Who is supplying the service? Private owners of forest land.

Who is paying for the service? Private hydroelectric company and a Government of Costa Rica fund -consisting largely of fuel tax revenues - with a local NGO providing some administrative expenses.

What instrument is being used? Payments made by utility company via a local NGO to landowners; such payments supplemented by government funds.

What are the intended impacts on forests? Increased forest cover on private lands; expansion of forests through protection and regeneration.

BACKGROUND

Although about one fifth of Costa Rica consists of protected lands, concern over deforestation and inadequate land use led the country to pioneer the establishment of compensation mechanisms for ecological services. The Government of Costa Rica established The National Forest Office and National Fund for Forest Financing (FONAFIFO) to provide incentives for reforestation by compensating private landowners in exchange for their commitment to reforest, regenerate or leave forested land pristine. The Fund, financed in large part by a 5% national sales tax on fossil fuel, was instituted primarily to protect biodiversity and did not focus on watershed services. FONAFIFO has contributed to making the public and the economic sector aware of the value of ecological services provided by forests.

Energía Global, a private hydroelectric company located in the Sarapiqui watershed, provides electricity for about 40,000 people. Two sub-watersheds covering about 5,800 hectares are the source of the company's water supply. Electricity production and revenues are maximized when the plant is running at full capacity and problems arise because the company is dependent on water stored in two small reservoirs that can only store enough water for five hours.

What water-related ecological service is being financed?

Energía Global wants both to increase stream flow regularity throughout the year and to reduce reservoir sedimentation and believes that an increase in forest cover upstream will provide these services. There was no in depth hydrological study to establish the relationship between forest cover and stream flow and hydrological studies conducted in other parts of the country have shown conflicting results. Given the value of electricity foregone by having to spill excess water, Energía Global estimated that its investment in watershed activities will pay off if it succeeds in capturing an extra 460,000 cubic meters of water - worth about $30,000.

Who is supplying the service?

Private owners of forest land

Who is paying for the service?

Energía Global, a private hydroelectric company and a Government of Costa Rica fund - consisting largely of fuel tax revenues - with a local NGO providing some administrative expenses

What instruments are being used?

Energía Global pays $18 per hectare to FONAFIFO. FONAFIFO then adds an additional $30 per hectare and then makes cash payments to those owners of upstream private lands who agree to reforest their land, engage in sustainable forestry and/or conserve their forested land. As a policy, landowners who have recently cleared their land or landowners planning to replace natural forests with plantations are not eligible for compensation. An NGO, FUNDECOR, (Fundación para el Desarrollo de la Cordillera Volcánica Central) oversees the implementation of the conservation activities and manages the legal and administrative operation. The financial compensation of about $48.0 per hectare per year is not based on the value of the hydrological services but is the approximate equivalent of the opportunity cost of foregone land development - mainly potential revenues from cattle ranching.

What is the legal context?

Because FONAFIFO was already established and FUNDECOR's contributions are voluntary, no major change in the legal and regulatory framework was required.

What is the role of the public sector?

The role of FONAFIFO, the government fund, supplements the funds provided by Energía Global.

What are the equity concerns?

Forest regeneration and conservation through the FONAFIFO scheme has been criticized for mainly benefiting large private forest landowners. Large landowners are better informed and can afford to conserve part of their lands. For smaller landowners such conservation efforts are more risky. Also designers of such programs are more likely to want to develop programs using large land holders because transaction costs of working with a small number of large landowners are less than those incurred in working with a large number of small owners.

What are the intended impacts on forests?

Increased forest cover on private lands

What are the lessons for designing similar systems?

Within Costa Rica itself there are a wide variety of innovative approaches similar to, but different from, that used by Energía Global. The differences in these approaches are often related to the roles for the public and the private sectors. Two public electricity companies (Compañia de

Fuerza y Luz, and CNFL) – and another private company (Hidroelectrica Platanar) - are compensating landowners through payments to FONAFIFO - it should be noted that CNFL finances 100% of the compensation. Two private hydroelectric companies have set up purely private initiatives – thus bypassing the public sector entirely. One of these companies, the Heredia Public Utility Company, has extended the concept to drinking water. Heredia increased the water fee and is presently in the process of establishing a Trust Fund for watershed protection. At present the stakeholders are still negotiating the final project design.

On the national level the Ministry of Environment is actively engaged in expanding the Energía Global concept to the national electricity and water utility companies (ICE and AyA). Expanding the compensation mechanism to national utility companies will require much more complex changes in institutional and regulatory arrangements. A proposal has been made that all utilities be legally required to pay for such services but the Costa Rican Congress has not acted upon it

A group of private consultants, exploring the possibility of using the "payment of environmental services" in Ciudad Quesada, a small rural town in northern Costa Rica, envisages including watershed land purchase. The program would be administered through FONAFIFO.

A slightly different example of private company financing is the agreement by Grupo de Oro, a Costa Rican grower and processor of oranges, to pay an equivalent of $5.0 per hectare to compensate the Guanacaste Conservation Area (GCA) for water and insect pollination ecological services. The National System of Conservation Areas (SINAC) of the Ministry of Environment and Energy (MINAE) manages the GCA.

The following are issues that should be considered wherever similar approaches are being considered:

- An electricity tariff structure establishes tariffs for state-owned electric utility companies that are higher during the dry season may discourage investment in land and forestry practices.

- The actual value of the ecological services should be examined with as much specificity as possible. Two case studies have been conducted in Costa Rica to estimate the ecological benefits of water resources, one initiated by the Tropical Science Center and another by the Ministry of Environment. The first study concludes that water prices should be increased up to 120% in order to reflect water's economic and ecological value. The second valuation study (Barrantes and Castro 1998), based on willingness to pay and economic benefits derived from water, proposes a new tariff structure differentiated by economic sector and geographic location.

- Actions of upstream landowners may not be of value to hydroelectric companies if water reservoirs are large and water does not need to be spilled.

- The presence of other downstream users who share the benefits of water, such as farmers needing water for irrigation, makes voluntary compensation less likely. A mechanism would have to be developed to separate out the benefits to the different stakeholders.

- A local NGO, such as FUNDECOR, may be able to assist in reducing transaction costs by organizing, managing and monitoring small landowners.

REFERENCES

Barrantes G. and E. Castro. 1998. *Valoración Económico Ecológico del Agua en Costa Rica: Internalización del Valor de los Servicios Ambientales*. San José, Costa Rica**.**

Chomitz, K., E. Brenes, and L. Constantino. 1998. Financing Environmental Services: The Costa Rica Experience and its Implications. Paper prepared for Environmentally and Socially Sustainable Development, Latin America and Caribbean Region, World Bank. Washington: World Bank.

Echavarria M., 2000. Personal communication. September 22 and 28, 2000.

____1999. *Policy Mechanisms for Watershed Conservation, Case Studies*. Arlington, Virginia: The Nature Conservancy.

Gámez, L., Ministry of Environment and Energy (MINAE), Costa Rica. 2000. Personal communication. August 24, 2000.

Rojas, M., consultant, Eco-Asesores Integrados, Costa Rica. 2000. Personal communication. September 19 and 28, 2000.

Watershed Protection and Hydroelectric Energy: A New Approach to Rainforest Conservation, Agreement between Energía Global de Costa Rica and the Foundation for the Development of the Central Volcanic Range (FUNDECOR).

Aylward B., International Institute for Environment and Development. 2000. Personal communication. September 25, 2000.

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CASE 3 - CAUCA RIVER, COLOMBIA: ASSOCIATIONS OF IRRIGATORS' PAYMENTS FOR IMPROVEMENT OF STREAM FLOW

Summary

What water-related ecological service is being financed? Improvement of base flows and reduction of sedimentation in irrigation canals.

Who is supplying the service? Upstream forest landowners.

Who is paying for it? Associations of irrigators and government agencies.

What instruments are being used?

