ASSESSING THE EFFECTIVENESS OF PAYMENT FOR ENVIRONMENTAL SERVICES (PES) SCHEME: THE CASE OF RUPA LAKE IN NEPAL

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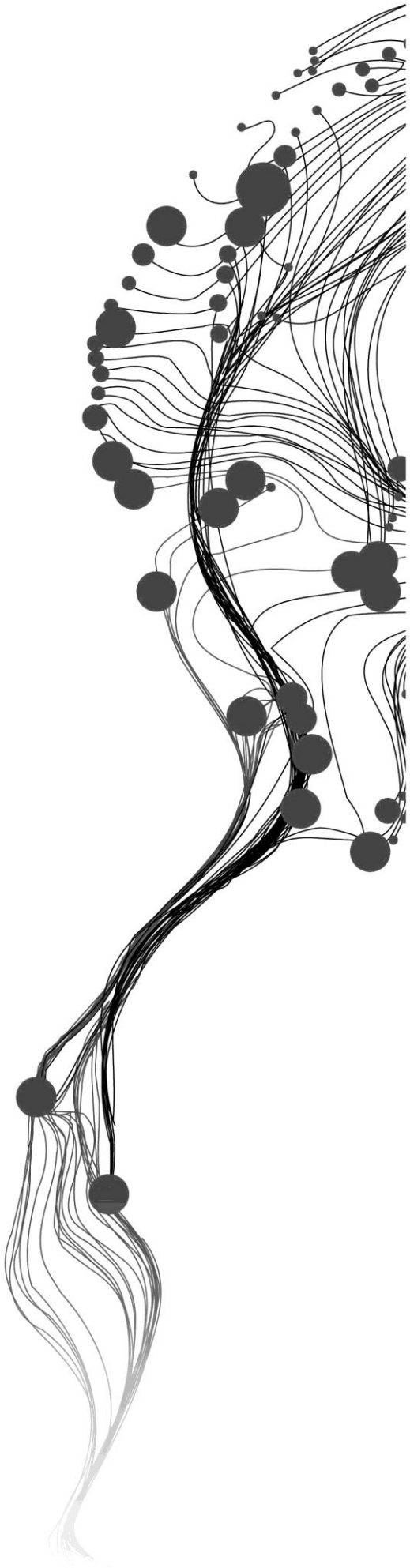

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KESHAV SHARMA
Enschede, The Netherlands, February, 2011

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.
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ABSTRACT

The concept of payment for environmental services (PES) has been introduced as a new approach for conservation practices where buyers and sellers are linked through environmental services. In this case study, the buyer is a cooperative, the sellers are Community Forest Users Groups and the environmental service is water in a lake. This study focuses on assessing the effectiveness of a PES scheme in Rupa Lake, Nepal and its watershed area. In particular, the effectiveness of the scheme is considered as the degree to which certain assessment criteria have been achieved. The assessment criteria used are elements of PES, resource manager's behaviour, land cover changes, socio economic conditions and current livelihood, opportunity cost and institutional settings. Nowadays, remote sensing is used to understand human activities in space. For this study, land cover maps were prepared and areas participating with a PES scheme and non-participating area were compared. The aim is to assess the forest cover and water cover changes. The findings show that there are positive changes in forest cover and water cover after the implementation of the scheme. In addition, a comparison study was undertaken among households between participating and non-participating area in PES scheme for assessing socio-economic condition and current livelihood. However, the results of the socio-economic survey do not reveal the significant positive impacts of the scheme in participating area. There are visible changes in infrastructural development and awareness-raising activities. Nonetheless, while the elements of PES are observed to be weak; the interesting part of the study is a downstream-upstream relationship which differs from the other PES arrangements where upstream sellers are paid for the environmental services they provided. In this case, the annual percentage based payment system from the income generated by fisheries management in the lake and membership in the cooperative set up a linkage to the upstream communities. Thus the scheme provides new insights in PES arrangement in local settings. Apart from these, the creation of conflict on benefits sharing between participating and non-participating areas due to the existing laws is a governance challenge.

Keywords: *Payment for environmental services, effectiveness, remote sensing, governance challenge*

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ALOS:	Advanced Land Observing Satellite
ASTER	Advanced Space borne Thermal Emission and Reflection Radiometer
CBS:	Central Bureau of Statistics
CEDERANA	Corporation for the Development of Renewal Natural Resources
CFUG:	Community Forest User's Groups
DFID:	Department for International Development
EGP:	Ecosystems Grant Program
ES:	Environmental Services
FCC:	Forest Consumer's Committee
FRC:	Fisheries Research Centre
ICIMOD:	International Centre for Integrated Mountain Development
ICRAF:	International Centre for Research in Agroforestry
IUCN:	International Union for Conservation of Nature
KHP:	Kulekhani Hydropower Plant
LI-BIRD:	Local Initiatives for Biodiversity, Research and Development
LSGA:	Local Self-Governance Act
MEA:	Millennium Ecosystem Assessment
PES:	Payment for Environmental Services
PROFAFOR:	Programa Face de Forestaci Ón
RLRFC:	Rupa Lake Rehabilitation and Fisheries Cooperatives
RUPES:	Rewards for, Use of and shared investment in Poor-poor Environmental Services
SLF:	Sustainable Livelihood Framework
SNP:	Shivapuri National Park
VWS:	Vandorn Water Sampler
WTA:	Willingness to Accept
WTP:	Willingness to Pay

1. INTRODUCTION

1.1. Background

Goods and services consumed from ecological systems have become the prominent issues for Conservationists in recent years. These ecosystem services are currently familiarized as a new and more straightforward way to promote conservation (Wunder, 2007). In this regard, the concept of payment for environmental services (PES) was introduced as a more direct conservation approaches with the economic incentives. It has been established as a market based tool to support the environmental conservation (Wunder, 2005). Mostly used common definition of PES is "(a) a voluntary transaction where (b) a well-defined environmental services (c) is being bought by a minimum one ES buyer (d) from a minimum one ES provider (e) if and only if the ES provider secures ES provision (conditionality)"(Wunder, 2005).

Watershed is the total area from which water is naturally generated and flow towards the downstream. It is a combination of land uses including forests, settlements, agricultural land and water bodies. The interaction of these phenomena in watershed is called an ecosystem. The ecosystem services are the benefits that people obtained from the ecosystem (Millennium Ecosystem Assessment, 2005). The widespread perception is that conservation of the forest can have a positive impact on watershed function but still there is not strong scientific relation with forest conservation and watershed. The basic assumption is forest helps in flow of clean water, prevention of soil erosion and flood control (Landell-Mills & Porras, 2002).

