Designing Payments For Watershed Protection Services Of Philippine Upland Dwellers[1]

BENNAGEN, M.E.[a*], Indab, A.[a] , Amponin, A.[a], Cruz, R.[b], Folledo, R.[b] van Beukering, P.J.H.[c], Brander, L. [c], Hess, S. [c], van Soesbergen, A[c], van der Leeuw, K.[c] and de Jong, J[c]

[a] Resources, Environment & Economics Center for Studies (REECS)
[b] College of Forestry and Natural Resources, University of the Philippines, Los Banos.
[c] Institute for Environmental Studies (IVM), Vrije University, Amsterdam.
* Corresponding author: REECs, Unit 405, Tower at Emerald Square, Project 4, Cubao, Quezon City, the Philippines.

Abstract
Payments for environmental services (PES) is an innovative approach in resource management that seeks to achieve any or all of the following goals: environmental integrity, poverty alleviation, and financial sustainability. In watershed protection, the basic concept in PES is to establish, through a payment system, a connection between the providers of water-related services who are the upland dwellers, and the downstream users or beneficiaries of the environmental service. The study explored the possibility of implementing PES in two northern Philippine sites by examining the science, economics, and institutions aspects of PES. The two sites are the Peñablanca Protected Landscape in Cagayan Province, and the Kalahan Forest Reserve in Nueva Vizcaya Province. This paper discusses the first case study. The results of the study are most useful to the local governments, water districts, non-governmental organizations and others that may wish to explore this mechanism as a strategy, among others, to improve watershed management and reduce poverty in their localities.

[1] This paper is part of the "Developing a System of Payments for Environmental Services: A Case for Forest Dwellers in the Philippine Uplands" project, which is funded by the Poverty Reduction and Environmental Management (PREM) Programme (www.prem-online.org). The authors express their appreciation to the PREM management for the financial support to this project.

1.0 INTRODUCTION

1.1 The Poverty-Environment Nexus in the Philippine Forest

About 60 years ago, more than half of the country's 30 million hectares were covered with forests. The forest-to-man ratio then was 1:13 ha and by the turn of the new century, this had dwindled to 0.1 ha per Filipino, accounting for an annual deforestation rate of 100,000 ha. In addition to large scale logging and land conversions, one of the other main cause of this forest depletion are the unsustainable forest and farming practices of the forest/upland communities. This forest degradation and other natural resources depletion have a major adverse impact on these poor communities whose livelihoods and overall welfare are dependent on these resources.

The link between poverty and forest degradation is not straightforward and in fact is a complex process (Arnold and Bird 1999). There is increasing evidence that this relationship is not always positive and that there are some poor forest communities that invest considerable time and resources in sustainable forest management practices while trying to meet their basic needs. In many cases, however, the dependence on the forests by these communities result in the degradation of the resources they depend on for their livelihood and survival.

In the Philippines the forest is home to a large, marginalized sector of society composed of both migrant and indigenous dwellers. They constitute about 20 million or 25% of total population and are generally considered the poorest of the poor. The attraction of the forests to the poor has partly to do with the lack of livelihood opportunities in the lowlands and partly with the numerous goods and services the forests provide for free. If properly managed by these communities, the forests can provide them and society-at-large with use values such as timber and non-timber products, beautiful landscapes, recreation and hydrological services and non-use values like climate regulation, carbon sequestration and biodiversity.

1.2 Poverty and PES

Payments for environmental services (PES) is an approach in forest management that shows some potential to address the poverty in the forests/uplands while maintaining forest conservation and protection. By providing the poor upland communities with the opportunity to be recognized and compensated for generating positive externalities to society, PES can help improve their economic well being. The central principle behind PES is that those who provide environmental services should be compensated for doing so and those who enjoy the services should be made to pay for their provision (Pagiola, Arcenas & Platais 2005). For instance, the compensation that the poor upland communities would receive in return for the watershed services they provide to downstream users under a PES program can be used to improve their livelihoods.

Recent literature on the links between poverty and PES, however, indicate that ensuring the poor benefit from the PES approach is not simple nor automatic. In fact, earlier prescriptions on PES prescribed that development objectives in general, and specifically, poverty reduction, should not be an objective of PES programs (Pagiola 2003; Wunder 2005). More recently though, as lessons are being drawn from on-going PES programs, there is an increasing interest and optimism about the potential of these programs to help improve the plight of the poor resource-dependent communities in developing countries (Pagiola et al 2005; Grieg-Gan & Bishop 2005). As a result, more discussion is now being focused on the potential impacts of PES on the poor, how PES can benefit the poor, impact on equally poor non-participants, and on the development of pro-poor PES programs.

The potential poverty-related impacts on the poor participants in PES programs can be seen in various ways (Grieg-Gan & Bishop 2005). One is their effect on cash incomes through direct payment schemes. Another is through the diversification of livelihood options, thus, reducing the risk of total loss of one's livelihood in the event of price fluctuations or natural disasters. PES programs can also provide the impetus to the formalization of land tenure or more secured land tenure. Direct participation by the marginalized forest communities also may result in capacity building on farming and forest management as well as enhancement of their social capital in terms of strengthened social organizations. As mentioned above, the realization of these impacts on the poor that participate in a PES program does not occur automatically. There are a number of constraints faced by the poor who participate or wish to participate in PES programs, such as the lack of property rights, high transaction costs, small land sizes, lack of credit, and others.

Another poverty-related issue about PES is its potential impact on the non-participants who are users of the environmental services and who may be as poor as the participants themselves. Two of the negative impacts that may arise from a PES program are restrictions on resource use and higher water and other fees (Pagiola et al. 2005).

In view of these concerns, recommendations to ensure the proper and careful design of pro-poor PES programs have been made. It is important to respond to these questions: (1) who are the actual and potential participants and how many of them are poor?; (2) what are the obstacles to the participation of the poor in PES?; and (3) what are the potential impacts of PES on the participants as well as non-participants? (Pagiola et al. 2005)

1.3 Objectives of the Study

The study aimed to explore the potential of payments for environmental services in two study sites to address forest conservation and poverty alleviation in the uplands. More specifically, it proposed to (a) examine the land-water linkages relevant in a watershed context; (b) examine the land use practices of the service providers; (c) conduct willingness to pay surveys; (d) estimate forest conservation costs; (e) conduct simulation modeling and multi-criteria analysis of alternative PES programs; (f) implement stakeholders analysis; and (g) recommend institutional arrangements.

The present report focuses on the processes implemented by the research team in the design of PES in one of the two project sites, the Peñablanca Protected Landscape and the lessons learned and policy insights drawn from the research process.

1.4 Conceptual Approach

In the design of a PES for watershed protection in the two sites, the study considered and examined the following important aspects: (1) the science, e.g. the land-water linkages; (2) the economics, e.g. the theoretical basis and economic valuation; and (3) the institutional environment, e.g. the set of governing rules and policies to support PES. The science aspect provides the scientific evidence that is necessary to establish the link between land use and environmental services. The lack of good information on this relationship is considered the Achilles' heel of the markets for watershed protection (Pagiola and Landell-Mills 2002). The existing case studies on PES reveal that very little attention has been given to this aspect particularly with respect to PES in watersheds. This observation is particularly relevant given the ongoing debate among forestry and watershed specialists about the role of forests in hydrology with some experts challenging the conventional wisdom that forests protect water supplies at all times.

The theoretical basis of PES is public goods theory. The basic premise in PES in the context of watershed protection is that there are upland communities that produce watershed protection services at an opportunity cost and there are consumers that benefit from such services for which no payments are made. In economics, such benefits are called positive externalities as these are produced external to the service provider, and thus, to the market. As a market-based instrument, PES aims to internalize these external benefits by capturing their values and to channel these to the upland communities as an incentive to pursue their watershed conservation and protection practices.

Lastly, the implementation of a PES program will involve institutional reforms that may require changes in the existing legal and regulatory framework and that may affect the various stakeholders with different interests.[2] It is therefore necessary to examine the institutional environment, e.g. the set of social norms or rules that govern human behavior, as well as the institutional arrangements, e.g. organizational forms, for PES (Rutherford 2000). Among the institutions that are relevant to PES, property rights over the environmental services are of critical concern since they define who owns what resource. In the context of PES for watershed protection, it is important to have well-defined property rights in terms of, for example, who owns the water flowing in the river or the carbon sequestered in the forests to facilitate market creation (Pagiola and Landell-Mills 2002). In addition, it is likewise important to examine the role and interests of the different organizations that constitute the actors in PES such as the peoples organizations and NGOs, government organizations (all levels), water districts, tour operators, etc., to formulate effective and equitable management interventions.

1.5 Organization of report

This report is organized as follows. **Section 2** discusses the methodology for each of the key activities conducted. **Sections 3** presents the results from the research processes and **Section 4** presents some lessons and policy insights.

2.0 METHODOLOGY

2.2 Science

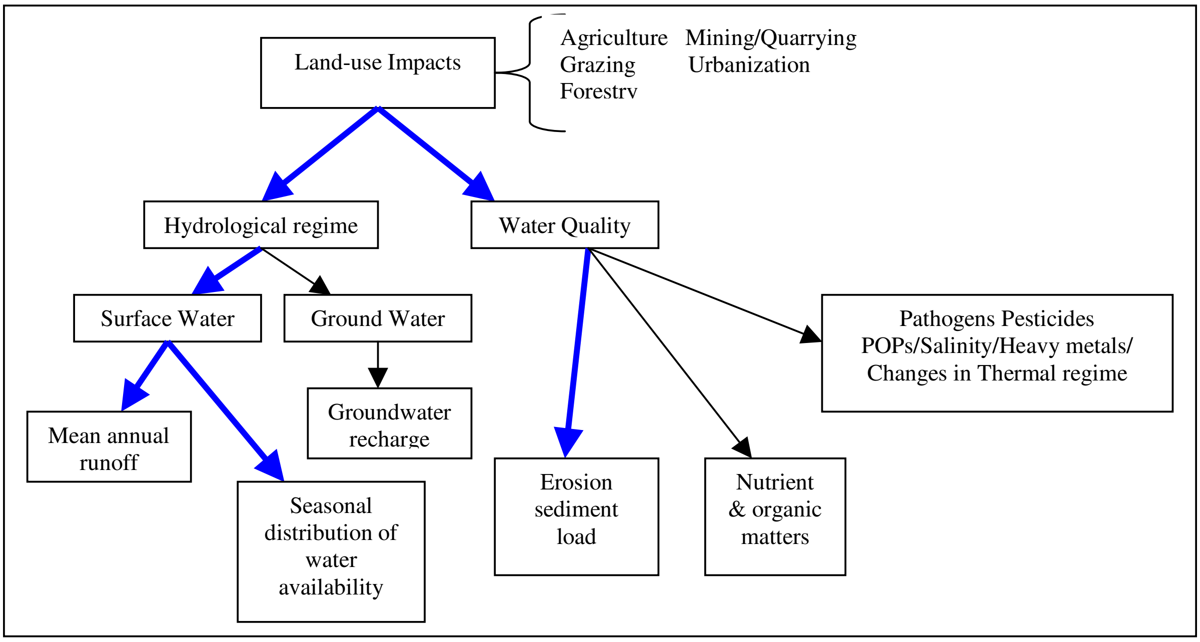
Understanding the land-water linkages

Land use in the uplands such as agriculture, grazing, forestry, mining, and urbanization and the accompanying land management practices have impacts on watershed services by affecting water availability and water quality. **Figure 2.1** shows the land-use and water linkages in a rural watershed (FAO 2002). Land use and management practices of upland agricultural farmers, for example, can impact on both surface and ground water supplies and in turn affect the annual run-off and seasonal distribution of surface water availability as well as the ground water recharge. Water quality is affected by the amount of erosion, sediment load, nutrients and organic matters, and pesticides arising from the farmers' agricultural land management practices and other domestic activities. In addition to human-induced activities and their interactions, some of these impacts can also be brought about by natural processes, including natural disasters such as earthquakes. The evaluation of land use and water linkages for purposes of establishing watershed protection services can therefore be an extremely difficult task.

[2] Institutions in this study are is broadly defined to include the sets of rules or constraints that govern human interactions in society and the actors that work within the sets of rules.

The study examined the land-water linkages connected by solid (blue) lines in **Figure 2.1.**

Figure 2.1 Land-use and water linkages in a rural watershed.