- **Payment for services:**
  - Private – voluntary payments by associations of irrigators to a government agency in order to finance watershed activities.
  - Public – payments by government agency to upstream landowners for watershed activities
- **Property Acquisition** – government agency's acquisition of lands necessary for watershed protection.

What are the intended impacts on forests? Reforestation – particularly on steep slopes, erosion control, springs and waterway protection, and development of watershed

BACKGROUND

The Cauca River watershed is one of the largest watersheds in Colombia. It drains a large, extremely fertile valley (roughly 200km per 15km) that provides food supply for Cali, the second largest city in Colombia. In 1959 the Government of Colombia created the Cauca Valley Corporation (CVC), modeled on the United States Tennessee Valley Authority. The CVC was to be responsible for allocating water between the different water users in the Cauca Valley and for managing the upper watershed, which covers the slopes leading into the valley. Administrative rather than hydrological criteria defined the geographic boundaries of the area covered by CVC.

Although water resources are abundant in the region, in the late 1980's rapid urban, industrial, and agricultural development resulted in the valley's five million people experiencing a growing water scarcity during the summer months and floods during the rainy season. Farmers were especially affected because the laws of Colombia require that water be allocated first to domestic users. Because the CVC had insufficient financial resources to deal with this water shortage, rice and sugarcane producers organized to create 12 water user associations and voluntarily agreed to increase the user fees they paid to the CVC in exchange for improved watershed management.

What water-related ecological service is being financed?

The objective of the joint CVC-Associations program is to improve stream flow for the benefit of agricultural producers. The program, covering one million hectares, involves improving watershed management, purchasing key segments of land, and developing watershed

communities. Improved watershed management will mean reforestation, particularly on steep slopes, erosion control, and protection of springs and waterways. No formal hydrological study has been conducted to establish a link between these activities and stream flow but there is anecdotal evidence that the program has contributed in stabilizing the basin and that the stream flow has improved. Local dwellers consider the fact that the Desbaratado River has not experienced floods for the past ten years a sign that the program is producing results.

Who is supplying the service? Upstream forest landowners

Who is paying for it? Associations of irrigators and government agencies

What instruments are being used?

- **Payment for services**

  - **Private: Voluntary payment by private association of irrigators.** Water users originally paid $0.50 per liter per second every trimester to the CVC for the right to water access. This fee was calculated to cover CVC's administrative costs and was based on theoretical water use for specific crop. Even when water supply became erratic and farm yields dropped, farmers were still paying the established water fee. The failure of this scheme was a major incentive for action. The water users in the associations voluntarily agreed to pay an additional fee of $1.50 to $2.00 per liter per second per trimester to be put into a separate fund to be used by the CVC to finance those watershed activities necessary to improve stream flow. This additional fee level represents the willingness of the association members to finance such activities. The fee level farmers were willing to pay is so high compared to the original fee level that it may reflect part of their perceived opportunity cost of declining water supply.

  - **Public: Contracts between the CVC and upstream forest landowners:** CVC uses part of the fees paid by the irrigators to pay the upstream forest landowners for watershed activities.

- **Property transfer**

  CVC also uses part of the associations' funds to purchase land in critical hydrological areas.

What is the legal context?

In Colombia private associations are not legally empowered to implement watershed management plans and must therefore work with the governmental entities. However, the existing regulatory framework did support the establishment of water user associations. The associations also benefited from the long experience that farmers in the sugar cane sector have had in organizing themselves. In the majority of cases the organization of the associations was based on personal and institutional complementarities and no formal agreements were necessary.

What is the role of the public sector?

The lack of sufficient public funds to support land and forest practices and the legal prohibition against private watershed management meant that the private associations and the public sector needed each other and formed partnerships, formal or informal. RACs instituted the watershed

management activities and provides technical assistance to local communities and landowners carrying out a variety of actions representing best practices.

What are the equity concerns?

There is insufficient available information to determine possible equity issues.

What are the intended impacts on forests?

The program intends to improve forest management, to reforest much of the area, control erosion and protect springs and waterways.

What are the lessons for designing similar systems?

The experience of the Cauca River watershed has spread throughout Colombia. In areas where there is no public corporation such as the CVC, associations have built partnerships with the Regional Autonomous Corporations (RACs). The Government of Colombia had instituted RACs in regions throughout the country to coordinate watershed management efforts. On the private side a Colombian Federation of Water Users is being established to facilitate the formation of water user associations throughout the country.

In a similar situation in the Philippines a majority of those using the Makiling Forest Reserve waters agreed to pay an additional monthly fee to finance watershed protection activities. The Forest Reserve watershed, located within five municipalities, is composed of six major watersheds and covers about 4200 hectares. The fee level was established based on a willingness to pay survey.

The following features are important to examine prior to establishing any private-public scheme similar to that used in the Cauca River watershed:

- **Profitability of agriculture.** The high profitability of agriculture in the Cauca Valley - large farms producing high value crops with large nearby urban markets – has meant that farmers have been willing and able to contribute additional funds to watershed activities.

- **Political stability.** As with all mechanisms, the more solid and transparent the legal, economic, and administrative institutions the greater opportunity for success.

- **Cost-effectiveness.** The cost-effectiveness of the program in the Cauca Valley has been assumed but not evaluated.

- **Administrative Parameter of Watershed Projects.** Problems can arise when, as is the case in the Cauca Valley, the public corporation or agency that administers the watershed is not coterminous with the watershed itself. This lack of common boundaries could negatively affect watershed management. In Colombia this could be RAC.

- **Scale.** The size of the association, the size of the watershed, and the number of upstream dwellers will influence the effectiveness of voluntary action and the amount of transaction costs. The Cauca River watershed with over 3000 km2 of valley floor has an advantage in being one of the largest watersheds in Colombia.

REFERENCES

Barbier, E. 1998. The value of water and watersheds: reconciling ecological and economic externalities. Paper presented at Conference on Managing Human-dominated Ecosystems. St. Louis, Missouri. March 26-28, 1998.

Colegia San Pablo, Departamento del Valle del Cauca. http://www.pablus.net/sanpablo/valle.htm. Updated May 3, 2001(accessed May 10, 2001).

Cruz, R., L. A. Bugayong, P.C. Dolom, and N.O.Espiritu. 2000. Market-based instruments for water resource conservation in Mt. Makiling, Philippines. Paper presented at 8th Biennial Conference of the International Association for the Study of Common Property. Bloomington, Indiana. May 31– June 4, 2000.

Echavarria M. 1998. *Informe sobre el tema del agua en Bolivia, Colombia, Chile, Ecuador, Paraguay y Peru.* Arlington, Virginia: The Nature Conservancy.

____2000. Personal communication. September 22 and 28, 2000.

____2000. Valuation of water-related services to downstream users in rural watersheds: Determining values for the use and protection of water sources**.** Paper presented on Land-Water Linkages in Rural Watersheds Electronic Workshop, United Nations Food and Agriculture Organization. September 18 – October 27, 2000. http://www.fao.org/ag/agl/watershed

Echavarria, M. and L. Lochman. 1999. *Policy mechanisms for watershed conservation: Case studies*. Arlington, Virginia: The Nature Conservancy.

CASE 4 - UNITED STATES: NUTRIENT TRADING

Summary

What water-related ecological service is being financed? Improved water quality.

Who is supplying the service? Point source polluters discharging below allowable levels and non-point unregulated sources reducing their pollution through such means as adopting ecologically sound agricultural practices.

Who is paying for it? Polluting sources with discharges above allowable level.

What instruments are being used? Trading of nutrient reduction credits among industrial and agricultural polluting sources.

What are the intended impacts on forests? Because program focuses on industrial and agricultural polluters limited impact on forests - mainly establishment of trees in riparian areas.