In accordance with this, watershed management practices were conceptualized in the 1960s in Nepal. Realizing the importance of watershed management, Government of Nepal established the Department of soil and watershed conservation in 1974 under the then Ministry of Forest. Since 1988, people's participation in the watershed management program has been highlighted by Water Plan of Forestry Sector but it still lacks effective watershed management program to cope up with the environmental and the social problems as well (Singh et al., 2004).The traditional watershed management practices basically depend upon regulatory approaches or subsidies to support the conservation techniques (Kaimowitz, 2000). Though watershed management has a long history in Nepal, literatures revealed that there is a gap of interlink between downstream users and upstream service providers (Upadhyaya, 2006).

In Nepal, PES program was initiated with dual aims of ecosystem conservation and enhancing livelihood at the local level. Rewards for, use of and shared investment in Pro-poor Environmental Services (RUPES) has implemented a project in Kulekhani watershed area supported by Winrock International for testing PES scheme to provide rewards to the communities in a catchment of the Kulekhani Hydropower Plant (KHP). Likewise, the study of potential PES framework is conducted by International Centre for Integrated Mountain Development (ICIMOD) in collaboration with International Centre for Research in Agroforestry (ICRAF) in Shivapuri National Park (SNP) for providing drinking water inside Kathmandu valley (RUPES)

The PES scheme in Rupa Lake and its watershed area is a new concept of watershed management by providing incentives to upland community from the benefit acquired in downstream. To support the program, Local Initiatives for Biodiversity, Research and Development (LI-BIRD) with financial support of Ecosystems Grants Program (EGP), IUCN-Netherlands piloted an integrated ecosystem based approach to manage wetlands. In Rupa lake payment for environmental system was initiated in 2001. The Rupa Lake Rehabilitation and Fisheries Cooperatives (RLRFC) pay 25% of its income from fishery management to the upstream communities. Besides cash payment, there are also other forms of support

to the communities. Though the support of LI-BIRD and EGP has been terminated in year 2008, the PES scheme has been continuing according to earlier established mechanism.

1.2. Definition of terms

The terms used frequently as a part of this study are effectiveness, assessment framework, payment for environmental services, watershed area; upstream, downstream and non-participating are briefly introduced in this sub-section.

1.2.1. Effectiveness

For this case study, effectiveness is a degree to which the evaluation criteria have been achieved. Any program is effective only when the program itself is actually root cause of the effect. It is measured by assessing the impacts to know what the changes are due to the particular program, policy or intervention (Kumar, 1999). In this work, effectiveness of PES scheme was taken as how far are the PES elements in the particular scheme explicitly or implicitly implemented and also the degree to which the impacts of the scheme are fulfilling the evaluation criteria.

1.2.2. Assessment Framework

A framework is a guideline or set of criteria with a clear theoretical and conceptual foundation and is essential for carrying out an evidence-based assessment in a consistent way. Assessment framework recommends the domain that should be anticipated in an assessment because without this assessment framework assessors may be unsuccessful to include core information (Crisp et al., 2005). In this study a set of criteria was derived based on common PES elements and other aspects like resource manager's behaviour, land cover changes, socio-economic conditions and sustainability based on literature survey, described in details on chapter two of this case study.

1.2.3. Payment for Environmental / Ecosystem Services (PES)

The arrangement of payment is established between group of people living in downstream around the lake and upstream of the watershed area. As in most of PES literatures, the term environment and ecosystem are interchangeably used same is the case here. The only difference is that the term environmental is used more in wider scope like carbon sequestration services and ecosystem is used in smaller scale like in watershed services.

1.2.4. Watershed area

The watershed area is the area of a catchment from where water feeds to the lake. For the objective of this case study the area of interest is defined according to the watershed. It consists of slopes having forest, water bodies including lake and also people living in the watershed area.

1.2.5. Upstream area

The upstream area in this context is the upper part of the watershed where environmental service providers are living. The people of the upstream are resource managers, sellers in terms of PES arrangement.

1.2.6. Downstream area

The downstream area is the lower part of the watershed, the area around the lake. The people living in this area are service receivers, buyers in terms of PES arrangement.

1.2.7. Non-participating area

The non-participating area is the adjacent area with the upstream of the PES scheme and has been selected for the comparison study of this research with the participating area, upstream of the PES

arrangement. The area has similar physical characteristics and the intention of the selection was also as a control group of the whole research for assessing the effectiveness of PES scheme.

1.3. Justification of the Study

The concept of PES introduces since 1980's and there are several exercises of PES mechanism found around the world. Engel et al. (2008) argued that in most of the cases the study focused on proposal mechanism than the assessment of the real work. Likewise, Lebel & Daniel (2009) draw attention for further research on how the practical knowledge of ecosystem services can be incorporated for improving governance of the ecosystem. This implies the need of actual assessment of the PES scheme. Furthermore, nowadays remote sensing method is popular for understanding people behaviour towards their land use. The use of remote sensing methods for assessing the forest cover changes in the PES scheme is in recent practice. For the research work, a PES scheme in Rupa Lake and its watershed area from Nepal was selected. More interestingly, this case study is related to water as an environmental service which has been used for fishing in the lake. Assessing the PES scheme using remote sensing methods from above and socio-economic survey method from the ground is quite popular field of the study. Similarly, in case of Nepal, there is absence of national policy related to PES mechanism till date, it is guided by the Local Self Governing Act, 1997 and most of the PES programs are focused on the incentives based on the negotiation and distributed to upland community. So this study would be helpful for designing PES framework in future. Moreover, as there is no single research which assessed the effectiveness of PES from the aforementioned perspectives has been done till date, this type of research can be an interesting field of study.

1.4. Research Problem

The PES scheme introduced as an effective approach for conserving bio-diversity and environment in the watershed area. However, the PES scheme has been in operation from the last nine years in Rupa Lake and its watershed area, the impact of the scheme has not been studied yet. Nowadays, the cooperative has a large income from fishery management and the benefit has been shared by its members. The number of cooperative members has increased from 36 to 722 during the period. The upland communities are also benefiting by including as a membership in the cooperative. So, both the communities are the members of the cooperative and they are sharing the local resource. In this situation the question pops up whether the economic activity is increased due to PES scheme or lake management by the cooperative? Furthermore, in the upstream from the long time, CFUG's are responsible for conservation of the forest. No study has been conducted to assess the changes in forest cover before and after implementation of the PES scheme. Thus the aforementioned issues pinpoints questions like whether this scheme really complies with the PES elements. Does the scheme have impacts on socio-economic condition of the people? Are there any changes in forest cover after the implementation of the PES scheme? Those questions lead the researcher to assess the effectiveness of the existing PES scheme.

1.5. Main Objective

To assess the effectiveness of Payment for Environmental Services (PES) scheme in Rupa Lake and its watershed area.

Sub-Objectives:

1) To assess the existing PES scheme with common PES elements.
2) To assess the contributions of PES scheme in the current livelihood of the stakeholder.
3) To assess the role of PES scheme in supporting the conservation of lake and forest.