Source of basic information: FAO (2000)

Method of land cover/land use classification

The land cover/land use classification of the study sites was determined by processing land satellite images guided by a series of field observations, ground validation and secondary reports. Since the required images of the two watersheds were not available in the national mapping office, the project acquired them directly from foreign sources. Satellite images for the years 1990, 1998 and 2002 were obtained from the U.S. Geological Survey and the GISTDA in Bangkok, Thailand. A GIS specialist implemented the image analysis and the ground verification. The classification process consisted of combined unsupervised classification and manual classification techniques. The analysis resulted in the classification of six land classes for the Peñablanca watershed.

Rapid assessment of watershed hydrologic functions

The hydrological functions of the two watersheds were assessed by a combination of analysis of the historical hydro-meteorological data coupled with an analysis of land cover/land use change over time. The analysis was supplemented by relevant information elicited from key informants interviews, focus group discussions and community surveys, which were used to fill in gaps and affirm the results of the analytical processes. Available historical stream flow and rainfall data for both the dry and wet seasons were analyzed to examine any correlation using simple statistical trending techniques.

The estimation of the sediment yield of the stream flow was based on the potential surface soil erosion in the watershed. Stream flow sediment yield consists of the suspended load and the bed load that could come from soil erosion, mass wasting and erosion of the stream channels and gullies. In order to get some indication of the extend of influence of land cover and land use on the quality of the stream flow in both watersheds, the University Soil Loss Equation (USLE) with the aid of Geographic Information System (GIS) to estimate the rate of surface soil erosion under different land cover and land use types. The USLE predicts the average annual soil loss per unit area as influenced by factors such as rainfall and runoff, slope, steepness, land cover and others. However, since there was no field data on sediment measurements, the USLE was used to predict the impacts of land use change on the quality of the stream flow in the two watersheds.

Carbon sequestration

In order to estimate the potential amount of storable carbon, land use and land cover data were combined with information gathered from key stakeholders and the literature. The application of the used methods differed per study site due to differing availability of data. For the Peñablanca watershed, land cover data were analyzed to ascertain the area suitable for reforestation. Interviews with local stakeholders were undertaken to supplement the available data on current land use. Because no biomass or carbon storage data is available for the watershed, a literature search was conducted in order to make a rough estimate on carbon storage in comparable Philippine forests.

Data availability for the KFR on biomass and carbon storage is much better. The KEF has been monitoring biomass growth and carbon content of the Reserve's forests since 1994. In order to quantify biomass, the area has been divided into 62 blocks of varying size. Between 2 and 4 quarter-hectare sized plots are assigned to each block, in which diameter and height of the trees is estimated. Biomass and carbon is then computed based on a formula provided by the University of the Philippines at Los Baños. Total biomass per plot is calculated and averaged over the entire block. However, several shortcomings in the data provided by the KEF were detected. In essence, biomass estimates are too low compared to other Philippine estimates, owing to the omission of several factors contributing to biomass such as soil carbon and branches. We therefore assume a conservative correction factor of 1.85.

2.3 Economics

Valuation of water-related benefits

The Pinacanauan River Watershed supplies water to Peñablanca and partly to adjacent Tuguegarao City for irrigation and domestic use. The watershed also provides recreational benefits to local tourists (i.e., swimming and picnicking) and to adventure tourists from Manila for white-water rafting, kayaking, swimming and bat watching. The protected area boasts of its famous multi-chambered caves of Callao that draws local as well as some foreign tourists.

These hydrologic-related benefits were valued using the contingent valuation method (CVM). Three sets of CVM surveys were conducted to collect socio-economic data and the willingness to pay of beneficiaries for watershed protection. These beneficiaries include the domestic water users, the rice farmers with irrigated lands, and the tourists. For domestic water use, local residents connected and not-connected to the local water district were included in the survey. A survey of upstream farmers residing in one of the three large villages in the Pinacanauan Watershed was also conducted to collect information on agriculture and forest use practices.

A combination of random and systematic random sampling was used in the survey design, and personal interviews using questionnaires were implemented [3].

[3] The research team acknowledges the support of Dr. Marge Calderon of the University of the Philippines, College of Forestry and Natural Resources, in survey questionnaire design.

Valuation of carbon benefits

The valuation of a potential carbon sequestration project was estimated primarily through literature research. Cost data for Philippine forest plantations were combined with literature on monitoring and verification costs and personal communication with key informants. Costs were calculated per ton of carbon and per hectare per year. Total costs were assumed to consist of project implementation costs, transaction costs and costs for monitoring and verification. Resulting costs were compared to cost estimates for other regions worldwide. Benefits resulting from a potential carbon project were calculated by using a comparative approach. A present value of the carbon reduction potential is determined on the basis of several carbon-offset projects and initiatives that have been implemented around the world. Prices for a ton of carbon range from US$0.5 to US$9 for Kyoto compliant projects and from US$0.5 to US$2 for non-Kyoto compliant projects.

Socio-economic impacts were largely assessed through stakeholder consultation. Information gathered in these interviews was combined with data from literature on existing carbon projects to make a rough estimate of impacts. Likewise, environmental impacts were based on literature review and key informant interviews.

2,4 Institutions

The study conducted the following activities in examining the institutional aspects of PES in the two study sites. First, the institutional requirements for PES were identified and assessed in each site in terms of the legal and regulatory environment, property rights, cooperative mechanisms and the role of government. Second, given the multi-stakeholder nature of PES, a stakeholders' analysis was implemented to identify the stakeholders in the two sites, their interests and their roles in a possible payment scheme. Lastly, at project end, consultation workshops were conducted with the key stakeholders on the salient findings of the project and the proposed PES institutional structure.

A comprehensive list of stakeholders and their interests was drawn based on project documents, field surveys, focused group discussions and key informant interviews for purposes of implementing the stakeholders' analysis. Based on this list, their impact on the watershed resources as well as their roles in the establishment of PES was deduced in terms of whether they are likely to facilitate or hinder its establishment. Finally, the stakeholder analysis examined how each stakeholder might participate in sustaining protection and conservation efforts, poverty reduction programs and management of funds accruing from the PES.

2.4 Simulation model

In order to investigate the potential of PES programs in the two sites, a dynamic simulation model was designed to compare the monetary benefits and costs to different stakeholder groups under alternative designs of PES programs. The eight scenarios plus the baseline scenario were designed on the basis of the following criteria: (1) the level of forest conservation; (2) the inclusion or exclusion of carbon benefits; (3) the type of intermediary institution; and (4) the means of payment. The temporal boundary of the project is 2005 to 2035. **Tables 2.1** provides a brief description of the scenarios.

Table 2.1. Baseline and alternative scenarios – Peñablanca Protected Landscape

Name of Option	Description alternatives Peñablanca
0. Baseline	Business as Usual scenario. The continuation of current trends of land use change, agricultural development, population growth etc. Deforestation rate of 3% per year.
1. Low conservation; Cash payment; no carbon investments	A package of conservation measures including replanting of regular forest (225 ha/yr), and expansion of agroforestry (75 ha/yr). Payments to upland communities participating in the scheme are in cash (PhP 6 million/year). Administration and monitoring costs amount to around PhP 0.19 million/yr and PhP 1 million/yr, respectively.
2. High conservation; Cash payment; no carbon investments	A package of conservation measures including replanting of forest 450 ha/yr), and expansion of agroforestry (150 ha/yr). Payments to upland communities participating in the scheme are in cash (PhP 10 million/year). Administration and monitoring costs amount to around PhP 0.34 million/yr and PhP 1 million/yr, respectively. Learning effects are more pronounced reducing variable costs over time.
3. Low conservation; Cash payment; Carbon sequestration.	Same as Option 1 but includes investment in additional carbon sequestration. Administration and monitoring costs amount to around PhP 0.33 million/yr and PhP 1 million/yr, respectively.
4. High conservation; Cash payment; Carbon sequestration.	Same as Option 2 but includes investment in additional carbon sequestration. Administration and monitoring costs amount to around PhP 0.58 million/yr and PhP 1 million/yr, respectively. Learning effects are more pronounced reducing variable costs over time.
5. Low conservation; Non-cash payment; no carbon investments	Same as Option 1 but payments to upland communities participating in scheme are not in cash. Instead payments are in the form of local infrastructure development, production inputs, and the provision of schooling. Administration and monitoring costs amount to around PhP 0.19 million/yr and PhP 2.5 million/yr, respectively.
6. High conservation; Non-cash payment; no carbon investments	Same as Option 2 but payments to upland communities participating in scheme are not in cash. Instead payments are in the form of local infrastructure development, production inputs, and the provision of schooling. Administration and monitoring costs amount to around PhP 0.39 million/yr and PhP 2.5 million/yr, respectively. Learning effects are more pronounced reducing variable costs over time.
7. Low conservation; Non-cash payment; Carbon sequestration.	Same as Option 3 but payments to upland communities participating in scheme are not in cash. Instead payments are in the form of local infrastructure development, production inputs, and the provision of schooling. Administration and monitoring costs amount to around PhP 0.33 million/yr and PhP 2.5 million/yr, respectively.
8. High conservation; Non-cash payment; Carbon sequestration.	Same as Option 4 but payments to upland communities participating in scheme are not in cash. Instead payments are in the form of local infrastructure development, production inputs, and the provision of schooling. Administration and monitoring costs amount to around PhP 0.58 million/yr and PhP 2.5 million/yr, respectively. Learning effects are more pronounced reducing variable costs over time.

2.5 Multi-criteria analysis

Further to the output of the simulation modeling described above, there are other criteria that are relevant to making decisions regarding the design of PES schemes that cannot be easily quantified in monetary terms. In order to support such a decision making process in which criteria cannot be expressed in a common unit of measurement, a multi-criteria analysis (MCA) was implemented. An additional advantage of MCA is that it allows a more participatory approach to decision making by taking input from experts and stakeholders. The following steps were applied in the conduct of the MCA: (1) problem definition; (2) selection of criteria; (3) standardization; (4) weighting; (5) ranking of alternatives; and (6) uncertainty analysis. The MCA was facilitated by the use of the DEFINITE computerized MCA software.

The criteria are grouped in four categories: financial costs, economic benefits, social impacts, and environmental impacts. In order to compare criteria that are expressed in different measurement units it is necessary to standardize to a common metric. This is done using the interval standardization method of the DEFINITE program. Scores are standardized to values between zero and one with a linear function between the absolute lowest score and the highest score.

The criteria included in the MCA do not necessarily have equal importance in the decision making process and were therefore assigned weights. This exercise was done at the stakeholder workshop held in Tuguegarao, on the 27th July 2004. Workshop participants representing the various key stakeholders were asked to rank the criteria within each group of criteria and then rank the groups of criteria. The 'expected value' weighting method of the DEFINITE tool was used to calculate quantitative weights from these rankings.[4] The participants were then asked to comment on the computed weights and to rank the different criteria. Having standardized the scores and weighted the criteria it is possible to produce a ranking of the alternative PES scheme designs through a weighted summation of scores. To examine the robustness of the ranking, an uncertainty analysis is performed to analyze whether the ordering of alternative PES scheme designs changes given uncertainty over the weights and scores that are used in the MCA.

3.0 RESULTS

3.1 Site Description

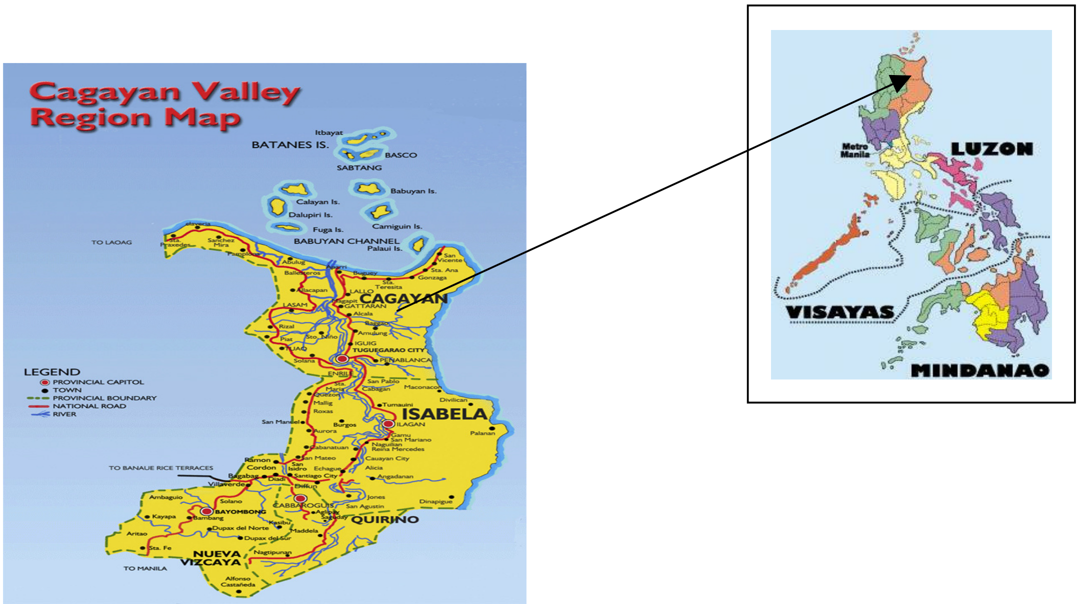
Location

The Pinacanauan Watershed is part of the newly proclaimed PPLS in the municipality of Peñablanca, Cagayan Province, which covers 103,000 ha. It is located in the Northern Sierra Mountain Range and is bounded in the north by the municipality of Baggao, in the south by the municipalities of San Pablo and Maconacon, Isabela, in the east by the eastern ridge of Sierra Madre and in the west by the City of Tuguegarao. It is 508 kilometers to the north of Manila and is accessible by land and air travel. The watershed is located between 17.58 degrees and 17.74 degrees north latitude and 121.82 degrees and 122 degrees east longitude.