BACKGROUND

In many rivers in the United States increasingly high nutrient loads have dramatically reduced water quality. Government regulations have traditionally tried to control water quality by establishing fixed standards for quality and/or fixed levels of allowable discharge for particular pollutants from particular point source polluters. Point-source polluters are those who discharge nutrients from a precisely localized source - often an industrial site or municipal sewage plant. Compliance costs have varied depending on the nature, scale, and location of the polluting activity, and to meet the regulatory standards for water quality point polluters have often have had to invest in expensive waste reduction technology.

Legally set allowances have not been fixed for non-point source pollution, i.e., pollution from diffused sources, such as fertilizer run off from agricultural fields. Measurement of the pollution created by non-point sources is difficult because of distance from the river, the nature of the effluent and the fact that loads vary with weather events.

The regulatory system has not been successful in lowering the level of nutrients and therefore, advanced treatment plants have needed to be built everywhere to ensure the quality of drinking water. As an alternative to regulation, nutrient trading has recently been instituted in several areas in the United States as a flexible, cost-effective and equitable way to achieve or exceed water quality standards in watersheds and to give non-point sources a financial incentive to participate in pollution control.

What service is being financed?

Improved water quality

Who is supplying the service?

Point polluting sources with discharge below allowable levels and non-point sources that are reducing their pollution through adopting ecologically sound practices

Who is paying for it?

Polluting sources with discharge above allowable level

What instruments are being used?

Trading of pollution reduction credits among sources allows polluters with low treatment costs to reduce their nutrient loads below allowable levels and sell the difference (a credit) to polluters for whom buying credits is cheaper than compliance costs. Thus sources, both point and non-point, have an incentive to reduce their discharge sources so as to be able to trade and sell credits.

- **Point - non-point credit exchange**: Under point - non-point trading a cap is set on total discharge for a specific nutrient, load limits are established for point sources, and trading is allowed with non point sources. Point sources may find it more cost effective to purchase credits from a non-point source that has reduced the amount of its discharge below the approved limits rather than expending funds on expensive technology to reduce its own discharge. Non-point source reduction is here a means to supplement point source reduction rather than a substitute. Point source and non-point source pollution has different characteristics due to the greater uncertainty associated with non-point source pollution. In order to trade a unit of point source pollution reduction with a unit from a non-point source, an equivalency or a "ratio" needs to be established. In Minnesota, the Rahr Malting Company is allowed to increase its discharge on a tightly regulated segment of a watershed in exchange for financing agricultural conservation programs for which the company receives reduction credit.

- **Point - point credit exchange:** This exchange mechanism does not require a ratio to be set. In the North Carolina Tar-Pamlico watershed, an association of point sources was established and point sources within that association are allowed to trade with each other under a cap. If association members fail to stay under the cap, they pay into a fund to support government programs that encourage the adoption of best management practices by farmers in the watershed.

What is the legal context?

A strong regulatory framework is a prerequisite for trading. A monitoring system, standards, and trading rules must be established to ensure that credits traded are really associated with ecological improvements. A legal remedy must be available to assure that a credit traded by a polluter corresponds to a true reduction in nutrient discharge.

What is the role of the public sector?

The public sector is essential. Trading not only requires strong regulations but there also must be sufficient financial resources to cover the associated high design and transaction costs – resources that usually come from the public sector.

What are the equity concerns?

A trading scheme transfers the burden of management and transaction costs from regulatory authorities to point sources. Control of point sources is easier and less politically risky than of non-point sources such as agriculture. Since industry bears most of the burden while the agricultural sector is the main contributor to the nutrient problem**,** it would arguably be more equitable to treat and control agriculture as a point source and link the provision of agricultural subsidies to ecological improvement.

What are the intended impacts on forests?

The trading system involves industrial and agricultural polluters and has no major impact on forests. The system does give incentives for establishing trees in riparian areas.

What are the lessons for designing similar systems?

In the United States trading has been used successfully to obtain cost-effective reductions in sulfur dioxide emissions. Carbon trading is a proposed option for addressing the build-up of greenhouse gas emissions that cause global warming; in countries such as Costa Rica carbon trading has contributed to improving the profitability and the management of forest lands. But so far, trading has not been as successful with water issues. However, several pilot trading programs, point-non point trading in the Saginaw Bay in Michigan, point-point trading in the Rock River watershed in Wisconsin, and ad hoc trades in the Minnesota River Valley, have shown potential for cost savings and improved water quality.

The largest opportunity appears to be trading between point and non-point sources (Faeth 2000). Point-non-point trading programs are currently in place at the Dillon and Cherry Creek Reservoirs which provide about half of the City of Denver's water supply and in North Carolina's Tar-Pamlico Basin, and they are being considered in other places such as Connecticut, Minnesota and Wisconsin. The feasibility of such trading appears to be limited to highly site-specific circumstances but some think that it could be applicable in as many as 900 watersheds in the United States (Faeth 2000).

United States mitigation banking, initiated in the 1970s, is a similar scheme under which a developer who causes harm to wetlands can offset such harm by buying credits earned by protecting, restoring, creating and/or enhancing another area of wetlands. In 1992 over 40 banks were facilitating the rehabilitation of about 20,000 acres of wetland and at present several hundred wetland banks are in operation.

When deciding whether trading is the optimal financial mechanism to insure water quality improvement several areas to be considered are:

- **Transaction and Administrative Costs**: Trading may not be the most cost effective way to assure water quality. Costs for trading appear to be higher than expected. Transaction costs associated with the design of trading mechanisms (regulatory framework, information gathering, identification of potential traders) and administrative costs (water quality monitoring) may be higher than those associated with traditional ways of treating water. For example, in south central Minnesota the cost of running a trading program was estimated at $12 to $15 per pound of expected phosphorus load reduction. This amount was about two or three times the estimated unit cost of phosphorus removal from municipal water treatment

systems. In actuality when incentive payments ($5 to $10 per acre) were included the cost rose to $48 to $70 per pound and this cost did not include transaction and enforcement costs nor the costs of an educational program designed to encourage landowners' participation (Senjem 1997).

- **Ecological, political and cultural site-specific issues:** The site-specific characteristics of the watershed may determine whether trading is the optimal approach. The effective use of trading will depend on watershed characteristics such as landscape, number of dischargers, type of discharge, size and level of treatment, the level of water quality degradation, and willingness of stakeholders to participate. The optimal design for effective implementation and compliance must be responsive to the following questions:

  - **Monitoring sources:** Are there a few point sources, multiple non-point sources or a combination?

  - **Government involvement**: Will there be government support for trading? Will the necessary government regulations be established?

  - **Trading geographical boundaries**: Are water quality standards best established for entire watersheds or for portions of the watershed? According to which criteria are geographical boundaries for trading to be established?

  - **Hydrological relationships**: Since trading design requires scientific knowledge of hydrological relationships in the watershed, is such knowledge available?

  - **Possible adverse effects**: How can the trading system ensure that it will not cause localized adverse effects?

  Fiscal issues:

  - **Value of credit**: How should the price of a credit be determined? Is the price fixed or variable? How much reduction in pollution is necessary to obtain a credit? How long are credits good for? Can credits be resold if not needed? How long can they be unused?

  - **Value of equivalence ratios**: What should be the number of units of pollution reduction that a source must purchase to receive a credit for one unit of pollution from another source? How should the equivalence ratios between point source and non-point source loads be established?

REFERENCES

Chesapeake Bay Program, Nutrient Trading. http://www.chesapeakebay.net/trading.htm. Updated May 5, 2001 (accessed May 10, 2001).

Environomics. 1999. A summary of U. S. effluent trading and offset projects. Paper prepared for Office of Water, U.S. Environmental Protection Agency. Washington, D.C.

Faeth, P. 2000. *Fertile ground: Nutrient trading's potential to cost-effectively improve water quality.* Washington, DC: The World Resources Institute.

Senjem N. 1997. *Pollutant trading for water quality improvement: A policy evaluation.* Minnesota: Water Quality Division, Minnesota Pollution Control Agency.