4) To assess the changes in land cover types in the study area and identify the spatial relationships to PES scheme.

1.6. Research Questions

Questions for sub-objective 1

(a) Who are the stakeholders?
(b) What are the benefits that stakeholders are getting from existing PES scheme?
(c) How the institutions involved are interacting?
(d) What are the relationships between buyers and sellers of ES?
(e) How the mechanism is working for the payment?
(f) What are the issues and challenges in implementation of PES scheme?
(g) How far it complies with common PES elements?

Questions for sub-objective 2

(h) What is the current livelihood system in the area participating in PES scheme?
(i) How effective is the livelihood in area with PES scheme?

Questions for sub-objective 3

(j) How the resource manager's behaving in the area with PES scheme?
(k) What are the measures taken for forest conservation and lake management?

Questions for sub-objective 4

(l) What changes occurred and why in land cover due to implementation of PES scheme in the study area during the period of 1998-2009?

1.7. Conceptual Framework

As the major objective of the study is related to assess the effectiveness of the PES scheme, a conceptual framework was designed to perform the study. The assessment framework has been used to assess the effectiveness of a PES scheme using a set of criteria determined by literature study and the related concepts. It contains common PES elements; voluntary transaction, well-defined environmental services, buyers and sellers, mechanism for payment and also other criteria chosen are resource manager's behaviour, land cover changes, socio-economic condition and sustainability. The comparative study between the area with a PES scheme and without a PES scheme was done. Likewise, the PES scheme was compared with common elements of a PES to assess how far the elements of PES have been implemented. The conceptual framework used for the study is mentioned below in the figure

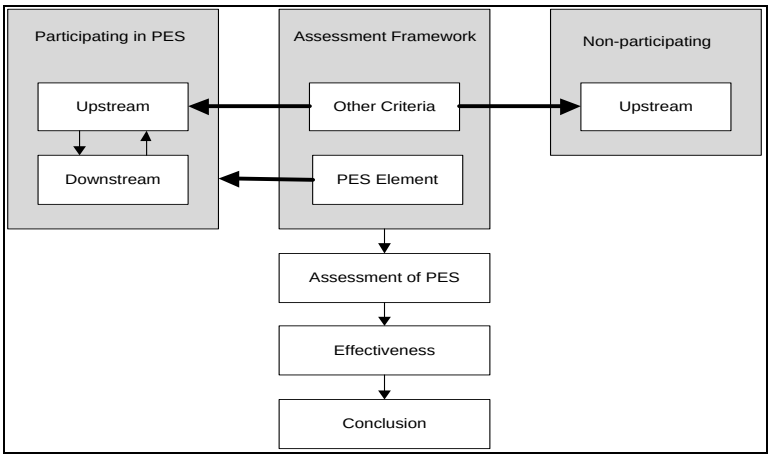

Figure 1.1: Conceptual Framework

1.8. Research Design

This research was started with literature review for the development of framework for assessing the effectiveness of the PES program in the particular study area. The research was undertaken in three stages namely pre-field work, field work and post field work which is shown in figure below:

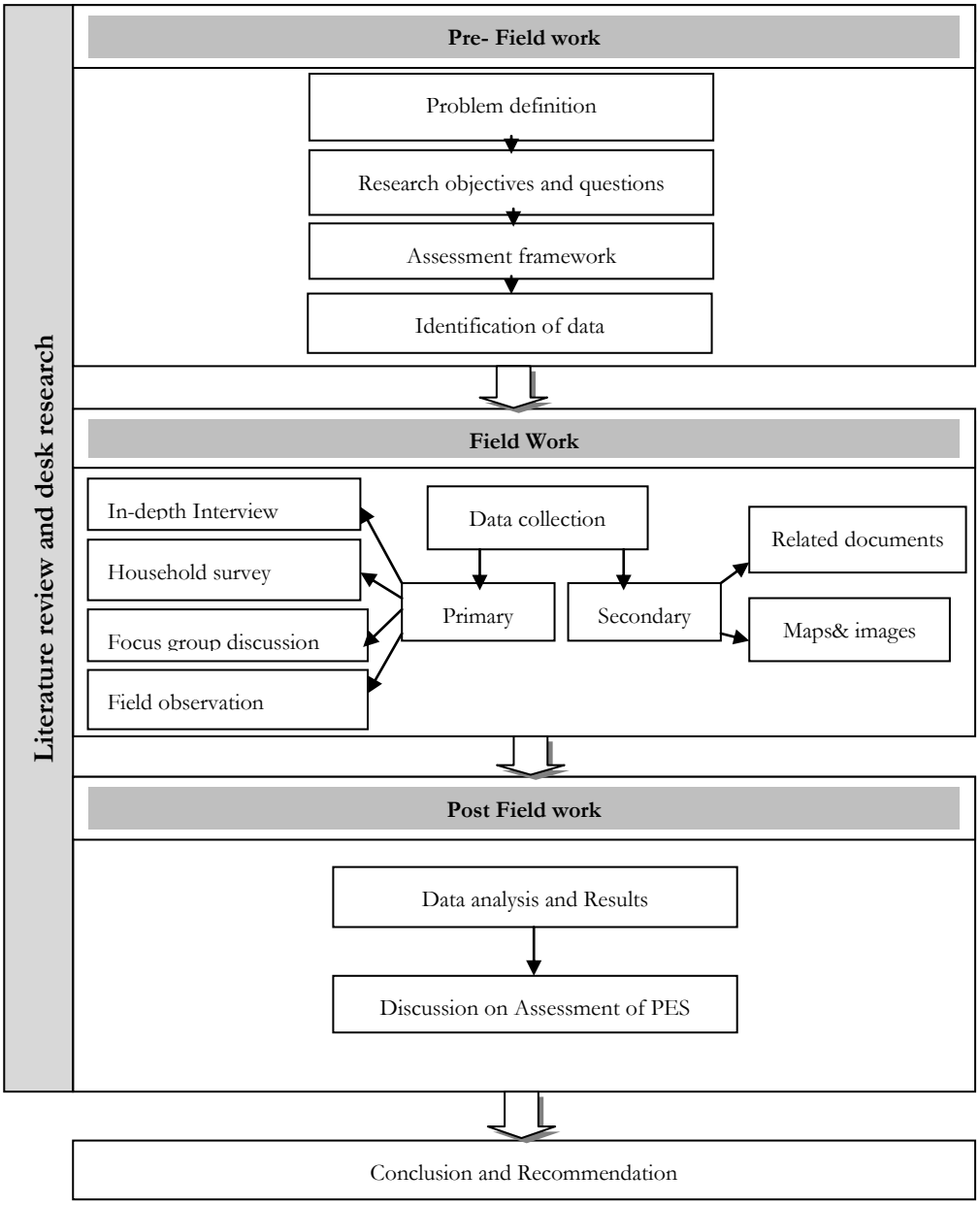

Figure 1.2: Research Design

1.8.1. Pre-field work

In this phase, the related literature of PES was identified and discussed as an introduction of the research topic which followed by defining the statement of problem and objective of the study. Likewise, as the main objective of the study was to assess the effectiveness of PES program, the related concepts were selected for the preparation of assessment framework. Moreover, selection of the study area, collection of field materials, research methodology (described in chapter 3), data collection techniques and development of questionnaires was done in this phase.