The Pinacanauan Watershed area under study is about 65,099 ha and encompasses 18 of the 24 villages in Peñablanca, the three largest being Minanga, Lapi, and Mangga (**see map below**).

[4] DEFINITE is a Windows-based decision support software package developed at the Institute for Environmental Studies of the Free University of Amsterdam, Netherlands. The software features graphical, multi-criteria and cost-benefit analyses, along with sensitivity and uncertainty analyses to systematically assess a finite set of alternatives.

The watershed covers more than 4,000 ha of land under the jurisdiction of Tuguegarao City and nearby towns. For the purpose of the study, the Pinacanauan Watershed was subdivided into five major sub-watersheds. Subwatershed 1 is the largest with an area of more than 26,000 ha, where most part of the largest barangay, Minanga, is found. Subwatershed 2 is the smallest with only 4,000 ha, most of which is within Barangay Lapi. Subwatershed 3, 4 and 5 have an area of at least 10,000 ha each.



Biophysical setting

The climate in Pinacanauan Watershed is classified under Type IV of the Corona Classification System, which has no pronounced season. Rainfall is more or less evenly distributed throughout the year, but it is relatively dry from December to April and wet during the rest of the year (Danielsen et al 1994). Rainfall data from the PAGASA Station in Tuguegarao City for 40 years reveal rainfall to be highest during the month of October and lowest in February. The hottest months are May and June while the coldest are months of December and January.

The area is characterized by hilly to rolling terrain with elevation normally ranging from 100 to 400 meters dominated by Sierra limestone. Elevation exceeds 1,500 meters above sea level in some parts. About 50% of the watershed is below 400 meters above sea level. On the eastern side, the topography is rugged and mountainous. More than 55% of the watershed has a slope of more than 25%. There are eight soil classes in the watershed with unclassified mountain soil and Ilagan sandy loan as the most predominant classes each covering more than 35% of the watershed area.

Based on the satellite image of 2002, at least 50% of the watershed is still covered with forests (**Table 3.1**). Generally, the remaining forests in the watershed are logged over from the intensive commercial logging activities during the 1970s and 1980s. Around 20% of the watershed is covered with grass followed by brush species covering about 10% of the total watershed area. The most common land use is agriculture and is found in 18% of the watershed land area. Some parts of the watershed are covered under government programs such as the Integrated Social Forestry (ISF) program or the Community Based Forest Management Agreement (CBFM).

Table 3.1 Distribution of land cover and land use in Pinacanauan Watershed, Peñablana, 2002.

Land use/land cover	Area (ha)	Percent
Forest	32,394	50
Brushland	7,311	11
Riverbank	601	1
Agriculture	11,641	18
Water	608	1
Grassland	12,540	19
Total	**65,094**	**100**

Socio-economic and institutional setting

The population in the municipality of Peñablanca in the year 1994 was 32,661 residing in 24 villages, eighteen of which fall within the PPLS. These 18 villages cover around 80 percent of the total municipal population. Ybanag and Itawes are the most spoken dialects by the residents. The majority of the population is Roman Catholics by faith.

The residents are mostly farmers, the majority of whom do not own the land they till. As tenants, landless farmers earn only about PhP 12,000 annually. A few farmer-households are participants to the government's social forestry program which provides long-term stewardships over forestlands.

Being a protected area, Peñablanca is under the administrative jurisdiction of the Department of Environment and Natural Resources (DENR). Each protected area has a Protected Area Management Board (PAMB) that was created by law to protect and manage it. In the case of Peñablanca, part of the protected area is under the jurisdiction of the Provincial Government (PG) of Cagayan by virtue of a memorandum of agreement between the PG and DENR for the former to manage the caving system within the protected area.

The protected area is faced with a number of threats, the most important of which are poverty in the uplands and illegal activities like timber poaching, destructive fishing methods, and mining of treasures and minerals.

3.2 Science

Assessment of land cover/land use change, 1990-2002

Table 3.2 shows the land cover for the years 1990, 1998 and 2002 (see also **Figure 3.1**). Between 1990 and 2002 the average forest cover loss was 167 ha/year with the rate picking up significantly between 1998 and 2002 to 240 ha/year. Assuming that there was 80% forest cover after World War II (1950), the forest cover of the watershed was reduced at an average rate of 440 ha annually from 1950 to 1989 with peak rates between 1970 and 1990.

Table 3.2 Land cover/land use changes, 1990-2002.

Land use / cover	Area (ha)			Annual Change (ha)
	1990	1998	2002	1990-2002
Forest	34,403	33,353	32,394	(167)
Brushland	9,879	7,888	7,311	(214)
Riverbank	536	595	601	5
Agriculture	9,966	10,979	11,641	140
Water	887	740	608	(23)
Grass	9,423	11,538	12,540	260
Total	**65,094**	**65,094**	**65,094**	

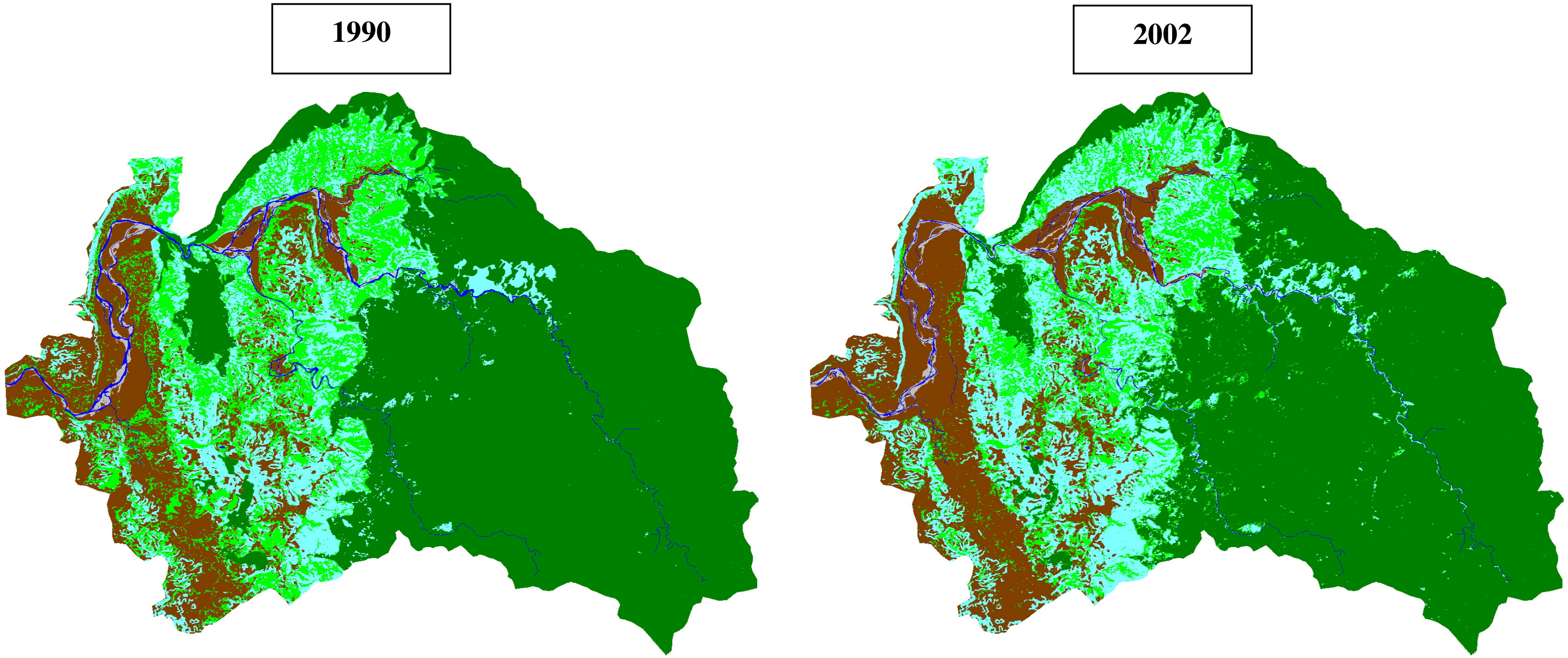
The plausible patterns of land cover and land use transformation could be gathered from **Figure 3.2**. As forest cover decreases, agricultural and grasslands are expanding through the years. From 1990 to 2002, agricultural areas expanded at 140 ha per year and grassland at 260 ha annually (Table 3.2). As seen in **Figure 3.2**, large areas of forests were transformed into brushlands between 1990 and 2002, while big areas of brushlands were converted into agricultural lands during the same period. These trends could indicate that the forests slowly underwent clearing process in preparation for cultivation. It could also be indicative of the slow process of forest clearing associated with poaching for timber or charcoal wherein larger trees are selectively removed leaving behind smaller trees that are unfit for desired uses.

It is also worth noting that the increase in grassland from 1990 to 2002 is apparently attributable to the conversion of more than a 1,000 ha of forests and 3,000 ha of brushlands. It is likely that these forests and brushlands were either used first for intensive farming until the areas became sub-marginal or were opened up for grazing animals that were observed to be common among upland communities.

Rapid assessment of hydrologic functions of the Pinanacauan watershed

The rapid hydrologic functions assessment of the Pinacanauan watershed revealed the following main results: (a) increasing variability in mean annual stream flow during the period 1950-2002; and (b) the dry season stream flow follows a declining trend, while the wet season flow follows an increasing trend. The declining dry season flow is generally attributed to insufficient groundwater recharge during the wet season which in turn can be the result of the following non-mutually exclusive factors: (1) a reduction in rainfall during the wet season, (2) an increase in evaporative loss, and (3) a reduction in the infiltration capacity of the watershed. The analysis of these factors revealed that the stream flow behavior cited above is likely to be associated with the third factor, i.e., reduction in infiltration capacity of the Pinacanauan watershed that was a result of decreased forest cover and the expansion of agriculture and grassland areas in the watershed. This finding is consistent with the field observations and interactions with the local communities of the project team that indicated cultivation and grazing are common in the watershed.

Figure 3. 1 Land cover/land use in 1990 and 2002, Pinacanauan Watershed.



Land Use	Change in Area (ha) 1990-2002
Forest	(2,009)
Brushland	(2,568)
Agriculture	1,675
Water	(279)
Grassland	3,117

Figure 3.2 Likely Pattern of Land Use and Land Cover Change from 1990 to 2002 in Pinacanauan Watershed.