CASE 5 - AUSTRALIA: WATER TRANSPIRAION CREDITS

Summary

What water-related ecological service is being financed? Reduction of water salinity.

Who is supplying the service? State Forests of New South Wales.

Who is paying for it? An association of irrigation farmers.

What instruments are being used? Water transpiration credits earned by reforestation by State Forests and sold to irrigation farmers.

What are the intended impacts on forests? Large scale reforestation.

BACKGROUND

The Mullay-Darling watershed covers more than one million square kilometers on the eastern side of the Australian continent. Land use in the watershed ranges from urban to rural with vast stretches of wilderness in the northwestern area. Salinity is a natural feature of much of the basin, but land clearing – particularly in the Macquarie River catchment area - has exacerbated the water salinisation problem. Loss in vegetation cover results in less water being absorbed and in more water being transferred to the atmosphere causing an increase in rainfall and a rise in the water table. This rise in turns brings dissolved mineral salts to the soil surface. The resulting salinity affects crop growth and yields.

State Forests is a New South Wales Government Trading Enterprise responsible for sustainably managing more 2 million hectares of public native forests and an expanding estate of hardwood and softwood planted forests. In October 1999, Macquarie River Food and Fiber (MRFF), an association of 600 irrigation farmers, entered into an agreement with State Forests to support tree planting as a cost-effective strategy. The association purchases salinity credits from State Forests based on the amount of water transpired from 100 hectares of newly established forest in the Upper Macquarie catchment area. The State Forests then uses these funds to finance reforestation.

What service is being financed?

Several strategies have been used to reduce salinity in river systems: pumping and evaporating saline water, planting desalinization plants and replanting trees or other deep-rooted perennial vegetation. On the land it owns in the upper Macquarie River catchment area State Forests has used all of these methods but most of its efforts are in planting trees or other vegetation.

Who is supplying the service?

State Forests of New South Wales

Who is paying for it?

An association of irrigation farmers

What instruments are being used?

State Forests, as owners of the upstream land, earn transpiration or salinity reduction credits by planting trees or other vegetation. The MRFF downstream water users purchase these salinity credits. Prices are expressed in $ per million liters of additional transpiration per year, assuming one hectare of forest generates five million liters of transpiration per year. At the present time the farmers pay $AUD17.0 per million liter of water transpired or a compensation of $AUD 85 per hectare per year. They have agreed to do so for ten years. So far the value of transpiration credits has been established by trial and error. The valuation will ultimately be done by the market, reflecting the costs of other salinity reduction alternatives and the validity of the present assumptions regarding forest transpiration.

For this to be a true trading scheme, forest cover targets will have to be established for individual landowners or watershed areas so that the landowners could trade among themselves.

What is the legal context?

During the pilot stage there has been no need for changes to state or federal laws. If a trading system were implemented after the pilot phase, the state or a watershed authority would need to establish a legal framework and formal trading rules.

What is the role of the public sector?

The public sector played a catalytic role in initiating the pilot project. Though State Forests, a government trading enterprise, was the seller of the salinity credits such a mechanism could be envisaged between private actors with public sector intervention limited to establishing the necessary legal and regulatory framework.

What are the intended impacts on forests?

Where clearing of native vegetation has contributed to increased salinisation large scale reforestation must be done on a large scale in order to reverse the trend.

What are the lessons for designing similar systems?

This pilot project was initiated a year ago and it is too early to evaluate trading performance. It was designed to test the possibility of generating a new market in water transpiration to benefit farmers and other water users. If the pilot is successful, water users, including farmers and government, could purchase salinity credits based on the amount of water transpired from newly established forests owned either by the government or private landowners. Without this incentive very few landowners in this area would restore forest cover since low rainfall (500-700mm/yr) limits timber growth and makes timber an unprofitable alternative.

Transferability will only be relevant in places where:

- Hydrological relationships are scientifically established and credible.

- Sophisticated regulatory and legal system can be established.
- Since research indicates the necessity for large-scale reforestation, a large area must be available. As much as 40% of the cleared vegetation and forest must be restored to reverse the salinity process.
- Funds from salinity credits are unlikely, on their own, to support sustainable forestry; therefore, such projects may require additional financing.

REFERENCES

Brand D. 2000. Integrating landscape management with climate change issues. Paper presented at The Australian Financial Review Third Annual Emission Forum, March 29-31, 2000. Sydney, Australia.

Brand, D., Director, Hancock Natural Resource Group. 2000. Personal communication. September 27, 2000**.**

Johnson, N. 2000. Strategies to build sustainable links between forests, water, and people, Paper presented at Environmental Markets and Forests Workshop. April 11-12, 2000. Katoomba, Australia.

CASE 6 - NEW YORK CITY: WATERSHED MANAGEMENT PROGRAM

Summary

What water-related ecological service is being financed? Purification of New York City's water supply.

Who is supplying the service? Upstream forest landowners, farmers, and timber companies.

Who is paying for it? Most of the funds come from a New York City tax on water users with supplemental funds from NYC bonds, the federal government, the State of New York, and local governments in the catchment area.

What instruments are being used?

- **Financing:**
  - **Taxation:** Additional taxation on NYC water bills. (Beneficiary pays)
  - **NYC Bonds**
  - **Trust Funds:** Set up and financed by NYC.

- **Compensation to landowners:**
  - **Cost-sharing /Subsidy Program:** Subsidies to farmers and forest landholders for any additional costs associated with the adoption of best management practices.
  - **Logging permits for forest management improvements:** Government provides logging companies additional logging permits in return for improvement of forest management services.
  - **Differential land use taxation:** Property tax reduction for better land management practices.

- **Property transfer:**
  - **Government acquisition and transfer of development rights.** Distribution of government owned land development rights to farmers and landowners in exchange for agreements to follow best management practices.
  - **Conservation easements.** Government purchase of conservation easements from private landowners that require retirement of certain ecologically significant land from production.
  - **Purchase of hydrologically sensitive land.**

- **Development of markets:**
  - **New markets for non-timber products.** Promotion by government and communities of new markets to lessen dependency on timber as sole forestry product.
  - **Timber product certification.** Local council's exploration of a market for "certified" wood products.

BACKGROUND

New York City's nine million residents receive 90% of their drinking water supply from the predominantly rural Catskill and Delaware watersheds located about 125 miles from the city. Combined, these watersheds cover an area of approximately 1,600 square miles with a population of around 77,000. Forests constitute 75% of the total land area in these watersheds and support a stable forest industry with approximately 130 timber harvesters. The smaller and more industrialized Croton watershed supplies the other 10% of New York City's drinking water.

The quality of the drinking water provided by these watersheds had historically been very high but in the late 1980's there was a growing concern about microbial contamination. In 1989 the United States Environmental Protection Agency (EPA) initiated a requirement that all surface water supplies be filtered, a requirement that could be waived if existing treatment processes or natural conditions provided safe water. In response to the EPA New York City built a filtration plant for the Croton watershed but in the Catskill/Delaware watershed decided to develop a program based largely on improvement of watershed management. The city hoped that this program would improve water quality so that an additional purification plant would not be necessary. As a result of its actions the city received a temporary filtration waiver from the EPA

The Watershed Agricultural Council (WAC), a local organization, was formed to provide leadership to improve land use practices and to support the economic development of local communities. The Catskill Watershed Development Corporation (CWDC), a non-profit organization, administers the watershed program for the Catskill watershed.

What water-related ecological service is being financed?

The key assumption upon which the program is based is that improvements in farm and forestry practices will significantly reduce microbial pathogens and phosphorus in the water. The key uncertainty is whether this initiative can achieve standards of water quality in the time allotted in the EPA waiver.

The major components of the NYC program in the Catskills/Delaware area are:

- Upgrading and rehabilitation of infrastructure: The City paid $472 million to upgrade and rehabilitate city-owned sewage treatment plants, dams and water supply facilities.