1.8.2. Field work

The three week long field visit was done for data collection in this phase. The household survey, interviewing locals and field observation were performed. The secondary data from cooperative, village development office, municipality and central bureau of statistics were collected. Moreover, ground sample points for forest, water, cultivation sand and barren land were collected by using GPS.

1.8.3. Post field work

This phase includes the data processing, data analysis and results, discussion on assessment of PES scheme and finally followed by conclusion and recommendations. The detailed are described in chapter four, five and six.

1.9. Thesis Structure

This chapter presents the background and justification of the study area. The basic concepts of PES, its application in watershed conservation and few examples from the study area are also included briefly with main objective, sub-objectives and research questions.

Chapter two deals with the conceptual framework and current trend derived from the literatures on PES. From the different examples and current experiences on PES, the framework for assessing the effectiveness is derived.

Chapter three provides the research methodology and description of the study area. The methodology involved, data collection methods and information about existing PES scheme is discussed in the chapter.

Chapter four presents data analysis and results obtained from the field study. It includes the results from household survey and image classification for the land cover changes in the study area.

Chapter five is the assessment of the PES scheme depending upon the data analysis and results obtained from the previous chapter.

Chapter six draws final conclusion and recommendation as well for the further study.

2. CONCEPTUAL FRAMEWORK AND CURRENT TRENDS : A DESK STUDY

2.1. Introduction

This chapter provides an insight on the concepts of PES in the conservation practices based on the various literatures. For the purpose of assessing the effectiveness of existing PES scheme the elements of PES are derived from theoretical and practical experiences. This chapter principally focuses on designing conceptual framework for assessing the existing PES scheme.

2.2. Concepts of Payment for Environmental Services(PES)

The Payment for Environmental Services(PES) has been promoted since the late 1980's with wider idea of market environmentalism (Kosoy & Corbera, 2010), attracting interest as a mechanism to translate non-market values of the environment into real monetary incentives for providing environmental services(ES)(Engel, et al., 2008). The concept follows the free market. In the current PES literatures, there are dominant market approaches for defining PES from Coasen economics which cannot be easily generalized and applied in a practice(Muradian et al., 2010).The PES is a market mechanism established between non-atomic buyer /seller and environmental services (natural product) which are difficult to quantify, quality measurement, and specification. The seller and buyer are also representing the group of people in different spatial location linked by environmental services. They are the institutions representing the aggregation of other institutions which makes the PES mechanism more complex and differs from normal market mechanism.

Ideally PES can be modelled as follows:

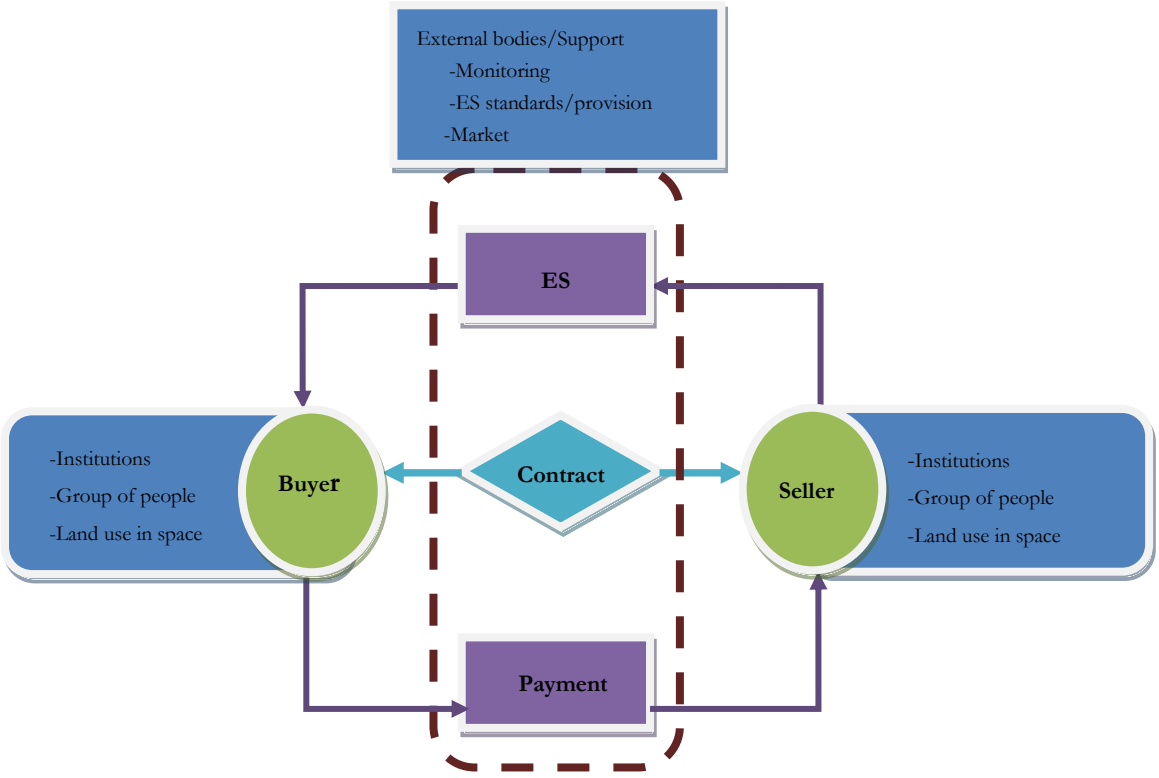

Figure 2.1: Conceptual Model of PES

2.3. Environmental Services (ES)

Environmental services are defined as the goods and services created by the environment or the ecosystem. These services are nature dependent and the quality of the services depends upon the people involved in the conservation and management of the services. Environmental services are mostly categorised as i) carbon sequestration; ii) protection of landscapes; iii) provision of habitat for endangered species; iv) various hydrological function linked to quality, quantity or fresh water flows from upstream to downstream(Gómez-Baggethun et al., 2010). Among them, water related environmental services are the most common, carbon sequestration services from forest are popular nowadays in global climate change issue and the rest of the environmental services are related to nature based tourism and bio-diversity.