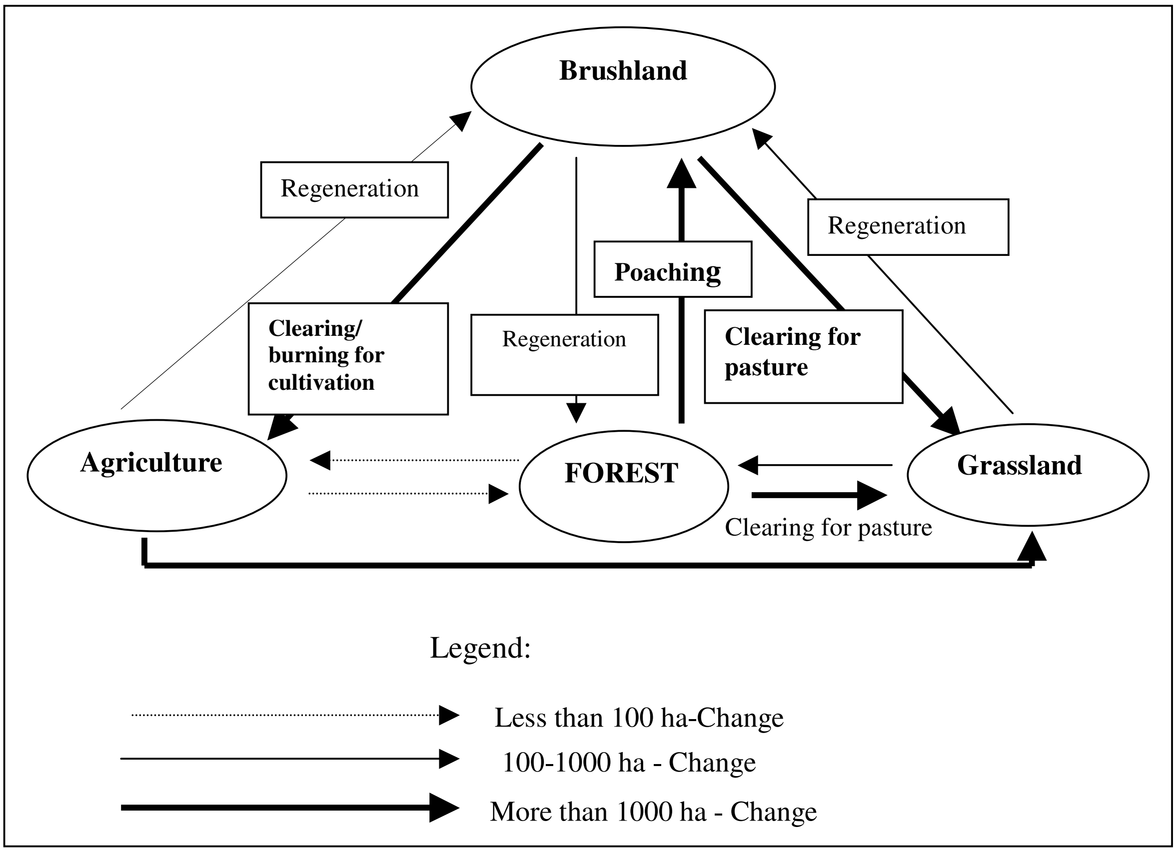


Table 3.3 shows that the potential soil erosion of the watershed increased from 1990 to 2002, though at a very modest rate. The results also revealed that areas with low potential soil erosion (between 0 and 12 tons/ha/year) decreased while areas with higher potential soil erosion increased. The increase in potential soil erosion is apparently due to the increase in grasslands and farmlands and the decrease in forests and brushlands as discussed above. Similarly the sediment yield for the same period showed the same increasing pattern and this is expected because sediment yield was estimated based on the potential soil erosion values.

Table 3.3 Potential annual sediment yield in Pinacanauan Watershed (tons/ha).

Year	Annual Sediment Yield (tons/yr)
1990	3,427
1998	4,029
2002	4,658

Carbon sequestration

For the first commitment period of the Kyoto Protocol, Certified Emission Reductions (CERs) can only be generated if the area to be reforested has been without forest since at least December 1989. In the Peñablanca Protected Landscape, an area of 21,147 ha was identified as being available for reforestation. Of this area 17,321 ha were not forested in 1989. In order to minimize leakage, we assumed only 15,000 ha of the total 21,000 ha to be reforested. This number is combined with calculations provided in **Table 3.4**. The numbers show that between 255 and 393 tons of carbon per ha is stored in two other, similar Philippine forests. Translated to the Pinacanuan watershed, this would correspond to between 3.8 and 5.9 million tons of carbon on 15.000 hectares stored in the project's lifespan. Comparison with other projects worldwide shows that the lower range of this estimate is realistic. It is therefore assumed that a conservative amount of 4 million tons of carbon can be sequestered in a potential project in Peñablanca.

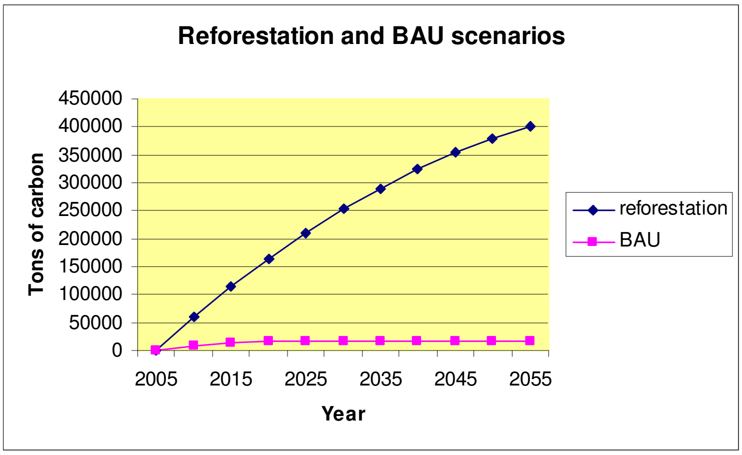
Table 3.4. Carbon storage in Philippine forests.

Name project	Country	Description	SOC included	Carbon stored per ha.
Quirino	Philippines	Reforestation	No	92 tons/ha
Mt. Makiling	Philippines	Reforestation	Yes	255 tons/ha
Leyte geothermal Reservation	Philippines	Reforestation	Yes	393 tons/ha

Notes: Based on Lasco (2002) and Lasco et al. (2002). SOC: Soil Organic Carbon

Considering the characteristics of the region, it is advisable to develop several small-scale projects with one overall coordinator instead of one large-scale project. A lifespan of 50 years is taken to be reasonable, and is comparable to other carbon-offset projects. In order to meet the additionality criterion of the Kyoto protocol, i.e. that a project must result in an anthropogenic enhancement of removals by sinks that are additional to any that would occur in the absence of the project activity, a baseline scenario is created. This so called business as usual (BAU) scenario is based on current land use practices and rates of land cover change. Because forest cover decreased and grassland showed an increase between 1990 and 2002, we assume a BAU scenario with little to no carbon sequestration. **Figure 3.4** depicts carbon storage under both the baseline scenario and a reforestation project.

Figure 3.4. Carbon stored under the two scenarios



Salient findings

(1) Land use and land cover in the watershed is moving along a trend where forests and brush lands are decreasing and agricultural and grassland areas are increasing. This is likely due to the rising demand to increase agricultural productivity to meet the growing needs of dependent communities.

(2) Rapid assessment of past stream flow behaviour of the watershed indicates that the increasing variability in the annual flow as well as the increase in wet season flow and decrease in dry season flow over the last decade are likely associated with the decreasing forest cover and increasing areas used for agricultural purposes.

(3) Results of the estimation of potential soil erosion and sedimentation appear to suggest a possible link between reduction in forest cover and expansion of agricultural areas in the watershed and the increase in potential soil erosion and sedimentation.

(4) There are possibilities for several carbon sequestration projects that would be compliant with the Kyoto rules.

3.3 Economics

Land use practices in upstream Lagum[5]

Socio-economic profile and land use practices of farmers in Lapi, Lagum Area

Table 3.5 shows that the average farm size in the village is 1.1 ha. With this farm size, only 47 percent of the farmer-respondents indicate this is sufficient to meet the needs of their household and the rest have to resort to other sources of livelihood in addition to farming. About 44 percent of the respondents own the lands they till, while 47 percent are occupying lands for free. Almost 50 percent of the respondents reported the lands they occupy are forestlands while the rest

[5] The upstream area in the protected area is commonly referred to by the local people as "Lagum" meaning "inside".

of the respondents indicated their lands are titled or they hold other forms of property rights (i.e., tax declaration).

Household income of the sampled Lapi farmer households averages PhP 26,640 annually. This household income level is equivalent to only US$1.30/day. On average, 47 % of the income of the farmer-respondents is sourced from farming, while only 6 % is forestry-based. Unfortunately, the survey did not probe into the specifics of the private and business activities that almost a third of the respondents engage in. These activities may include hidden income from illegal activities, specifically timber poaching. All of the farmer-respondents engage in corn and root crop farming and a majority is also involved in livestock and vegetable farming. Rice is hardly grown in Lagum and only one farmer-respondent is engaged in cattle raising.

Table 3.5 Profile of upstream farmer-respondents in Lapi, Peñablanca, 2004.

Item	**Unit (n = 32)**	**Value**
Farm size	Hectare	1.1
Sufficiency of farm size	% reporting yes	47
Annual income	PhP	26,640
Farm lot tenurial status	% reporting yes	
Private/owned		44
Tenanted		9
Occupied for free		47
Farming system	% reporting yes	
Corn		100
Rootcrops		91
Piggery/poultry		59
Vegetable		59
Fruit trees		53
Rainfed palay		3
Cattle		3
Sources of income	% of income	
Farming		47
Private/business		32
Government		14
Forestry		6

The costs and revenues from corn and peanut farming of selected farmer-respondents were analyzed to estimate net income from these farming systems and in order to have some indication of the opportunity cost of conservation. **Table 3.6** shows that the net income from corn and peanut farming combined is PhP 3,263 per ha and includes the imputed value of the output consumed by the household. Only 18 percent of corn production is sold in the market, 55 percent is home consumption, and the rest is payment for farm labor.

Table 3.6 Net Income from corn and root crop farming of selected farmer-respondents, Lapi, Peñablanca, 2004.

Item	Unit	Value
Area planted	Ha	
Corn		1.70
Peanut		1.15
Quantity harvested	Kg/ha	
Corn		630
Peanut		90
Marketed output	Percent	
Corn		18
Peanut		62
Home consumption	Percent	
Corn		55
Peanut		33
Farm gate price	PhP/kg	
Corn		8
Peanut		16
Total revenue	PhP/ha	5,309
Production cost	PhP/ha	2,047
Net income	PhP/ha	3,263

Notes: Total revenue is combined revenue from corn and peanut production and Computed based on gross harvest per hectare. Production cost is based on the actual production expenses collected by the survey. Cost of peanut production is incidental to corn production. Part of the output is collected for the payment of hired labor. US$1=PhP55

Regarding the application of chemical fertilizer on their farms, very few of the farmer-respondents reported that they apply chemical inputs as a regular farming practice. They indicated that their use of chemical fertilizer is limited because they cannot afford it.

Forest use and conservation practices

Table 3.7 provides information on the extent of forest use and dependence by the Lapi farmer-respondents. Most of them collect their fuel wood from the forests and about half of them engage in collection of non-timber forest products (NTFP), most of which is for home consumption. Many of the farmer-respondents also depend on the forests for the timber for house construction, although a few admitted to marketing the timber collected.

Table 3.7. Forest use practices of upstream farmer-respondents, Lapi, Peñablanca, 2004.

			Final Use (%)	
Forest use Activity	**No. of Respondents (n=32)**	**%**	**Home consumption**	**Marketed**
NTFP collection	15	47	96	5
Small-scale logging	1	3	100	0
Fuelwood collection	29	91	100	0
Timber utilization	21	66	98	7

Note: Average number of days spent/HH in all activities is 11 days/month

There is a perception among 44 percent of the farmer-respondents that cutting of trees in the forests is a problem, half of whom feel the problem is severe (**Table 3.8**). The survey data reveal that only a minority of the farmer-respondents participate in government forestry programs. Moreover, only about half of the farmer-respondents engage in tree planting and ago-forestry as forest conservation measures and even fewer farmers participate in forest protection by patrolling. As expected, almost all of the farmer-respondents indicated their willingness to participate in a PES program if introduced in their community

Table 3.8 Forest related perceptions and willingness to participate in PES of upstream farmer-respondents in Lapi, Peñablanca, 2004.

Item	Unit	Value
Cutting of tress is a problem	% reporting yes	44
Participation in government	% participating	
Forestry program		
CBFM		16
ISF		9
Conservation/Protection Measures	% engaged	
Patrol the forest		13
Tree planting		50
Fire breaks/fire line		6
Agro-forestry		47
Willingness to participate in PES	% reporting yes	98

Willingness-to-pay for watershed protection

Domestic water users

The Peñablanca Water District (PWD) serves only six percent of the local residents while the rest obtain their water for free from groundwater, streams and the Pinacanauan River. Only the urbanized villages are connected with the PWD (i.e., Centro and Camasi). The water consumption characteristics of the respondent-domestic water users are shown in **Table 3.9** broken down by water connection status to the local water district. On the average, a respondent-household of 6 members consumes about 17.5 cubic meters of water a month to meet all its water requirements. The average water consumption of the water users who are connected and those who are not connected to the local water district does not differ significantly.[6] Local residents who avail of the water district's services pay, on the average, a monthly bill of PhP189 or PhP 11/cubic meter.[7]

Table 3.9 Water consumption characteristics of respondent-domestic water users in Peñablanca, 2004.