- A watershed program: The watershed program consists of purchasing conservation easements from farms, promoting forest and agricultural best management practices, instituting education and outreach programs, and working with the US Department of Agriculture on the Conservation Reserve Enhancement Program (CREP).

Who is supplying the service?

Upstream forestry landowners, farmers, and timber companies

Who is paying for it?

The City of New York paid the initial costs of the watershed program with state, federal and the local governments within the watershed area providing supplementary funding later in the process. The construction costs of an additional filtration plant were estimated at $6-8 billion with an additional $300-500 million needed for annual operating costs. Faced with such costs,

the city agreed to invest $1.0 to $1.5 billion over ten years in a watershed program principally financed by a 9 % percent increase in the taxes on water bills over a five-year period. Building a new filtration plant would have required a twofold increase in taxpayers' water bills.

What instruments are being used?

- **Financing**

  - **Taxation.** New York City residents voted to allow the government to levy additional taxes on their water bills.

  - **New York City Bonds.** NYC issued bonds for additional financing.

  - **Trust Funds.** NYC financed the Catskill Fund for the Future, a $60 million trust fund that provided loans and grants for environmentally sustainable projects in the Catskill watershed. Another Trust, the NYC Trust Fund, provided $240 million for water quality and economic programs in the Catskill watershed and $70 million for programs in the Delaware watershed.

- **Compensation**

  - **Cost-sharing /Subsidy Program.** NYC provided $40 million to dairy farmers and foresters who adopted best management practices. Many farmers agreed to adopt such practices as long as the subsidy covered all additional associated costs. Of the approximately 350 Catskill/Delaware dairy farmers, 317 agreed to participate in the program and so far 55 of them have instituted best management practices. The City does not provide any additional farm income support during the transition phase because such practices improve short-term profitability.

  - **Logging permits for forest management improvements.** In return for improving forest management practices, such as the adoption of low impact logging, the timber industry gets additional logging permits in areas to which they had no prior access.

  - **Differential land use taxation.** Forest landowners owning 50 acres or more and willing to commit to a ten-year forest management plan are eligible for an 80% reduction in local property tax.

- **Property transfer**

  - **Outright purchase of land:** NYC is acquiring hydrologically sensitive land – such as that near reservoirs, wetlands, and watercourses.

  - **Government acquisition and transfer of development rights:** The City also purchases development rights from owners of water quality sensitive lands at market price. Development rights allow landowners sell their rights to develop their land to someone wishing to develop land in a non-priority area. These rights are distributed to farmers and logging companies in exchange for their adopting best management practices.

  - **Conservation easements.** Under the federal Conservation Reserve Enhancement Program farmers and forest landowners can enter into 10 to 15 years contracts with the

United States Department of Agriculture (USDA) to retire environmentally sensitive lands from production. Case 9 of this paper discusses the United States Conservation Reserve Program.

DEVELOPMENT OF MARKETS

- **New markets for non-timber products**. To promote local economic development the WAC actively searches for ways to create new markets for non-timber products that in turn will create incentives to improve forest management and promote forest regeneration.

- **Timber Product Certification.** The WAC is also exploring development of a market for wood products from "Watershed Improved Timber harvesting" or under "Smart Wood" certification.

What is the legal context?

- A number of federal, state and local regulatory changes were necessary to implement the watershed management program including:

- The EPA agreement to waive the filtration requirement provided time to develop a cost-effective alternative to achieving water quality.

- A ten-year permit from the State Department of Environmental Conservation enabled the NYC to acquire land in the watersheds.

- The revision of the long-standing New York State Watershed Rules and Regulations established new standards for water facilities and construction projects and required City review and approval of activities having potentially adverse effects on water quality.

What is the role of the public sector?

Though NYC led the watershed management efforts, both the federal and state governments provide financial and technical help to the project. USDA provides technical assistance and financial incentives to farmers under its Farm Bill Conservation Program. New York State grants financial help to the Conservation Enhancement Program and the State Department of Conservation conducts water quality research and nutrient monitoring studies throughout the watershed.

What are the equity concerns?

Some farmers made the decision to participate in the watershed because of concern that they might be put out of business by imposed regulations. Many farmers had lost land when the New York City reservoirs were built and they were not willing to risk losing their land again.

Those landowners who own small areas of forests were concerned because the 80% local property tax reduction only benefits those forest landowners with 50 acres or more. The WAC pointed out that this legislation discourages forest stewardship by small landowners and is lobbying to extend the coverage of this law to all private forest landowners.

What are the intended impacts on forests?

Owners of forests have adopted best management practices, such as adoption of low impact logging, and some environmentally sensitive croplands have been retired from production allowing forests to regenerate.

What are the lessons for designing similar systems?

The approach used by NYC can only be cost-effective and politically acceptable if the cost of the watershed program is less than the cost of the additional filtration plant(s), and if the water users are willing to be taxed to support the cost of the program. These factors rarely exist except when there is a large downstream population benefiting from the hydrological services from upstream landowners and a manageable number of upstream landowners. NYC authorities used as its model a similar program in the Netherlands. The approach may not be widely applicable in the United States because most cities already have sufficient filtration plants and the watersheds surrounding the cities are more commercially and industrially developed and more densely populated than in the Catskill/Delaware area.

REFERENCES

Allen, S., New York Watershed Coordinator. 2000. Personal communication. October 10, 2000.

Barbier, E. 1998. The value of water and watersheds: Reconciling ecological and economic externalities, Paper presented at Conference on Managing Human-dominated Ecosystems. St. Louis, Missouri. March 26-28, 1998.

Combe, R. Head, Watershed Agricultural Council. 2000. Personal communication. October 12, 2000.

Echavarria, M. 1997. *Water: Together we can care for it! Case study of a watershed conservation fund for Quito, Ecuador.* Arlington, Virginia: The Nature Conservancy.

____1999. Agua: valoración del servicio ambiental que prestan las areas protegidas, *America Verde Training Manual 1:1*. Arlington, Virginia: The Nature Conservancy.

____2000. Personal communication. September 22, 2000.

Echavarria, M. and L.Lochman. 1999. *Policy mechanisms for watershed conservation, case studies.* Arlington: The Nature Conservancy.

New York City Department of Environmental Protection. 2001. http://www.ci.nyc.ny.us/html/dep/. Updated May 3, 2001(accessed May 9, 2001).

NYCEP Watershed Forest Ad Hoc Task Force. 1996. *Policy recommendations for the watershed of New York City's water supply.* New York: New York City Department of Environmental Protection (NYCEP).

Office of Water, United States Department of Environmental Protection. 2001. Watershed Protection. http://www.epa.gov/OWOW/watershed/. Updated March 28, 2001 (accessed May 9, 2001).

Router K., Outreach Officer, Watershed Agricultural Council. 2000. Personal communication. October 12, 2000.

Tomkinson-Church, M., Senior Advisor for International Water Policy, The Nature Conservancy. 2000. Personal communication. August 29, 2000 and October 3, 2000.

CASE 7 - COLOMBIA: ENVIRONMENTAL SERVICES TAX (Eco-tax) FOR WATERSHED MANAGEMENT

Summary

What water-related ecological services are being provided? Regularity of water flow for hydroelectricity production and other industrial uses; regularity and water purity for drinking water supply.

Who is supplying the services? Private land owners and municipalities that own hydrologically sensitive land.

Who is paying for them? Municipalities and water using companies.

What instruments are being used?

- **Environmental Services tax:** Taxation of industrial water users on basis of water use.
- **Direct payments:** Payments from municipalities and watershed authorities to private landowners for ecological services.

What are the intended impacts on forests? Improved forest management

BACKGROUND

Faced with dwindling ecological funds and an increasing need to protect hydrologically sensitive forest areas, the Government of Colombia established Regional Autonomous Corporations (RACs) in regions throughout the country to act as coordinators of watershed management efforts. A national funding system was enacted to provide funds for watershed management to be used by the RACs, municipalities and private landowners.