2.4. Types of PES Scheme

The various types of PES schemes which have been practiced in developed and developing countries ranges from market based pure pro-efficient PES scheme to pro-poor scheme based on redistribution of benefits. McAfee & Shapiro (2010) classified the PES scheme as pro-efficiency, pro-market and pro-poor and compensation for ES, depending upon their primary goal. The first type of schemes have environmental efficiency as a primary outcome; second type schemes try to balance environmental conservation with poverty reduction and third type schemes aim on social outcomes with compensation based on the principle that poverty reduction and environmental conservation are inseparable. Area-based and product based PES schemes are another classification by Wunder(2005). The area based schemes are based on the agreements where payment depends on the effort made for the conservation like land used in catchment conservation and tree planted for establishing forest-carbon relationship whereas in product based schemes depend on the current market price for the environmental services provided. Engel et.al (2008) categorised the PES schemes as a public and private schemes, depending upon the nature of buyers. In public PES schemes, government is ES buyer or acting as a intermediaries whereas when the buyer are actual users and paying directly to ES seller then such types of PES are considered as a user-financed or private PES schemes. Likewise, Wunder(2005) also mentioned about asset building and use restriction schemes. The former type is based on the renovation of the particular area, providing ES by adding extra efforts for maintain the services whereas later types are more depends upon the opportunity cost of ES providers. For an example if upstream community is protecting forest for the fresh water services, then the cost for not cutting the forest or lower their dependencies to the forest is use restriction types of PES scheme.

2.5. Current Practices and Deliberation in PES

While the concepts of PES program started from the developed countries like Australia and America in late 1980's, it has been spreading all over the world in a short time. There are succeed PES interventions in New South Wales, Australia, where organization of farmers buys salinity credits from the State Forest Agency and the state agency in return contracts with upstream farmers for tree plantation. United States induced PES arrangement as agro-environmental payment system(Claassen et al., 2008). Likewise, in 1966, Costa Rica established a national system of conservation payments in which the government brokers made contracts between international and national buyers with local sellers of sequestered carbon, watershed services and scenic beauty(Chopra et al., 2005). Ecuador has decentralized and consolidated experiences in PES scheme, one is Pimampiro municipal watershed-protection scheme and another is PROFAFOR carbon-sequestration scheme. Both the schemes are successful having strong focus on the targeted environmental services and degree of conditionality, key factors of achievements(Wunder & Alban, 2008). In comparison, Costa Rican PES schemes are centralised whereas Ecuadorian schemes are self-organised and decentralised. In Ecuador PES program is a part of forest management plan. The Ecuadorian Corporation for the Development of Renewal Natural Resources (CEDERENA) involved for designing the scheme(Wunder & Alban, 2008). Likewise, in Vietnam, PES has grown particularly as a pro-poor and conservation approach which does not fall in pure marked based PES definition(Wunder, 2005) because

there are strong connections to nature and surroundings based on people indigenous knowledge related to forest(Petheram & Campbell, 2010). In Asia, Indonesia and Philippines have a lot of experiences in implementing PES scheme whereas countries like India, Nepal, Thailand and Vietnam have a short history in experiencing PES scheme. In developing countries most of the PES schemes are supported by external donors and still are in phase of trial and error. In case of developed countries the environmental conservation is a central theme of PES design while in developing countries the most of the PES schemes have a twin goal of environmental conservation and poverty alleviation. Furthermore, nowadays the issues of ecosystem services within local and regional policy framework are also in discussion (TEEB, 2010). It focuses on the implementation of ecosystem services in local settings.

Apart from the current practices of PES scheme in implementation level, the conceptual arguments lead to the various views. Most commonly, two different schools of thoughts, environmental economics and ecological economics have their views in PES. The environmental economics approach focuses on PES as a market model, emphasis on efficiency whereas ecological economics approach has more attention on economic institutions, ecological sustainability and just distribution (Farley & Costanza, 2010). The majority of literatures focused on efficiency as a guiding principles of PES which in turn mismatches the theory and practices of PES(Pascual et al., 2010). The need of reflexive dialogue to reconcile both theoretical and practical views is raised as an alternatives concept of PES (Muradian, et al., 2010). Moreover, Corbera et al.(2009) put emphasis on institutional design, performance and interplay between various actors as a major dimension for PES design and implementation. The results of PES program in terms of equity and efficiency are still in question. There are interdependencies between efficiency and equity from conceptual view which should be considered on PES schemes (Pascual, et al., 2010). Engel et al. (2008) argued that "*Though there is significant interest in the exercise of PES mechanism, few PES mechanism have been cautiously documented, mostly confined in a grey literature focusing more on proposal mechanism rather than assessment of actual working mechanism"*. Lebel & Daniel (2009)draw attention to further research on *"How the practical knowledge and experiences of ecosystem service managers can be integrated into scientific research to improve the governance of ecosystem services?* "Likewise, Skutsch et al.(2010)mentioned about the chances of slippage between the design and response, possibility of collusion among givers, targets and intermediaries rather than coordinated alliances in PES mechanism.

This implies that the debate on PES started from its emergence and scholars have their views based on theories, practices and background. The real crux around PES discussion is, it is a mechanism established for providing incentives/rewards/compensation to service provider for the environmental conservation and the mechanism, scheme, or method depends upon the geographical context and local settings so every PES mechanism is more case specific than universal.

2.6. Framework for Assessing the Effectiveness of PES scheme

This research is conducted to assess the effectiveness of PES scheme in Nepalese watershed conservation and current livelihood of the people. The watershed consists of all water bodies, forest, agro ecosystem with distinct socio-economic ,environmental and political dimensions(Regmi et al., 2009) which makes the resource management mechanism more complex and multifaceted because of the interaction and interplay among people of different interest in a specific bio-physical and socio-economic context(Ostrom, 2005) Looking at biodiversity through a single lens neglects other values that play an important role in biodiversity conservation(Kosoy & Corbera, 2010). That's why for this research set of criteria were developed depending on Wunder's criteria and from other types of PES schemes.

2.6.1. Effectiveness in PES scheme

Effectiveness of any policy or program is measured on the basis how far it is effective in goal achievement. To assess the environmental institution, it is urgent to identify the positive impact in environmental conservation. After studying various PES types and practical experiences in PES it has

been observed that there is not any specific types of PES which can be used for comparison in other locations. The important characteristic of every PES scheme is there are some fundamental elements of PES which can be used for assessing the PES scheme. The effectiveness of PES scheme was taken as how far are the PES elements in the particular scheme explicitly or implicitly implemented and also what are the impacts of the scheme in the area. The set of criteria were taken, depending on Wunder's criteria(Wunder, 2005) and other aspects of PES schemes. To measure the actual impact of any program it should be measured what would happen if the program were not in place, which includes the comparison research design, before and after / time series design(Purdon et al., 2001).