Item	**Unit**	**Connected to PWD (n=68)**	**Non-connected (n=104)**
Water consumption	m^3/mo/hh	17.1	18.4
Water bill	PhP/mo/hh	189	NA
Water supply problem	% reporting yes	7	31
Willingness to connect	% reporting yes	NA	66

The survey results indicate that the respondent-water users availing of the water district's services are generally satisfied with the services and do not experience water supply problems, either in quantity or in quality. On the other hand, about a third of those who avail of water for free reported water supply problems, particularly during the dry season. This observation explains the high percentage (66% of respondents) in their willingness to avail of the piped water services of the local water district.

On the willingness to pay for watershed protection, on average, the respondent-water users are willing to pay PhP20 per month, which represents approximately an additional 10 % in their monthly water bill.

Rice farmers with irrigated farms

Most of the Peñablanca downstream rice farmers avail of irrigation water from the Pinacanauan River Irrigation System, which currently services 15 villages (out of 24) in Peñablanca and one village in Tuguegarao City. **Table 3.10** shows that the average size of rice farms of farmer-respondents is less than one hectare (0.82 ha) producing 4 tons/ha during the dry season and one ton less during the wet season. [8] Almost half of the farmer respondents indicated they have problems with water supply although the problems are related more to management of the irrigation system rather than to volume.

[6] The average water consumption of connected respondents was obtained from their water district's monthly billing, while that of not-connected respondents was obtained through the survey. The latter respondents were asked to estimate their water consumption by use, i.e., drinking, washing clothes, bathing, etc. in terms of number of average sized-pails. The average monthly water consumption for a family of 5 in Metro Manila is 30 cubic meters.

[7] Piped water in Metro Manila is priced lower, i.e., Php 7 /cubic meter. The local water district has operated for only 4 years and is still recovering its capital investment costs, which may explain the higher pricing.

[8] The average farm size of the respondent-lowland rice farmers in the second study site (Kalahan Reserve case study) is significantly larger, i.e., 2.1 ha. The province of Isabela where the respondent-farmers are located, is a major rice farming area and the farmers are relatively better off than in Peñablanca. Average palay production in the Philippines and Cagayan Valley (Region 2) in 2003 was 3.4 and 3.7 t/ha, respectively.

Table 3.10 Farming characteristics of rice farmer-respondents, Peñablanca, 2004.

Item	Unit	Value (n = 80)
Farm size	Ha	0.82
Production Wet season Dry season	t/ha	 3 4
Production cost Wet season Dry season	PhP/ha/cropping	 10,384 11,113
Average farmgate price	PhP/kg (palay)	P8.80
Water supply problem	% reporting yes	47

The farmer-respondents (65%) indicated a positive willingness to pay for watershed protection in order to have adequate and dependable irrigation water. Their WTP is estimated at PhP182 per ha per cropping (there are on average two croppings of rice in one year). On a monthly basis, this is estimated to be about PhP30 per hectare.

Tourists

The tourism statistics of the Provincial Government of Cagayan that manages the protected area show that tourism has increased at 3% annually over the last three years. In 2002, about 420,000 tourists visited the area, only 10 percent of which were foreign tourists. Most of the local tourists (within the province and outside, including Metro Manila) visit the area for the caves and river swimming. About 600 tourists go to the area annually for adventure tourism (i.e., kayaking, rafting and bat watching through a local tour company that caters to the high-end Metro Manila residents.

The contingent valuation survey results also indicate a positive willingness to pay for watershed protection among the tourists with the local tourists willing to pay on average PhP37 per person per visit and the adventure tourists about 4 times more or PhP133 per person per visit.

A summary of the mean WTP values of the different water users discussed above is provided in **Table 3.11.**

Table 3.11 Mean WTP for water-related services and income of respondent beneficiaries.

Beneficiary	Positive WTP (% reporting)	Unit	WTP Value (PhP)	Monthly income (PhP)
Rice farmers	65	Per ha/crop	182	4,971
Domestic users	52	Per month	20	9,026
Local tourists	81	Per visit	37	23,679
Adventure tourists	64	Per visit	133	45,833

Carbon Sequestration

The unit cost of reforestation for the Philippines is US$ 504 per hectare (Lasco 2002). Applying this to the 15,000 ha identified as suitable in the Peñablanca region yields total reforestation costs of US$ 7.56 million. Monitoring and verification costs are estimated between US$ 1 and US$ 5 per hectare annually or between US$ 15,000 and US$ 75,000 per year for the whole project area. This culminates in 0.75 to 3.75 million dollars for the 50-year project lifespan. Total costs will therefore lie in the range of 8.31 to 11.31 million dollars. In **Tables 3.12** and **3.13** the project features and costs are summarized.

It is estimated that it will take 152 man-days for reforesting one hectare (Lasco, 2002). The PPLS is inhabited by at least 25,654 people, and more importantly, closely situated to the city of Tuguegarao, which clearly suggest that there will not be a lack of workers. This information combined with a feasibility study by Lasco (2002) and a comparison with the Klinki Forestry Project we assume that the reforestation activities can be finished within 6 to 9 years. During this period the largest share of the costs (US$ 10.1 million) will be spent, and afterwards only M&V costs (US $ 15,000 to 75,000 annually) will continue.

Table 3.12 Possible features of a carbon offset project in Peñablanca

Life time (year)	Size (hectares)	Expected carbon sequestered (tons)	Type of project	Reforestation costs (US$)	M&V costs (US$)	Costs (US$)
50	15,000	4 million	Commercial	7.56	0.75 – 3.75 million	8.31 – 11.31 million

Table 3.13 Costs for setting up a carbon project in the PPLS per tons C

Carbon estimates (tons)	Initial costs per ton C (US$)	M & V costs per ton C per year (US$)	Total M & V costs per ton in 50 year (US$)	Total costs per ton per 50 year (US$)
4 million	1.89	0.004 – 0.019	0.19 – 0.94	2.09 – 2.83

For a project to be successful it needs to be cost effective. The proposed reforestation project in this study is aimed at generating CERs under the Kyoto protocol. As mentioned in section 2.3, the price of carbon ranges from US$ 0.50 to US$ 9.00 per ton. If we combine this with the costs (US$ 2.09 to 2.84 per ton) mentioned earlier this section, a cost effective project seems feasible. It is important that during negotiations an appropriate price is set for the carbon. Detailed recommendations for this are beyond the scope of this research. In this stage we can only state that a project has a large potential to be cost effective and to generate benefits.

Salient findings

(1) Income levels of farmers in the village of Lapi are very low.

(2) There is some dependence of upstream farmers on the forests for part of their subsistence such as non-timber forest products and fuelwood.

(3) Farmer involvement in conservation oriented activities such as agro-forestry and tree planting is modest.

(4) There is positive willingness to pay for watershed protection among all the three types of respondent-beneficiaries, i.e., rice farmers, domestic households and tourists.

(5) A carbon sequestration project would be cost effective if carbon could be sold for more than US$ 2.83 per ton.

3.4 Institutions

Institutional conditions for PES

Legal and regulatory environment for PES

The brief policy review conducted for this study shows that there several existing legal and regulatory enactments that would support a PES in the study site although some realities in the watershed can pose constraints to PES implementation. The overriding legislation that governs the Peñablanca Protected Area is the National Integrated Protected Area System (NIPAS) law that placed all protected areas under the system in 1992. The NIPAS provides several opportunities to support a PES in this site, of which three of the most relevant are: (a) the creation of multiple-use zones that allows settlement, traditional land use and other income-generating or livelihood activities and granting of land tenure to qualified dwellers; (b) the creation of a multi-sectoral government body in each protected area called the Protected Area Management Board (PAMB); (c) the creation of the Integrated Protected Area Fund (IPAF) to sustain financing of the protected area; and (d) creation of the Protected Area Superintendent post within the DENR regional office (PASu). One of the sources of the IPAF are the fees generated from the management of the protected area.

In support of the NIPAS law, the guidelines for determining the fees for access and sustainable use of resources in protected areas were formulated by the DENR in the year 2000 (DAO 2000-51). These guidelines define the types of fees that may be collected from those availing of the services of the protected area as well as the guiding principles and valuation methods in fee estimation.

In a very recent executive order (EO 318, 2004), the sustainable management of forests and forestlands in watersheds is promoted as a national government policy and watersheds are now deemed as ecosystem management units. Of particular interest to PES, the issuance advocates for the development of mechanisms for the proper valuation and the fair and comprehensive pricing of forest products and services. More importantly, the policy allows for the adoption of plowback mechanisms of utilizing the proceeds from the use of environmental services of watersheds and forests, such as power generation, domestic and irrigation water, and eco-tourism.

The other recent legislations that support the establishment and implementation of PES are the Clean Water Act (2004) and the Local Government Code (1990). The former promotes the use of appropriate economic instruments for the protection of the country's water resources while the latter can be invoked by the local government units to collect fees from resource access and use, that can be used for watershed protection and management.

Property rights

The survey of upstream farmers in the village of Lapi revealed that 44% of those sampled own the farm lot that they till, 9% are either tenants or renters, and 47% occupy the land they till for free most of which is forest land. It is not clear from the survey whether the free occupants have any usufruct rights to the forestland. As indicated earlier (Section 4.1), some parts of the watershed are covered under government forestry programs that provide use rights to qualified forest occupants. The NIPAS law grants land tenure to watershed occupants who were settled there for a period of at least five years prior to its passage. These tenured migrants are eligible to become a steward of a portion of land within the multiple use management or buffer zone of the protected area and from which they may derive their subsistence. A census of occupants in each protected area has to be conducted to determine the qualified occupants.

It appears however that in the case of the Peñablanca protected area, there is a continuing occupancy occurring within the watershed as shown in **Table 3.14**.[9] The farm occupancy rate (i.e., number of people entering the watershed per year) is shown to be increasing since the 1960s to the present, i.e., from 11% during the 1961-70 decade and to 24% during the period 2001-2003. If the law is strictly enforced, these recent migrants cannot be provided security of tenure over the land they occupy. This is a concern that has to be addressed in establishing a PES in the protected area.

Table 3.14 Farm occupancy rate in upstream Lapi, Peñablanca.

Year of farm occupancy	**No. of occupants**	**Occupancy rate (occupants per year)**
Before 1960	116	NA
1961-1970	105	11
1971-1980	147	15
1981-1990	146	15
1991-2000	192	19
2001-2003	73	24

Cooperative mechanisms

Cooperative mechanisms are formal or informal organizations that can facilitate PES establishment and implementation, particularly in terms of mobilizing both service providers and beneficiaries to promote their respective interests and at the same time, reducing transaction costs. Examples of these organizations are people's organizations, non-governmental organizations, private foundations, watershed councils, council of elders, village councils, and others.

[9] The census on which the occupancy information is based was conducted by an international NGO that is active in the Penablanca Protected Area.

In the Peñablanca protected area, there is only one such organization in upstream Lapi, i.e., the Lapi Farmers Cooperative, although the village councils can also be mobilized to service as cooperative mechanisms on behalf of the upstream service providers. Conservation International can also serve as a cooperative mechanism to facilitate mobilization of the upstream service providers and to link them with the downstream water beneficiaries.

In downstream Peñablanca, there are various groups that can be tapped to act as cooperative mechanisms to promote their respective interests, like the irrigators association for the rice farmers, the adventure tour operator for the tourists, and the village councils for the domestic water users. There are also small organizations such as the fisherfolk association and boat operators association.

In terms of the institutional preferences for fund management of both the service providers and beneficiaries, **Table 3.15** reveals that there is preference for the existing institutions to manage PES funds such as the irrigation authority and the water district. The data also reveals that the environment department ranks low among the institutional preferences of both service providers and users to manage PES funds. This result has partly to do with the bad image of the department (i.e., officials and employees are often suspected of involvement in illegal forest activities) and partly with the inadequate financial resources to operate its programs.

The PAMB is particularly beset with a very low operating budget (p.c. 2004). Very little funds to date have been generated by the Peñablanca PAMB for various reasons: (1) the entrance fees to the caves are collected by the Provincial Government for their use; (2) the lengthy bureaucratic process to plow back the funds for conservation activities serves as disincentive to the PAMB;[10] and (3) lack of financial resources for PAMB operations. The lack of financial resources in particular weakens the clout of the PPLS superintendent to implement its mandate. The establishment of a PES program in the protected area could address these issues.

Table 3.15 Institutional preferences for fund management.