What services are being financed?

The Colombian program is designed to finance watershed protection and enhancement throughout Colombia so as to produce regularity of water flow for hydroelectricity production and other industrial uses and regularity and water purity for drinking water supply. No local studies have proved that improved forest management leads to better hydrological services.

Who is supplying the services?

RAC is in charge of over all watershed management. Municipalities manage their own watershed lands and pay private landowners to protect their hydrologically sensitive forest areas.

Who is paying for them?

- **Towns and departments:** The Government of Colombia requires that towns and departments allocate one percent of their budgets to purchase land in order to protect those hydrographic basins on which the town and/or department relies for its water supply.

- **Electricity Sector:** Hydroelectric power companies with capacity greater than10,000 kilowatts must transfer three percent of gross electricity sales to the Regional Autonomous Corporations (RACs). Another three percent must be transferred to the municipalities in which the hydrological basins and reservoirs used by the power companies are located.

- **Other industrial users of water:** Any corporation using water in it industrial processes is required to allocate one percent of its investments to the RAC for the protection of the hydrographic basin that provides its water.

What instruments are being used?

- **Ecological Services Taxation (Eco-taxation):** Companies benefiting from hydrological services are taxed in relationship to their use of these services. The Eco-tax forces hydroelectric power companies and other industrial water users to recognize the value of the ecological service, i.e. waterpower necessary for producing electricity or other products.

- **Public Payment by municipalities and departments to private landowners:**

    - for watershed management of their private lands

    - to purchase hydrologically sensitive lands for watershed management by government agencies

What is the legal context?

At all levels of public government a major change in the legal and regulatory framework was necessary to implement the new initiative.

What is the role of the public sector?

The fact that in Colombia private associations are not legally empowered to implement private watershed management plans makes the administration of watershed management in Colombia particularly dependent on government action.

What are the equity concerns?

RACs are almost totally financed by local sources. 80% of their funds come from property taxes and the electricity sector within their region. Since these revenues come primarily from the private sector, RACs located in rich regions tend to have a financial advantage. To remedy this inequity, a compensation mechanism was set up under which 20% of the income from the national electricity sector is pooled into a general fund from where it is redistributed to the poorer regional corporations (Rodríguez and Ponce de León 1999).

What are the intended impacts on forests?

Improved forest management.

What are the lessons for designing similar systems?

On the other hand eco-taxes can be found in many places around the world. In New York City, as discussed earlier, represents one such case where municipal water users were taxes to pay for the ecological services provided by upstream landowners.

REFERENCES

Echavarria, M. 1998. *Informe sobre el tema del agua en Bolivia, Colombia, Chile, Ecuador, Paraguay y Peru*. Arlington, Virginia: The Nature Conservancy.

____2000. Valuation of water-related services to downstream users in rural watersheds: Determining values for the use and protection of water sources. Land-Water Linkages in Rural Watersheds: Background paper no. 4, FAO Electronic Workshop, September 18-October. 27, 2000. http://www.fao.org/ag/agl/watershed/papers/echavar.pdf. ***

Kaimowitz D. 2000. Personal communication. August 22, 2000.

Rodríguez, M. and E. Ponce de León. 1999. Financing the Green Plan ('Plan Verde') in Colombia: Challenges and opportunities. Paper presented at The Workshop on Financing of Sustainable Forest Management, PROFOR-UNDP Programme on Forests, London, October 11-13, 1999.

CASE 8 - STATE OF PARANÁ, BRAZIL: PUBLIC SECTOR REDISTRIBUION MECHANISM

Summary

What water-related ecological service is being financed? Watershed protection and biodiversity conservation.

Who is supplying the service? Municipalities and private landowners.

Who is paying for it? The State of Paraná.

What instruments are being used? A public sector redistribution mechanism through which State governments allocate transfer payments on a competitive basis to those municipalities with more water reserves, conservation units or protected areas.

What are the intended impacts on forests? Rehabilitation of degraded forest areas.

BACKGROUND

Brazil has been actively promoting its protected areas as critical instruments for biodiversity conservation and watershed protection. Yet results have been unsatisfactory. Strict government regulations restricting forest exploitation and requiring property owners to rehabilitate degraded areas have reduced the profitability of the forest sector. Furthermore, laxity of enforcement has provided an incentive for landowners to disregard these regulations that have proven very expensive to follow.

At the state level the revenue distribution mechanisms discouraged conservation efforts by the municipalities. A large part of municipalities' revenues come from the state redistribution of income from the Circulation of Goods and Services (ICMS), an indirect tax charged on consumption of goods and services. This sales tax is one of the largest sources of income for the states. Though each state may establish its own criteria for 25% of these ICMS' revenues the other 75% has to be allocated according to the fiscal value added generated by economic activities within the municipality. Those municipalities with significant economic development and population density received more funds than municipalities with large protected areas. In response to this problem, the State of Paraná was the first Brazilian state to develop a redistribution mechanism to encourage environmentally sustainable activities.

What service is being financed?

The funds distributed by the State of Parana are to encourage municipalities and private forest owners to promote and rehabilitate watershed areas and areas for biodiversity conservation.

What instruments are being used?

In the 1991 the General Assembly of the State of Paraná passed a law requiring that 5 % of the revenues it received from ICMS ('Ecological ICMS') be distributed according to environmental standards. 2.5 % was to go to those municipalities with conservation units or

protected areas and the other 2.5% to municipalities that have watersheds that supply water to neighboring municipalities. The transfer is basically a compensation for the opportunity cost of development foregone by environmental protection but it is not calculated according to the true opportunity cost nor according to scientifically established relationships between forest cover and water improvement. The municipalities are in competition with other municipalities within Parana for the ecological ICMS. The more areas within the municipalities that are involved in ecological activities the more revenues the municipalities will receive from the State.

What is the legal context?

Because the Brazilian Constitution gives any state government the power to decide how it will distribute 25% of the ICMS the State of Parana was able to make changes within its own laws to encourage municipalities to be active in practices that often resulted in maintenance and extension of forests.

What is the role of the public sector?

Ecological ICMS are not generated through market instruments but constitute a public sector redistribution mechanism. The distribution mechanisms are solely in the public sector - between the states and the municipalities. The application of the Ecological ICMS and the associated monitoring effort require the devolution of most responsibilities for land and forest management to the municipalities.

What are the equity concerns?

Some of the larger industrialized municipalities oppose the new distribution system as not fair because it lowers the importance of size and population.

What are the intended impacts on forests?

Some degraded forest areas are being rehabilitated although the exact extent is not known.

What are the lessons for designing similar systems?

There are indications that in the State of Paraná the program has been successful in encouraging some municipalities both to establish public conservation units and to assist landowners in protecting and maintaining the ecological quality of their own lands. The area allocated for conservation units (for biodiversity) increased nine folds (WWF 1998) and the ICMS administrators claim that the cost-effectiveness of the mechanism is remarkable. Costs for program administration were estimated to be as low as $32,000 (Echavarria 1999) although which activities are included in this estimation are not clear.

Other Brazilian states have also adopted the “Ecological ICMS” approach. For example, in Minas Gerais in 1996 the system generated $3.8 million that was distributed among 97 municipalities with protected areas, municipalities of hydrological importance and municipalities with a sewage treatment facility serving at least 50% of the population. Total compensation cannot exceed the cost to the municipality of investing in protected areas and water quality improvement. The program’s effect on water appears to have been significant as municipalities have increased their water conservation measures by two-thirds (Echaverria 1999).

A strong regulatory framework and decentralization of financial resources and responsibilities is a critical prerequisite to expand the model outside Brazil. To determine whether this system can act as a valuable model for use in other situations one must examine its performance and its problems. The system in Paraná has presented several problems:

- Since the amount allocated in a given year is fixed, an increase in the number of municipalities in the program may well result in dwindling resources available for each municipality. If the resources allocated are too small to be an incentive for conservation the long-term effectiveness of the program is questionable.