For assessing the effectiveness, mixed approach research design was used, which contains quasi experimental design, qualitative data, content analysis and statistical methods (Golledge & Stimson 1997). Firstly, the existing program was compared with the common elements of PES from (Wunder, 2005). Secondly for evaluating the performance of environmental institutions, a comparative study was done between the state of the world in presence of an environmental institution to what that would have been in the institution's absence using Mitchell(2008). Fortunately, in this case there is a watershed in neighbourhood having same physical characteristics for the comparison. Thirdly, a comparative analysis was conducted on the situation before and after implementation of PES scheme.

2.6.2. Elements of PES

For the assessment of the effectiveness of PES scheme, based on mostly used definition of Wunder (2005), the following elements were chosen.

- **Voluntary Transaction**: It is based on voluntary cannot be enforced. Both parties (seller and buyer) have Willingness to Pay (WTP) and Willingness to Accept (WTA).
- **Well-defined Environmental Services**: Measurable services and has specific standards in terms of quantity, quality for a certain time and space.
- **Buyers (Beneficiaries) and Sellers (Resource manager):** There must be defined buyers, recipient who pays a price to seller who provides an Environmental Services.
- **Mechanism for transferring payments/compensation (conditionality):** There should be mechanism which secures ES sellers is paid what they provided and ES buyers are paid what they received. There are various institutional roles in PES mechanism for safeguarding of stakeholders and environmental conservation, including efficiency and equity concerns.

Apart from the aforementioned common elements of PES scheme, the following additional criteria were found worthwhile for assessing the effectiveness of the PES scheme in a particular area.

2.6.3. Resource manager's behaviour

The change in resource manager's behaviour in using resources is a one of the key criteria for assessing effectiveness of PES program. There is successful example in ecosystem management like in Costa Rica, by introducing effective incentives for the conservation rather than calculating the economic value of ecosystem. Such incentives can be monetary or in-kind incentives (Pagiola, 2008) and the level of transfers is based on changes in institutional practices and individual habits and behaviour (Spangenberg & Settele, 2010). Thus the successful implementation of PES scheme necessitates the changes or improvements in resource manager's behaviour.

2.6.4. Land cover changes and Land use

Nowadays, the application of remote sensing method for understanding the environmental and socio-economic conditions has long attraction (Lu & Weng, 2007). After implementation of PES program, it is essential to look at the changes in land cover during certain time interval. Assessing forest cover changes is the most popular way to see the forest conservation practices which provides the impacts of PES arrangements (Pagiola, 2008). A better understanding of land use and cover changes are important for

PES scheme design and implementation. What kinds of policies really influence the pattern of land use? Is it regulation based traditional approach or rewards for the environmental services (Tomich et al., 2004)? The PES mechanism is only realistic when it has connection with land use activities. For the forest cover assessment, remote sensing technology was used in Costa Rica for preparing base line map. The supervised image classification process was done for the forest assessment(Kalacska et al., 2008). The image classification includes selection of ground truth points, image processing, classification approach, post-classification processing and finally accuracy assessment of the work (Lu & Weng, 2007).

2.6.5. Socio-economic condition and Current livelihood

While PES concepts emerged as a purely market based approach-focusing on efficiency for payments in environmental conservation, the issue of just distribution and how it would be more effective in supporting socio-economic condition of the resource manager are the challenging aspects in implementation of PES basically in developing countries. Though the main goal of PES is not poverty alleviation, several cases reveal that it helps in improving livelihood security of the environmental service providers (Wunder, 2005). Pro-poor PES schemes assist people to participate in the program (Pagiola et al., 2005). Thus the comparison of socio-economic condition of the areas participating in PES and those which do not with is one of the conditions for assessing the effectiveness of the scheme. It shows whether the particular program has an additional effect on the livelihood of the people. The Sustainable Livelihood Framework (SLF) developed was developed by Department For International Development(DFID) in vulnerability context(DFID, 2001). Livelihood is defined as capabilities, assets (both material and social resources) and means of living and is sustainable when it can cope with and also recover from shocks and retain the capabilities and assets for present and future (Chambers & Conway, 1991).The five types of livelihood assets described in DFID(2001)are human capital (the knowledge, skill, and health), physical capital (local infrastructures like road, schools and hospitals), and socio-political capital (membership of groups, networks and access to institution of the society), natural capital (stock of natural resources) and financial capital (income, saving and other financial resources). For assessing the livelihood impacts of PES, a comparative case study of nine cases from Asia, Africa and Latin America were done in livelihood analysis approach focusing on these five capitals. The analysis was done by using five types of capital, namely financial, human, natural, socio/political and physical(Tacconi et al., 2009).

2.6.6. Sustainability

If payment is sufficient for the costs of undertaking a desired activity, the receivers may feel inherent responsibility to respond (Farley & Costanza, 2010). For the sustainability of the PES program it is necessary to maintain opportunity costs otherwise their motivation of conservation might be decreased. Similarly, the sustainability of PES mechanism depends upon long term-land use planning, the transaction cost of the program and finally on the possibilities for the self-regulation of the PES scheme. (Noordwijk, 2010) emphasises on the linkages between the environmental service and land use for the realistic PES. Likewise, the distribution of benefits and poverty issues are overarching concerns in PES scheme for developing countries. Nonetheless, the economic efficiency is a major issue by most of the academicians; the problem for practitioners is that it is difficult to measure the economic efficiency. In most of the cases, the resource managers are poor people in uplands. The issue is how the poor stake holders can become efficient environmental service providers and the PES scheme arises as win-win situation in terms of poverty reduction and providing environmental services as well (Pascual, et al., 2010). For the efficient outcomes, the distribution of benefits and existing power structure (whose voice affects the decision) are also likely to change, the matter of equity. Finally, institutional aspects for arranging the whole mechanism of PES scheme are also crucial(Corbera, et al., 2009). Thus the reflections on these factors in particular PES scheme were also taken for assessing the effectiveness of the scheme.

2.7. Concluding remarks

This chapter provided the concepts of PES, current practices and conceptual arguments leads to the various views. Likewise, the framework was developed for assessing the effectiveness considering the various evaluation criteria. The evaluation criteria chosen are elements of PES, resource manager's behaviour, land cover changes and land use, socio-economic condition and also the opportunity cost, equity and poverty issues and institutional setting for the sustainability of the PES scheme.

3. RESEARCH METHODOLOGY AND STUDY AREA

3.1. Introduction

The concepts of PES and the framework needed for assessing the effectiveness of a particular PES scheme was designed in the previous chapter based on the various literatures on PES. This chapter aims to describe the data collection procedure and research methodology followed for the data collection including the details of the study area.