Stakeholder/ Institutional preference	**Percent of sampled beneficiaries reporting yes**
Rice farmers	
Irrigation authority	40
Village council	19
Irrigators association	18
Environment agency (PAMB/DENR)	8
Private corporation	6
Domestic water users	
Water district	20
Municipal government	15
Village council	15
Private corporation	8
Environment agency	8

[10] See Rosales (2003) for an assessment of the IPAF.

Stakeholder analysis

Table 3.16 presents the results of the simplified stakeholder analysis showing three categories of stakeholders, namely, upstream, downstream and intermediary. (Only the key stakeholders are shown in the table. The analysis shown in the table indicates that it is important that the role of each stakeholder in PES establishment has to be considered since some stakeholders may have the tendency to hinder the process if it will affect their vested interests. For instance, the upstream village councils may hinder the process if they are actively involved in illegal forest activities. Those downstream beneficiaries whose willingness to pay for watershed protection is negative may also hinder the process.

These potentially conflicting interests among the key stakeholders in the protected area with respect to the establishment of a PES pose a challenge to all the stakeholders committed to conservation, protection and livelihood goals. One activity that may help in strengthening the commitment of the direct beneficiaries and convincing those who may have some resistance to the PES project, for one reason or another, is effective and comprehensive information, education and communication (IEC) which should include information campaigns in various forms, especially face-to-face or community consultations. From experience, it has been shown that improved knowledge about the various aspects of the PES has helped convinced individuals, groups and institutions to accept and support the project.

Table 3.16 Simplified stakeholder analysis, Peñablanca Protected Area.

Category/ stakeholder	Main interest in watershed	Potential impact on watershed	Role in PES establishment	Relative importance	Participation in PES
Upstream					
Farmers	Livelihood	M	+	1	Implementor
Village councils	Conservation	M	+/-	2	Project mgt
Downstream					
Rice farmers	Irrigation water	L	+/-	1	Buyer
Households	Domestic water	L	+/-	1	Buyer
Tourists	Recreation	M	+	2	Buyer
Intermediary					
Water district	Domestic water	L	+/-	1	Fund mgt
Irrigation agency	Irrigation water	L	+/-	1	Fund mgt
Village council	Conservation	O	+/-	2	Policy
Municipal govt.	Conservation	O	+/-	2	Policy
Provincial govt.	Tourism revenues	O	+/-	2	Fund mgt
PAMB	Conservation	O	+	1	Fund mgt, policy
Conservation Int'l	Conservation	O	+	1	Advocacy

Legends: Potential impact on watershed: H = highly extractive/pollutive, M = moderately extractive, L = minimally extractive, O = others (policy, advocacy); Role in PES establishment: + = facilitating, - = hindering; Relative importance: 1 = extremely important, 2 = important; 3 = slightly important or doubtful

Results of stakeholder consultation workshop

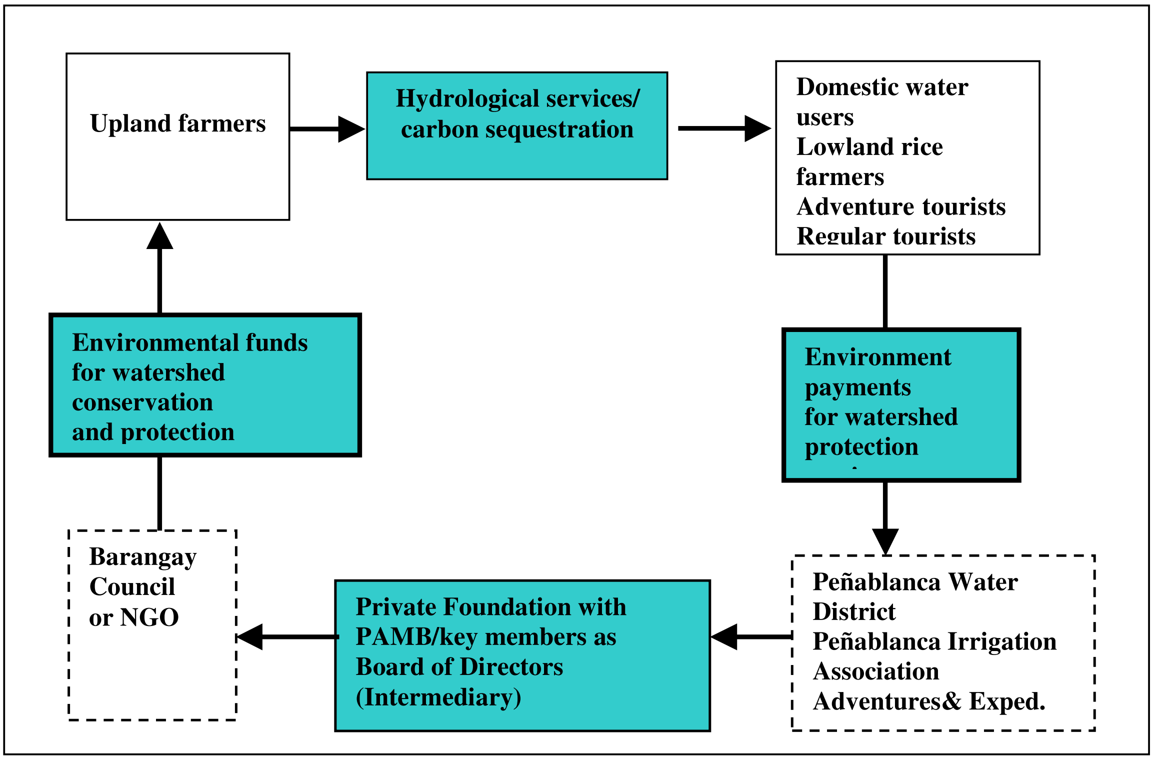
The consultation workshop conducted in August 2002 provided the following institutional-related outputs:

(a) A set of PES goals that can guide its establishment in the future. Some of the goals were (1) to reduce poverty; (2) to build conservation constituency; (3) to empower the upland dwellers in forest protection and conservation; (4) to sustain the integrity of the watershed; and (5) to provide incentive mechanisms.

(b) A set of criteria that should govern the PES. The more important criteria that were given by the participants were: (1) the service provider should have a total and continuous commitment in watershed protection; (2) the PES should make a measurable contribution (e.g. spatial and temporal); (3) no fraudulent acts such as timber poaching should be committed; (4) payment mechanisms should be acceptable to service providers; (5) the social and cultural acceptability of the PES should be considered; and (6) the LGUs should participate in the program.

(c) A proposed institutional arrangement for PES that would involve the establishment of a private foundation to serve as the independent intermediary between the service providers and the service beneficiaries (**Figure 3.5**). The foundation would consist of the members of the PAMB with well-defined roles and responsibilities as distinct from those of the PAMB. The creation of a private foundation in lieu of the PAMB is expected to facilitate fund management.

Figure 3.5 Proposed PES institutional structure in the Peñablanca Protected Area.



Salient findings

(1) A PES mechanism in the Pinacanauan watershed will have to consider the provisions of the NIPAS law since it is within the PPLS.

(2) There is a continuing and increasing occupancy of the watershed by landless farmers.

(3) The environment department (DENR) is among the least preferred agencies among the service beneficiaries to manage PES funds.

(4) There are some key stakeholders both upstream and downstream that could hinder the establishment of a PES in the protected area.

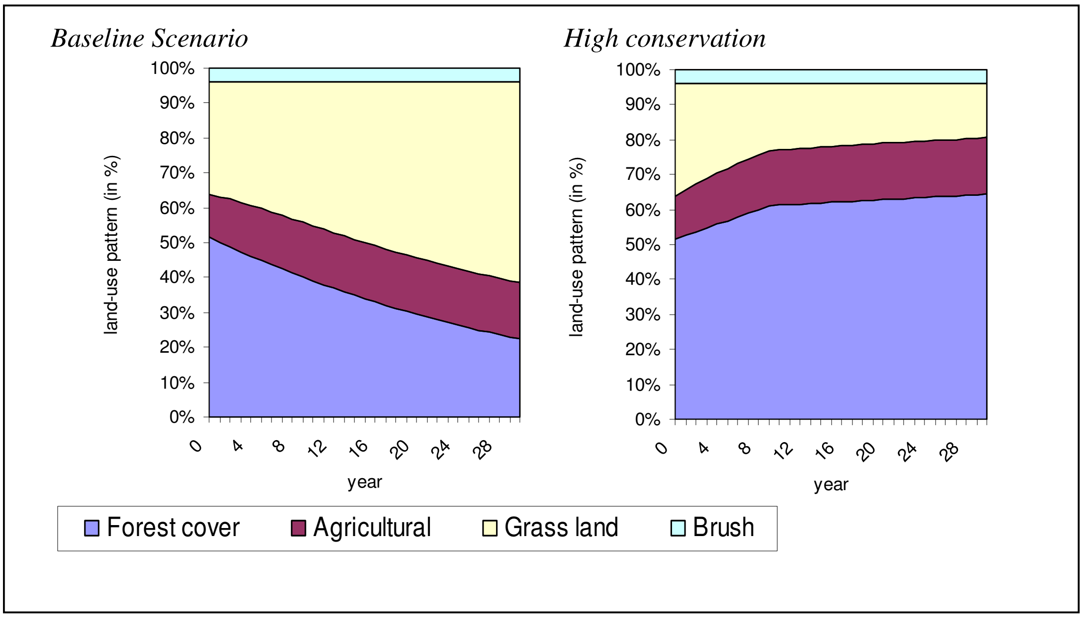
(5) There is a preference among the key stakeholders for a private foundation or corporation to handle the PES funds.

3.5 Simulation model

Land use change over time

The driver of the scenarios presented in **Table 2.1** is the change in land-use patterns. The main forms of land-use include forest, agriculture, pasture land and brush land. **Figure 3.6** shows an example of the change of different scenarios over time. In the baseline scenario, deforestation is assumed to continue at its present rate of 3% per year. In the "high conservation" scenarios, a package of conservation measures will be implemented which involve replanting of forest (450 ha/year) and expansion of agro-forestry (150 ha/year).

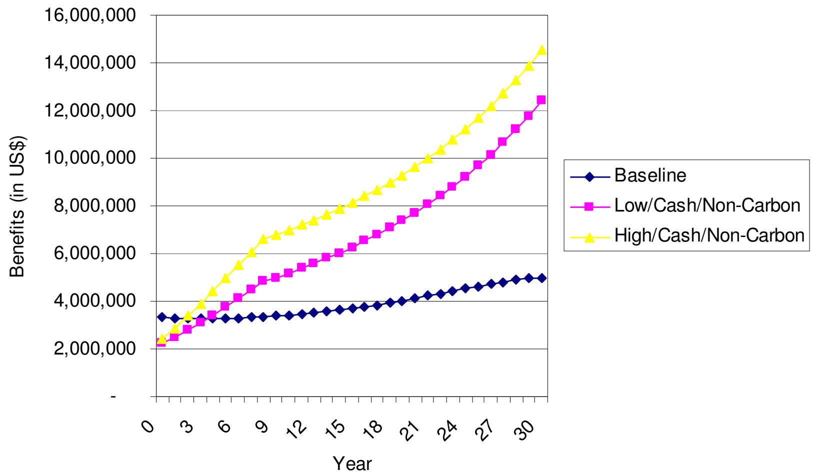
Figure 3.6 Land use change in Peñablanca over time



Benefits

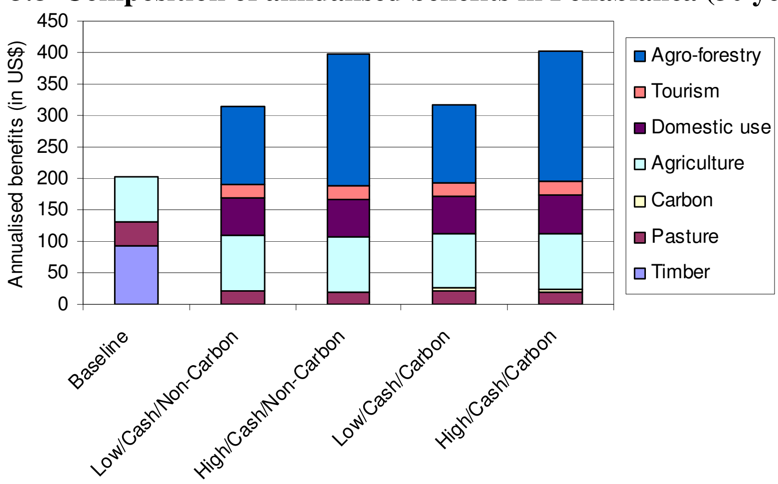
The change in land-use practices causes different growth levels over time. **Figure 3.7** shows how the baseline assumes moderately expanding welfare impacts in the Pinacanauan watershed. The welfare increase in the baseline scenario is caused by the expansion of timber production and pastureland activities. Intensifying conservation activities first reduce the benefits accruing in the Pinacanauan watershed, after which higher levels of welfare can be attained compared to the baseline scenario.