- A possibility exists that municipalities may claim that areas were "protected" for the sole purpose of collecting financial transfers. Municipalities initially received a compensation payment using two indices: 1) the proportion of municipal land under protection and 2) a conservation factor index associated with the management category of the area – based on what ecological factor or factors were being protected - and the level of associated land use restriction. An attempt to assure actual ecological improvement led to another index calculated not just on the quality of the protected area but also on the interest of local communities, the level of compliance and enforcement, and the year to year improvement in water quality.

- Administrative boundaries often do not coincide with watershed areas.

- Resources received by municipalities are not always allocated for water or biodiversity conservation.

- Projects are constantly subject to changes because of political agendas (WWF 1998).

- Management categories of conservation units are not legally defined.

- Technical parameters defining the quality of improvement of the environment are difficult to determine and monitor.

- Institutional structure is often inadequate for implementing the mechanism properly and effectively.

- Scientific knowledge is insufficient to evaluate the ecological implications of the project.

REFERENCES

Bernardes A. 1999. Some mechanisms for biodiversity protection in Brazil, with emphasis on their application in the State of Minas Gerais. Paper prepared for the Brazil Global Overlay Project, Development Research Group, World Bank.

Echavarria M. 1999. Policy mechanisms for watershed conservation. Arlington, Virginia: The Nature Conservancy.

Hauselmann, Zwahlen, P. 1998. *From theory to practice: Incentive measures in developing countries.* Gland, Switzerland :World Wildlife Fund International.

Loureiro W. 1998. ICMS Ecológico – uma experiencia brasileira exitosa no incentivo economico para a conservação da biodiversidade. In: *Cadernos de Biodiversidade*, vol. 1(2), Instituto Ambiental do Paraná - IAP, Curitiba, Paraná. p 25-47.

CASE 9 - UNITED STATES: THE CONSERVATION RESERVE PROGRAM

Summary

What water-related ecological service is being financed? Reduction of soil erosion; improvement of water quality; regularity of stream flow.

Who is supplying the service? Owners of cropland and marginal pasture lands..

Who is paying for it? United States Department of Agriculture (USDA).

What instruments are being used?

- **Conservation Easements**: permanent and 30 years easements.
- **Restoration cost share agreements:** landowners' commitment to restore degraded lands.
- **Yearly rental payment**: Payments to landowners equal to opportunity cost of change in land use and can include additional payment for establishing certain approved conservation practices.
- **Incentive payments:** payments for additional specific practices such as tree planting or building fences.

What are the intended impacts on forests? tree planting through planting strips, riparian buffers, field windbreaks, shelterbelts, living snow fences, establishment of bottomland timber and wetland restoration.

BACKGROUND

The Food Security Act (FSA) of 1985 established The Conservation Reserve Program (CRP), a nationwide voluntary long-term retirement cropland program of the United States Department of Agriculture (USDA). The program was established in response to the sharp decline in farm income and the growing public concern about damages to water caused by agricultural soil erosion and water runoff of nutrients and chemicals. Though the program is scheduled to end in 2002 it has wide spread support and is likely to continue and perhaps even be expanded.

What water-related ecological service is being financed?

Landowners are being compensated for retiring cropland for 10 or 15 years and for establishing conservation practices approved by the USDA. Practices include establishment or maintenance of shallow water areas for wildlife, establishment of bottomland timber on wetland, planting grass cover, cropping alleys and reducing the use of agro-chemicals. During the early days of the program (1986-1989) the main objective was to reduce soil erosion. After 1990 the program's focus broadened to include improvement in water flow and quality and other ecological goals such as fostering wildlife habitat. Wetland restoration was added as an USDA approved practice in 1997.

Ecologically sensitive lands, such as private cropland or marginal pastureland, are eligible. Land selection is done primarily through a bidding process. After 1995 bids were ranked by an Environmental Benefit Index (EBI) which includes criteria such as wildlife habitat benefits, water quality benefits from reduced erosion, runoff and leaching, on-farm benefits of reduced erosion,

and likely long-term benefits of practices such as tree planting. The index also included criteria measuring the benefit to cost ratio of practices. Applicants must have owned or operated the land for at least 12 months. Eligible land devoted to special conservation practices such as riparian buffers, grassed waterways, or shallow water areas for wildlife may be enrolled at any time and are not subject to competitive bidding.

In 1996 the CRP enrolled approximately 36.4 million acres**,** of which 2.5 million acres are planted in trees, 2 million acres converted to wildlife practices and 32.3 million acres are devoted to grass cover. There are an estimated 8,500 miles of CRP filter strips along bodies of water. CRP has addressed some of the most pressing ecological issues in the US such as Chesapeake Bay pollution, the quality of New York City drinking water, and the decline of Pacific Northwest salmon.

The key assumption of the program is that land retirement and conservation practices will be effective in reducing soil erosion, protecting wildlife habitat, and improving water quality and regularity of stream flow. Especially because the USDA now uses an environmental index to select priority lands, such an assumption is probably correct for water quality and wildlife habitat, but whether this is the most cost effective way to reach these goals is not known. Whether these actions will affect the regularity of stream flow and soil erosion is also uncertain.

The Natural Resource Council estimates that annual reduction in topsoil loss for acres under contract with the CRP amounts to 700 million tons or an average of 19 tons per acre. Erosion on these lands has been reduced by an average of about 21%. Producers who enroll in CRP greatly reduce their application of pesticides and nutrients, largely eliminating CRP lands as a source of excess pesticides and nutrients runoff.

Who is supplying the service? *Owners of cropland and marginal pasture lands*

Who is paying for it? *United States Department of Agriculture (USDA) uses funds from general* revenues from the federal government.

What instruments are being used?

- **Amount of transfer payments**: The CRP annual payments of approximately $1.8 billion represents less than ten percent of the annual income transfers paid to farmers by the US government (about $21 billion). USDA economists estimate that, as a result of the program, net farm income increased by between $2.1 to $6.3 billion. They estimate the value of future timber resources at $3.3 billion. Estimates for the benefits from the preservation of soil productivity range between $ 0.6 and 1.7 billion. Benefits from improvements in surface water quality are estimated to range between $1.3 to 4.2 billion, reduction in damage from wind blown dust between $0.3 to 0.9 billion and benefits from small game hunting between $1.9 and 3.1 billion. In addition, the Fish and Wildlife Service estimates the non-consumptive wildlife benefits at $4.1 billion.

  The payments average approximately $50 per enrolled acre. The cost of establishing conservation practices per acre varies widely ranging from $2 for the establishment of permanent vegetation to reduce salinity to $226 for the establishment of field windbreak. Tree planting is estimated at $59 per acre and bottomland timber establishment on wetland costs about $58 per acre. The USDA also provides technical assistance.

- **Transfer mechanisms:**

  - **Annual rental payment**. In exchange for retiring land from production and establishing conservation practices the USDA's CCC (Commodity Credit Corporation) makes annual rental payments to producers and shares the cost of establishing certain approved conservation practices. The payments are based on the relative productivity of soils within each county and the average of the past three years of local dry land cash rent. Bids for lower rental rates increase the likelihood to be accepted into the program. For marginal pasture, rental rates range from $26 to $66 per acre for riparian buffers along perennial streams and $14 to $66 along seasonal streams

  - **Incentive payment:** The USDA provides additional subsidies for specific practices.

    Bonus incentive payment: This payment provides up to 20% of the annual rental rate to encourage certain continuous practices such as filter strips and riparian buffers.

    Practice Incentive Payment (PIP): The PIP provides up to 50% of the cost of establishing an approved conservation practice - generally a permanent tree or grass cover.