3.2. Research Method

Based on the time for data collection (three weeks) and the topic of the research, researcher selected case study method supported by desk study. For assessing effectiveness, mixed approach research design was used which contains quasi experimental design , qualitative data, content and statistical analysis (Golledge & Stimson 1997). Likewise, to assess how far the program is effective in implementation level, the comparison study between the state of the world in presence of an environmental institution to what that would have been in the institution's absence described in Mitchell(2008) was used. In this case, fortunately there is a watershed in the neighborhood with same physical characteristics. Thus the area participating in PES scheme was compared to the adjacent area, not participating in the scheme. The effectiveness was assessed to the predetermined assessment criteria.

3.3. Flow chart of research work

The overall research was carried out in the following steps which are shown in the flow chart below:

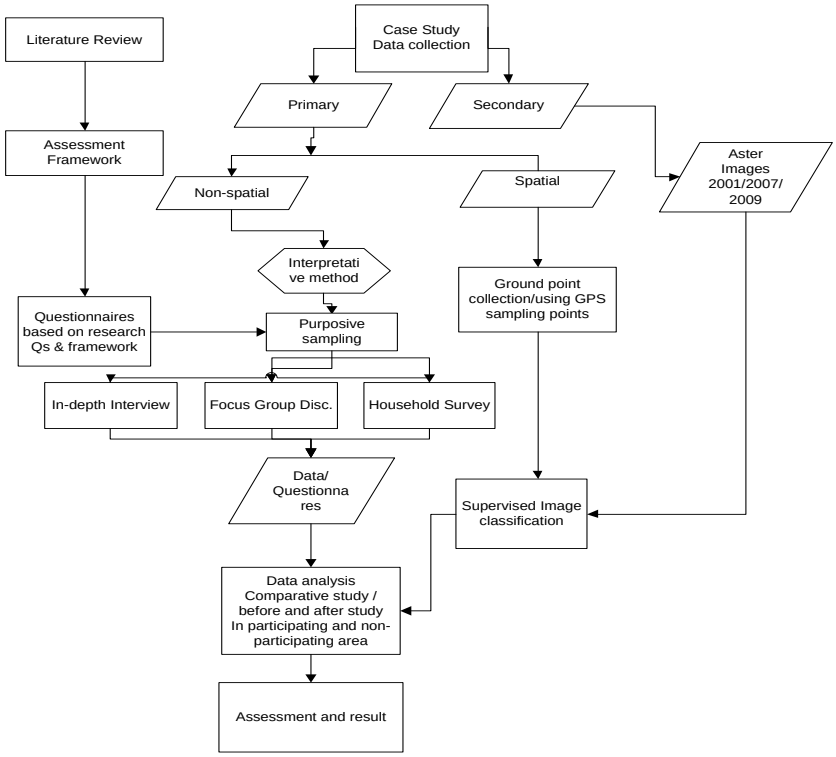

Figure 3.1: Flowchart of research work

3.3.1. Case study

The main focus of the case study is to acquire in-depth understanding of a phenomenon and its background. "Case studies typically combine data collection techniques such as interviews, observation, questionnaires, and document and text analysis"(Darke et al., 1998). For the proposed study, qualitative data collection, concerned with words and meanings and quantitative methods which are related with numbers and measurement were used. Thus for assessing a particular PES mechanism in a specific area, a case from Nepal was chosen and the fieldwork was considered as a source of providing empirical situation for the entire study.

3.3.2. Desk study

For the development of assessment framework, desk study was based on literature review of the related content and used to find out some concepts for the assessing the effectiveness of the PES mechanism. The major concepts which were used are listed below:

3.3.3. To study elements of PES

From the existing literatures on PES, the common PES elements were derived to look at the particular PES scheme in Nepal. For assessment, the existing scheme was compared to the common PES element derived from Wunder's criteria (Wunder, 2005).

3.3.4. To study socio-economic condition and current livelihood situation

To know the contribution of PES in current livelihood situation, the Sustainable Livelihood Framework (SLF) developed by Department for International Development (DFID), London, UK was selected. This study assessed the effect of PES program in natural assets, financial assets, human assets, physical assets, and social assets(DFID, 2001). The assessment was based on the data and information collected during the field study.

3.3.5. To study land cover changes

For assessing the forest cover changes and lake condition, the before and after research design was used. As, the before and after research design only provide the change in totality(Kumar, 1999), the forest cover changes were analyzed in series of year 1998 , 2001, 2007 and 2009. The land cover maps of four years were prepared for the analysis of forest cover changes. Besides these, for actual assessment of effectiveness in forest cover changes due to PES scheme, the comparison study was done with non-participating area in neighborhood which has same characteristics like rural area, population density and altitude ranges in order to identify the actual impact of the scheme by applying same methods of image classification for both areas. The details of images used and method applied for image classification are as follows:

3.3.6. Image classification method

The images used for this study are ASTER and ALOS images. The image resolution is the key factor for affecting the results of image classification(Lu & Weng, 2007).So the ASTER images are of 15m resolution and the ALOS image of 10m resolution were used. According to principle of re-sampling, for the accuracy maintenance the higher resolution images should be changed into lower one. So, the ALOS image of 10m resolution was re-sampled into 15m resolution. The Area of Interest (AOI) was generated according to study site, namely participating and non-participating area. All images were adjusted to the modified Universal Transverse Mercator projection system in Everest spheroid, system used in topographical map of Nepal. The printed images were used for the image interpretation for defining map classes which further used for the digital image classification process.

The land cover map of year 1998 was prepared by existing digital data of the area provided by Survey Department, Government of Nepal. The rest of land cover maps were prepared by using supervised image classification process.

Table 3.1: Details of images

Type of image	Date of acquisition	Resolution	Remarks
ASTER	2001/06/04	15m	
ASTER	2007/04/23	15m	
ALOS	2009/07/20	10m	Resampled to 15m

Supervised image classification method was followed for the classification of the image. The following process was done. The major steps of image classification are image pre-processing, feature extraction selection of classification process and accuracy assessment (Lu & Weng, 2007). The classification steps are based on ITC Digital Image classification Hands-on 2009.