Figure 3.7 Benefits in Peñablanca over time



The composition of the benefit levels of the various scenarios is shown in **Figure 3.8** below. The additional gains of the interventions upstream are particularly prominent in agro-forestry and the fruit-processing industry. Downstream beneficiaries that benefit from protected watershed services include farmers through improved irrigation and households via secured provision of drinking water. Sectors that are worse off compared to the baseline scenario are the livestock industry, which is handicapped by the reduction in pastureland, and timber production, which disappears completely. Due to the improved landscape beauty and secured water flow, nature-based tourism develops further and will become a significant contributor to the welfare of the Peñablanca economy.

Figure 3.8 Composition of annualised benefits in Peñablanca (30 years, 4%)



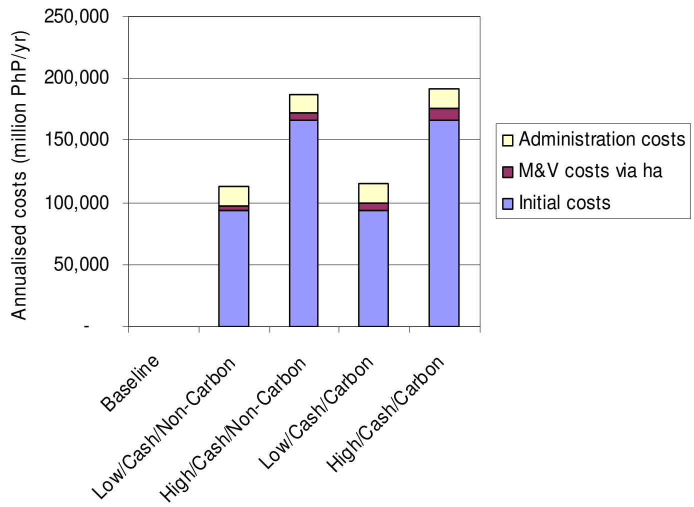
Costs

To generate higher levels of welfare through conservation interventions, investments need to be made to achieve these benefits. The considered interventions involve 3 categories of costs: (a) the initial investment at the early start of the intervention; (b) the monitoring and verification (M&V) costs which are directly related to the area that the intervention focuses at; and (c) the administrative costs of each intervention.

As shown in Figure 3.9, the variations across the intervention costs are caused for various reasons. The main variation in annualized costs between the scenarios is caused by the initial investments, which vary from US$90,000 to US$160,000 per annum. These costs mainly consist of fences that need to be built in order to keep grazing cattle outside the reforested premises.

M&V costs vary, depending on the size of the reforested area, thereby showing higher costs in the high conservation scenarios. The administrative costs vary depending on the way in which the upland dwellers are compensated. If payments to upland communities participating in a scheme are in cash, the administrative costs are relatively low. If compensation is paid in kind, (i.e. local infrastructure development, production inputs, and the provision of schooling) the administrative costs are significantly higher, as such investments require much more coordination.

Figure 3.9 Composition of annualised costs in Peñablanca (30 years, 4%)



Benefits vs costs

Table 3.17 derives the additional costs and benefits by deducting the annualized costs and benefits of the baseline scenario from the annualized costs and benefits of the 8 interventions, respectively. The last column in Table shows the benefit cost ratio of the respective interventions. With a time horizon of 30 years and at a discount rate of 4%, only those scenarios that follow a strategy of high conservation are economically feasible. Also, cash payments reduce the costs and therefore increase the economic viability of the scheme. Revenues from carbon credits also add to welfare growth but are partly offset by increased monitoring and verification costs.

Table 3.17 Overall outcome of the analysis in Peñablanca (in US$, 30 years, 4%)

Scenario	Total annualised costs	Total annualised benefits	Additional costs	Additional benefits	Benefit cost ratio
0.BAU	-	6,072,718	-	-	-
1.Low/Cash/Non-Carbon	103,067	5,714,774	103,067	-357,944	-3.5
2.High/Cash/Non-Carbon	177,627	7,222,075	177,627	1,149,357	6.5
3.Low/Cash/Carbon	105,595	5,775,024	105,595	-297,694	-2.8
4.High/Cash/Carbon	182,044	7,319,974	182,044	1,247,255	6.9
5.Low/Non-cash/Non-Carbon	133,067	5,714,774	133,067	-357,944	-2.7
6.High/Non-cash/Non-Carbon	208,524	7,222,075	208,524	1,149,357	5.5
7.Low/Non-cash/Carbon	135,595	5,775,024	135,595	-297,694	-2.2
8.High/Non-cash/Carbon	212,044	7,319,974	212,044	1,247,255	5.9

Figure 3.10 shows the sensitivity of the benefit-cost ratio to the choice of discount rate. Economies of scale dictate that low conservation efforts do not outweigh the costs of setting up a full-fledged reforestation programme. Only high conservation efforts generate sufficient marginal benefits to compensate for the initial investments that need to be made. The support of carbon funds does not seem to be essential in setting up economically viable interventions.

Figure 3.10 Sensitivity analysis of the effect of the choice of discount rate on the benefit cost ratio in Peñablanca

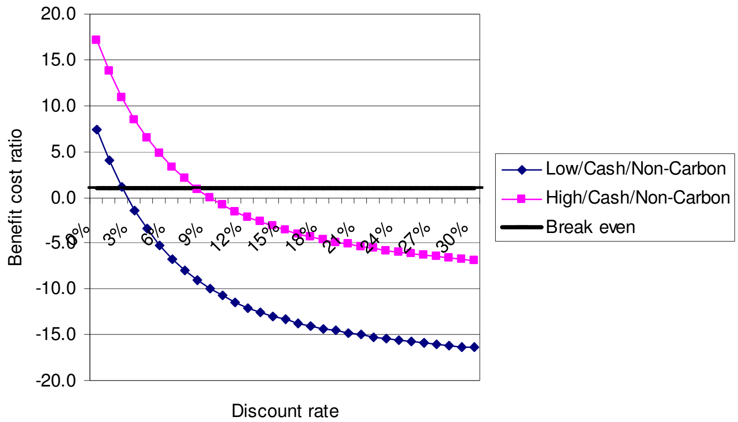
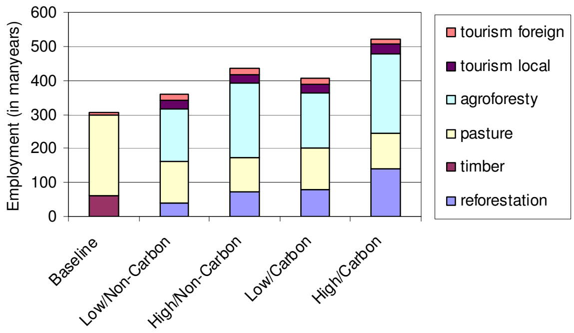


Figure 3.11 shows the level and composition of the employment created by the various scenarios. In the baseline scenario, most employment is found in the timber industry and the livestock and farming sector. Conservation efforts result in greater amounts of fruits being available from the forest. Therefore, the high conservation scenarios employ substantially more labourers that work in the fruit collection and fruit processing industry. The tourist industry will also generate additional employment in terms of adventure recreation activities and river-based tourism. Finally, the reforestation and carbon marketing efforts are adding to the labour requirements of the conservation scenarios, as well.

Figure 3.11 Employment composition in Peñablanca



Salient findings

(1) A PES program with high conservation, cash payments and investments in carbon crediting is the most beneficial option in the Peñablanca Protected Area.

(2) A PES program with high conservation is beneficial to the service providers because of its employment enhancing component.

(3) The administrative costs of running a PES program are considerably reduced when payment schemes involve cash rather than in-kind payments.

3.6 Multi-criteria analysis

The results of the weighting exercise and computed weights are presented in **Table 3.18.**

Table 3.18 Ranking of criteria and computed weights for Peñablanca.

	Weight level 1	Weight level 2	Weight level 3	Actual weight
Financial costs	0.25			
Cost administration		0.457		0.114
Costs planting		0.09		0.022
Cost monitoring and verification		0.157		0.039
Opportunity costs to upland dwellers		0.257		0.064
Costs to downstream users		0.04		
Farmers			0.257	0.003
Households			0.457	0.005
Ordinary tourists			0.123	0.001
Adventure tourists			0.123	0.001
Carbon buyers			0.04	0.000
Economic benefits	0.25			
Farmers (irrigation)		0.242		0.060
Households (drinking water)		0.408		0.102
Tourism (river-related)		0.061		0.015
Herders (pasture/fodder)		0.131		0.033
Agro-foresters (fruit)		0.131		0.033
Carbon sequestration (credits)		0.028		0.007
Social	0.25			
Employment		0.25		0.063
Income distribution		0.25		0.063
Security ecosystem service provision		0.25		0.063
Public acceptability		0.25		0.063
Environment	0.25			
Flood risk		0.25		0.063
Biodiversity		0.75		0.188

Having standardized the scores and weighted the criteria it is possible to produce a ranking of the alternative PES scheme designs through a weighted summation of scores. The results are represented in **Figure 3.12.** The high conservation, cash payment scheme with investments in carbon crediting (alternative 4) is ranked as the most beneficial alternative. The baseline, "do nothing', option is ranked lowest – in other words, adopting any design of PES scheme is preferable to maintaining the status quo. The color code in **Figure 3.12** represents the contribution of each group of criteria to the total score of each alternative, and helps to identify trade-offs between different groups of criteria. For example, alternative 8 (high conservation, non-cash payment, with carbon crediting) performs better than alternative 4 in terms of social effects but performs relatively badly in terms of financial costs.

It can be expected that different stakeholder perspectives would lead to different weights on the criteria and therefore different rankings of the alternative PES designs. **Figure 3.13** presents the ranking of alternatives given different perspectives. For each perspective, a 50% weight is given to the group of criteria that is considered most important. The remaining 50% weight is divided equally amongst the other groups of criteria. Alternative 4 remains the highest ranked option in all cases except for the financial cost perspective, in which it is ranked second after alternative 2 (high conservation, cash payment, no carbon crediting). This indicates that the ranking of alternatives is reasonable robust.