    Signing incentive payment (SIP): The SIP provides payment for each acre enrolled in filter strips, riparian buffers, grassed waterways, field windbreaks, shelter belts and living snow fences. The incentive is $10 for each year of contract, $100 per acre for a ten-year contract, or $150 for a 15-year contract.

    Conservation practices maintenance: Under this aspect of the program $7 is provided for tree planting, fencing and up to $10 per acre if a water facility development is involved.

- **Restoration cost-share agreements**: USDA pays farmers up to 50 % of their costs in establishing approved conservation practices. These agreements require a ten-year minimum commitment to restore degraded wetlands and associated upland habitat. No easement is placed on the property and there is no land incentive payment.

- **Easements**

  - **Permanent easement:** an easement attached to the property deed insuring that future owners of the property will preserve the wetland for generations. USDA will pay 100% of the cost of the restoration and legal costs to establish the easement. In addition, the landowner receives a payment for a permanent easement that is the lesser of the geographical rate area cap, the appraised agricultural value of the land or an amount offered by the landowner.

  - **Thirty-year easements**: These easements expire at the end of 30 years. Easement payments are 75% of the restoration costs. USDA will also pay the legal costs associated with establishing the easement.

What is the legal context?

Major changes in the legal and regulatory framework of the Agricultural Bill were necessary to establish the CRP. Rules and regulations regarding eligibility criteria and compensation payments kept changing during the program's fifteen sign ups - those time periods during which farmers can enter the program.

What is the role of the public sector?

This program is established and administered entirely through the CCC's Farm Service Agency. The Natural Resources Conservation Service, the Cooperative State Research and Education Extension Service, state forestry agencies, and local soil and water conservation districts provide program support.

What are the equity concerns?

Despite calls for better ecological targeting there are a number of political forces in place, such as attempts to alter the parameters and weights used in the Environmental Benefit Index, so as to spread funds more evenly over congressional districts.

Regulations have been developed in response to concerns that conservation payments were going mainly to large landowners. The targeting problem and the problem of determining the appropriate payment rate for many areas - especially in areas where returns from farming are high - contribute to the high spatial concentration of payments.

What are the intended impacts on forests?

Though the program is directed at agriculture the advantages to trees are many: tree planting through planting strips, riparian buffers, field windbreaks, shelter belts, living snow fences, establishment of bottomland timber and wetland restoration.

What are the lessons for designing similar systems?

Any consideration of transferability must include examination of the problems within the program. Despite the positive results, CRP enrollment is still small. Only two states have enrolled more than 10% of the private land within the state. According to the Farm Service Agency, transactions problems such as administrative delay, lack of staff resources, and the complexity of the application process may have kept land owners from getting involved. According to the USDA, the most difficult challenge is to determine the right land rental price to meet the producers' opportunity cost.

Another concern is that "leakage" could reduce the ecological benefits of the program. Restrictions on land use reduce total production from the land. If done on a large scale, output prices may go up and induce the utilization of previously idle marginal lands. Even if output prices are unaffected, cash flow constraints can induce farmers to use previously marginal land. It is estimated that for every 100 acres contracted, 20 acres of non-cropland were brought into production, thus off-setting many ecological benefits (Ferraro 2000).

In the United States CRP was the inspiration for The Wetlands Reserve Program (WRP), which was initiated in 1996. The WRP is a voluntary program offering landowners nationwide the opportunity to protect, restore, and enhance previously drained wetlands on their property. To be

eligible for WRP land must be restorable and suited for wildlife benefits. Lands under CRP contracts where trees have been successfully established are not eligible. The USDA Natural Resources Conservation Service (NRCS) provides technical and financial support while landowners retain ownership of the land. In Europe the European Union has adopted and is now expanding a system similar to the CRP.

REFERENCES

United States Department of Agriculture, Farm Service Agency, Conservation Reserve Program. http://www.fsa.usda.gov/dafp/cepd/crp.htm. Updated on May 9, 2001 (accessed on May 9, 2001).

United States Department of Agriculture, Natural Resources Conservation Service, Wetlands Reserves Program. http://www.wl.fb-net.org/. Updated February 14, 2001 (accessed on May 9, 2001).

Ferraro, P. 2000. Personal communication. November 3 and 7, 2000.

Annex 1: Features of innovative cases of watershed management from around the world

	Name of Case Study	*What water-related ecological service is being provided?*	*Who is supplying the service?*	*Who is paying for the service?*	*What instruments are being used?*	*What are the intended impacts on forests?*
Self-Organised Private Deals	**France: Perrier Vittel's payments for water quality**	Quality drinking water	Upstream dairy farmers and forest landholders	A bottler of natural mineral water	Payments by bottler to upstream landowners for improved agricultural practices and for reforestation of sensitive infiltration zones	Reforestation but little impact because program focuses on agriculture
	Costa Rica: Hydroelectric Utilities Financing of Upstream Reforestation	Regularity of water flow for hydroelectricity generation	Private upstream owners of forest land.	Private hydroelectric utilities, Government of Costa Rica, and local NGO	Payments made by utility company via a local NGO to landowners; payments supplemented by government funds	Increased forest cover on private land; expansion of forests through protection and regeneration.
	Cauca River, Colombia: Associations of Irrigators' Payments	Improvement of base flows and reduction of sedimentation in irrigation canals.	Upstream forest landowners	Associations of irrigators; government agencies.	Voluntary payments by associations to government agencies and by agencies to private upstream landowners; purchase by agency of lands.	Reforestation, erosion control, springs and waterway protection, and development of watershed communities
Trading Schemes	**United States: Nutrient Trading**	Improved water quality	Point source polluters with discharge below allowable level; unregulated non point sources polluters that reduce their pollution	Polluting sources with discharge above allowable level	Trading of marketable nutrient reduction credits among industrial and agricultural polluting sources	Limited impact on forests – mainly the establishment of trees in riparian areas
	Australia: Irrigators Financing of upstream reforestation	Reduction of water salinity	State Forests of New South Wales	An association of irrigation farmers	Water transpiration credits earned by State Forests for reforestation and sold to irrigators	Large-scale reforestation, including planting of desalination plants, trees and other deep rooted perennial vegetation.

	Name of Case Study	*What environmental service is being provided?*	*Who is supplying the service?*	*Who is paying for the service?*	*What instruments are being used?*	*What are the intended impacts on forests?*
Public Payment Schemes	**New York City: Watershed Management Program**	Purification of NYC's water supply	Upstream landowners	Water users taxed by NYC with supplemental funds provided by federal, state and local governments	Taxes, NYC Bonds, Trust Funds; subsidies; logging permits; differential land use taxation; property transfer: development rights and conservation easements. development of markets for non timber products and certified wood	Adoption of low impact logging; retirement of environmentally sensitive land from agricultural production; forest regeneration
	Colombia: Environmental Services Tax (Eco-tax) for Watershed Management	Regularity of water flow for industrial uses; regularity and water purity for drinking water	Private land owners and municipalities	Industrial water users and municipalities	Eco-tax on industrial water users; Payments by municipalities and watershed authorities to landowners.	Improved Forest management; expansion of forests
	State of Parana, Brazil: Ecological Value Added Tax and Public Redistribution Mechanism	Rehabilitation of private and public areas for watershed protection	Municipalities and private landowners	The State of Parana	Public sector redistribution mechanism: State provides additional funds to those municipalities with protected areas and which harbour watersheds that supply neighboring municipalities.	Rehabilitation of degraded forest areas
	United States: The Conservation Reserve Program	Reduction of soil erosion; improvement of water quality and regularity of stream flow.	Owners of cropland and marginal pasture lands	United States Department of Agriculture	Conservation Easements; Restoration cost share agreements; Yearly rental payments to landowners for engaging in conservation; additional incentive payments.	Though the program is directed at farms advantages to trees are many: tree planting, strips, riparian buffers, grassed waterways, field windbreaks, shelter belts, living snow fences, and establishment of bottomland timber.