Figure 3.12 Ranking of alternative PES scheme designs

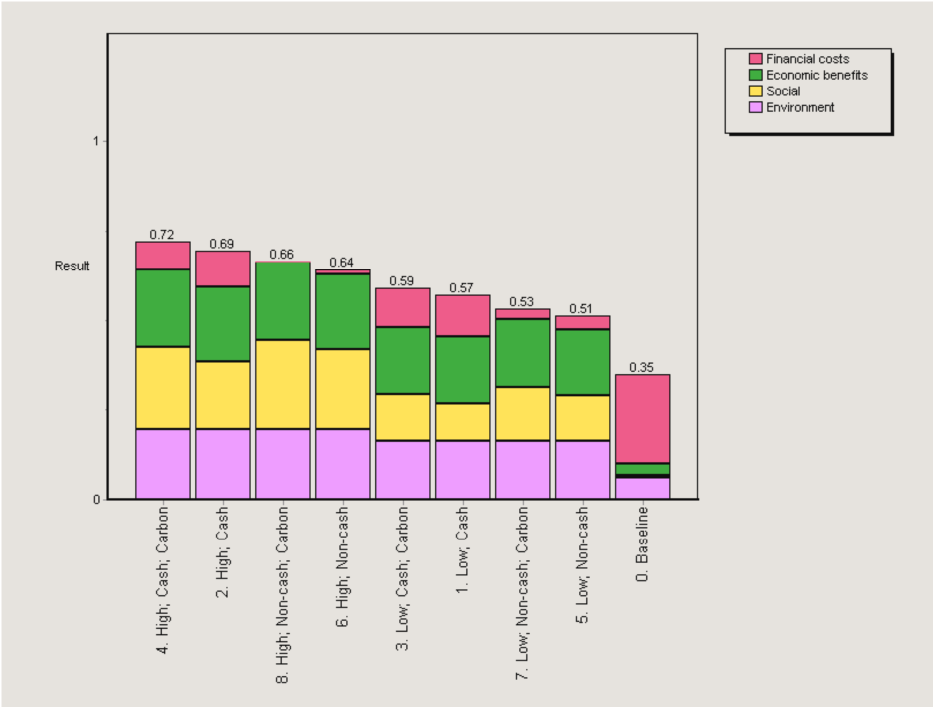
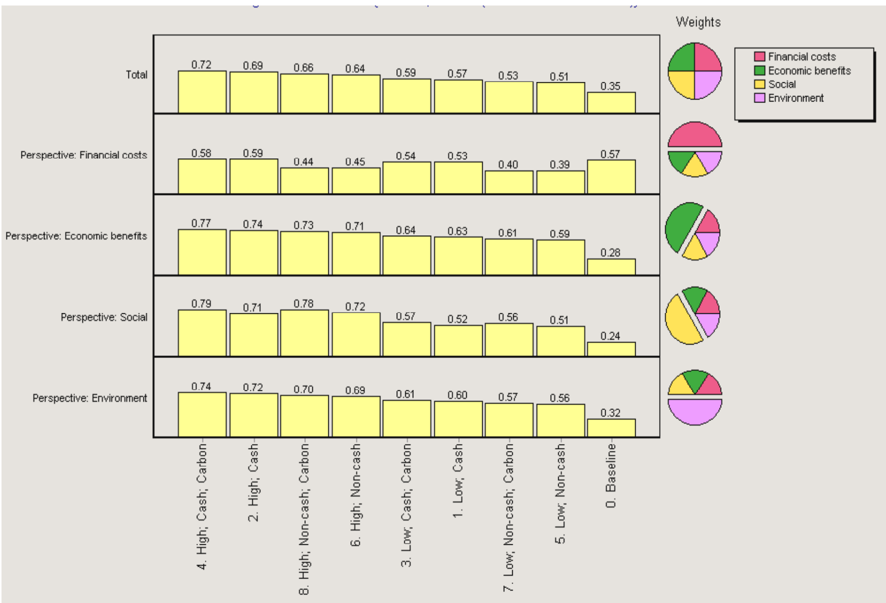
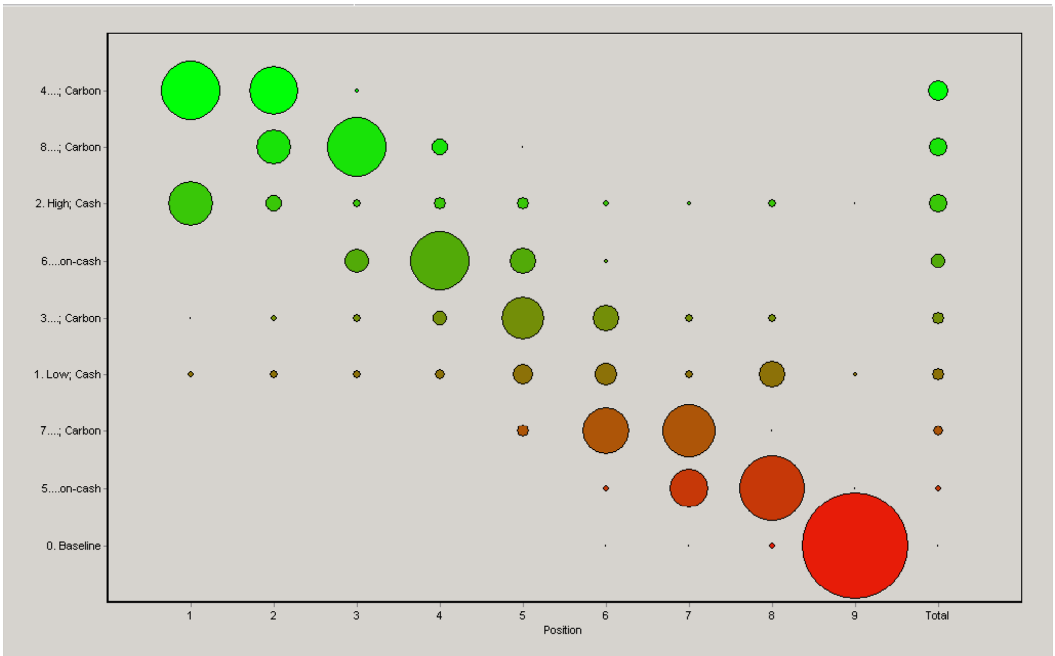


Figure 3.13 Ranking of alternatives with weights representative of different perspectives



To examine the robustness of the ranking further an uncertainty analysis is performed to analyze whether the ordering of alternative PES scheme designs changes given uncertainty over the weights and scores that are used in the MCA. **Figure 3.14** represents the results of an uncertainty analysis given a 30% uncertainty on all scores.[11] The ranking of alternatives is not particularly stable given this level of uncertainty. Alternative 2 also has a high probability of being ranked highest. The result, however, that the business-as-usual case is the lowest ranked alternative is stable.

Figure 3.14 Score uncertainty: Probable ranking of alternative PES schemes given 30% uncertainty over all scores given in the effects table.



Due to the stakeholder participants' lack of experience with the MCA and weight setting process, the selected weights need to be treated with caution. An uncertainty analysis on the weights given to each group of criteria was implemented and showed that the ranking of alternatives is not sensitive to the weights used in the analysis.

Salient findings

(1) The key stakeholders in the Peñablanca Protected Landscape consider financial, economic, social and environmental factors of equal importance in designing a PES program.

(2) The concern over the loss of biodiversity ranks very high among the stakeholders.

(3) A PES program with high conservation, cash payments and investments in carbon crediting is the most beneficial option in the Peñablanca Protected Landscape

[11] An uncertainty of 30% can be interpreted as a confidence interval for the given score, i.e. that we can be (99%) confident that the true value of the score lies within an interval 30% above and below the score in the effects table. The DEFINITE program runs the MCA 2000 times with different score values given this level of uncertainty. The procedure generates a probability table with the probabilities of each alternative receiving a given ranking.

4.0 Summary, Lessons and Policy Insights

4.1 Summary

This study explored the potential of implementing PES in the Peñablanca Protected Landscape by examining the science, economics and institutional aspects of PES. The results revealed some important strengths and weaknesses in these aspects in the two sites, as follow:

(1) The science shows that the Pinacanauan watershed has degraded over the last 12 years, although at a modest rate, and will continue to degrade unless measures to reverse the trend are undertaken.

(2) The economics reveals that there is demand for watershed protection services by the different water users within the protected area of Peñablanca.

(3) The institutional aspects show that while there are several legal bases that would support the establishment of PES in the Peñablanca Protected Landscape, the property rights of the majority of upland dwellers in the area are not well defined. This is further complicated by the continuing influx of people into the upland areas and the absence of peoples' organizations.

(4) There is potential for carbon sequestration projects in the two sites. There are large degraded areas within the PPLS that need rehabilitation through reforestation and projects to undertake reforestation activities are eligible for CDM.

4.2 Lessons on Poverty-and-Environment Nexus

(1) The poor upland dwellers residing within the Peñablanca Protected Landscape are much aware of the negative consequences of forest degradation caused by illegal logging and by their own unsustainable farming and forest use practices. However, in view of their poverty, these upland dwellers admit they have no alternative but to exploit forest resources since farming as the main source of livelihood is not sufficient for their subsistence needs and there are no additional livelihood opportunities.

4.3 Methodological Lessons

(1) In the design of PES programs, the science, economics and institutions elements should be examined to assess its potential for implementation.

(2) The linkage between land use and the level of environmental services is crucial in determining the sustainability of a PES program.

(3) In designing a PES program, it is important to first determine if there is demand for the environmental service.

(4) Key stakeholders in the PES program should be involved and consulted in the design.

4.4 Policy Insights

General

(1) PES should be promoted by the concerned government and non-government organizations in areas where it is proven by the science, economics and institutions that environmental services are being provided by the local communities and there are downstream communities that benefit from the services.

(2) Similarly, global donors (i.e., GEF, ICRAF) should continue supporting communities that, by their sustainable conservation practices, have contributed global environmental benefits. This could serve as an incentive for other communities to adopt similar practices.

(3) PES should be promoted as a policy reform to address illegal activities within critical watersheds since it provides incentives to upland dwellers to protect them by giving them a stake in the resources.

Specific

(1) DENR/PAMB should aggressively pursue a PES program in the Peñablanca Protected Area as one of various initiatives to arrest the slow degradation of the watershed and to address the poverty problem among the upstream communities. The following activities need to be undertaken:

- Monitor influx of people into the uplands
- Improve property rights of upland dwellers
- More consultations with stakeholders to present PREM results
- Aggressive IEC, particularly among beneficiaries
- Capacity building of upland dwellers both in community organizing and sustainable farming practices
- Alternative or additional livelihood opportunities

(2) The presence and support of Conservation International in Peñablanca should be aggressively tapped in PES establishment

(3) Institutional reforms must be undertaken with respect to access of funds for conservation activities in the Integrated Protected Area Fund to make it less bureaucratic.

Bibliography

Bishop, J. 2003. "Payments for ecosystem services: A case of sustainable globalisation? Paper presented at the "Globalisation, localization and tropical forest management in the 21st century", Amsterdam, October.

Bishop, J. and N. Landell-Mills. 2002. "Forest Environmental Services: An Overview." In Pagiola, Bishop and Landell-Mills (eds), 2002.

Dixon, R.K., K.J. Andrasko, F.G. Sussman, M.A. Lavinson,, M.C. Trexler and T.S. Vinson. 1993. The forest-sector carbon-offset projects: near term opportunities to mitigate greenhouse gas emission. Water, Air and Soil Pollution 70., 561-577.

Federer C.A. and Lash D. 1978. BROOK: A hydrologic simulation model for eastern forest. Water Resources Research Center, University of New Hampshire. Durham, New Hampshire.

Grieg-Gran and J. Bishop. 2005. "How Can Markets for Ecosystem Services Benefit the Poor?".

Grieg-Gran, M. and C. Bann. 2003. "A Closer Look at Payments and Markets for Environmental Services." In Gutman, P. (ed), 2003.

Gouyan, A. 2003. **Rewarding the Upland Poor for Environmental Services: A Review of Initiatives from Development Countries**. World Agroforestry Centre. Bogor, Indonesia.

Gutman, P. (ed). 2003. **From Good-will to Payments for Environmental Services: A Survey of Financing Alternatives for Sustainable Natural Resource Management in Developing Countries**. Worldwide Fund for Nature and DANIDA.

Kerr, J. 2002. "Sharing the Benefits of Watershed Management in Sukhomajri, India." In Pagiola, Bishop and Landell-Mills (eds), 2002.

Landell-Mills, N. 2002. "Developing markets for forest environmental services: an opportunity for promoting equity while securing efficiency?". **Phil. Trans. R. Soc Lond.** 360, 1817-1825. The Royal Society.

Landell-Mills, N. and I. Porras. 2002. **Silver bullet or fools' gold? A global review of markets for forest environmental services and their impacts on the poor**. Instruments for sustainable private sector forestry series. International Institute for Environment and Development. London.

Lasco, R.D., F.B. Pulhin. 2000. Forest Land Use Change in the Philippines and Climate Change Mitigation. Mitigation and Adaptation Strategies for Global Change 5, 81-97.

Lasco, R.D. 2002. "Carbon generation through Multiple Land Use Activities in the Sierra Madre. Quirino, Philippines. A feasibility Analysis for Development of a creditable Carbon Offsets Project". Conservation International.

Lasco, R.D., J.S. Lales, Ma. T. Arnuevo, I. Q. Guillermo, A. C. de Jesus, R. Medrano, O.F. Bajar, C. V. Mendoza. 2002. Carbon dioxide (CO2) storage and sequestration of land cover in the Leyte Geothermal Reservation. Renewable Energy 25, 307-315.

National Commission for Indigenous Peoples Survey. 2003. NCIP, Region II.

Pagiola, S., A Arcenas and G. Platais. 2005. "Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to date from Latin America," **World Development,** Vol. 33, No. 2, pp. 237-253.

Pagiola, S., J. Bishop and N. Landell-Mills (eds). 2002. **Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development.** Earthscan Publications Ltd.

Powell, I., A. White and N. Landell-Mills. 2002. **Developing Markets for the Ecosystem Services of Forests**. Forest Trends. Washington, D.C.

Rosales, R. 2004. Developing Pro-Poor Markets for Environmental Services in the Philippines. International Institute for Environment and Development. London

Tipper, R. 2002. "Helping Indigenous Farmers to Participate in the International Market for Carbon Services: The Case of Scolel Te." In Pagiola, Bishop and Landell-Mills (eds), 2002.

Wunder, S. 1999. **Promoting Forest Conservation through Ecotourism Income? A Case Study from the Ecuadorian Amazon Region**. Occasional Paper No. 21. Center for International Forestry Research. Bogor, Indonesia.