3.3.7. Flow chart of image classification process

The image classification process was carried out on following steps. The detail flow chart is presented below:

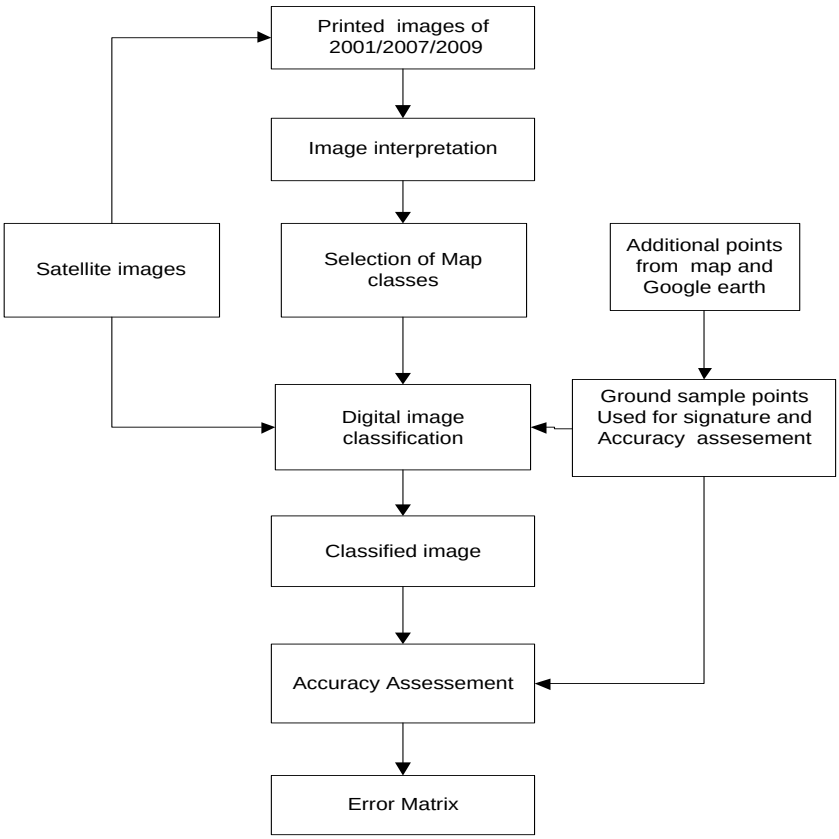

Figure 3.2: Flow chart of image classification process

3.3.8. Defining signatures

For the classification, signature files for the respective images were prepared using signature editor and AOI tools. The classes namely, forest, water, cultivation and sand were used for the entire classification of the images. As the area is small, the built up area, road, foot trail were classified under cultivation, dominated class. Likewise, in 2001 image, lake was covered by shrub so classification was done for shrub also.

3.3.9. Classifying the image using Maximum Likelihood (ML) classifier

There are three types of decision-making algorithms which are commonly used in supervised image classification process, namely Minimum Distance to Mean, Minimum Mahalanobis Distance classifier and Maximum Likelihood (ML) classifier. The ML classifier partitioned the feature space by not only considering the cluster center but also its shape, size and orientation. In this method, the every pixel is assigned to the class to which it has the highest probability(Tempfli et al.). Lu & Weng, (2007) also mentioned that ML classifier is commonly used in supervised image classification process.

3.3.10. Recoding Classes

After classification, the number of classes used in classification was recorded in five major classes of forest, water, cultivation, shrub and sand. The major focus was on forest cover and the water cover in lake.

3.3.11. Accuracy Assessment

The collected ground truth points were entered in the spreadsheet by coding it to easting, northing coordinates with cover classes. The accuracy assessment was done using those points compared with the classified images. The error matrix approach is widely used for accuracy assessment for the categorical classes(Lu & Weng, 2007). The accuracy results of the image classification are presented in detailed on chapter four.

3.3.12. Ground sample points

The sufficient number of ground sample points is necessary for accuracy measurement. The points collected from the field survey and also from existing topographical map of year 1998(Survey Department of Nepal, National Mapping Agency) were used as a sample points. The 125 sample points were collected during the field survey using GPS. The observation was done by waiting for the maximum accuracy signal from the satellite. The additional 30 points were selected by using existing topographical map and Google Earth image. After plotting the points in Arc Map, the total 49 points were used as a ground truth point and other points for defining signature for the image classification. The error points were eliminated.

3.3.13. Limitation

As the area of study is small, the number of cover was limited to five and due the non-availability of the recent image of 2010 of ASTER, ALOS was used. However, there are errors due to difference in time of acquisitions and resolution of the images, the same method of image classification and assessment in rate of changes in land cover by comparing between two adjacent areas helped to minimize the error.

3.4. Source of Data

The major sources of this study were primary data and secondary data.

3.4.1. Primary data

It includes the data from field work, by interviewing individual, data from household survey and focus group discussion during field study period. For the collection of household data, sampling techniques were used. The sample size was decided by using Glenn (1992) as follows:

n = N / ((1 + (N*e^2))
Where:
n = number of sample HHs
N = 1500, total number of HHs in the field study area which was decided during field study area using topographical map and local information about HHs in watershed area within PES scheme and also HHs in neighbourhood watershed area, without PES scheme, the estimated total HHs were found 1500.

e = margin of error and 10% margin of error was considered for this case.

n = 1500 / (1 + (1500*.1^2))
n= 93
For sampling, with additional households total 130 households were selected. 50/50 from upstream and downstream and 30 from non-participating area were selected.

3.4.2. Secondary data

The secondary data was collected from village development committee, municipality and national level agencies. The documents related to Community Forest User's Groups (CFUG) and cooperatives were collected. Moreover, authentic documents of the study area including village profile, newsletter, articles, local literature, Central Bureau Statistics (CBS) data, topographical map, and satellite image were collected. The ASTER images were collected from ITC Remote Sensing lab.

3.4.3. Data collection techniques

While it was necessary to understand the local setting, interpretative method of data access was applied. According to which, close reading of documents, available related reports, agreements were analyzed before data collection(Hajer & Wagenaar, 2003). This background information helped to assess the local setting, which is helpful for community study. The data collected in two phases: In the first phase, two assistants were selected and general training was provided to them for the data collection. Likewise the overview of the study area, distribution of questionnaires, and identification of potential respondents for interviewing, pre-information to local communities, Community Forest User's Groups, Rupa Lake Rehabilitation and Fisheries Cooperatives (RLRFC) was done. After the first visit, the general scenario helped for the detail field work. In the second phase, the data were collected. Besides these, selection of ground sample point was done by using GPS supported by topographical map of the area and printed images.

For this study, following data collection techniques were used.

3.4.4. In-depth interview

This kind of interview was conducted with two experts, two local leaders, and one expert from LI-BIRD for understanding their views and interest towards PES scheme.

3.4.5. Focus group discussion

The two focus group discussions were conducted with community forest user groups and cooperatives in the study area to understand their role and intention towards the PES scheme.

3.4.6. Household survey

The household survey was conducted to find out the socio-economic condition, their perception toward PES scheme, environmental conservation activities, and willingness to continuation of the program. The people of watershed area (service provider) and downstream (service receiver) were selected according to purposive sampling method based on population density and specific local characteristics like ethnic groups. Moreover, for comparison study, the household survey was done in non-participating. The number of sample collected were 50 for upstream, 42 for downstream and 27 for non-participating area.

After discussion with local informants and locating the area on map following area were selected in upstream: Sudaridanda Rupakot, Jammunkuna, Sahukuna, Bhimsendada, Jamunkuna, Phaprethar, Bhangara and Talbsei. Similarly for downstream: Khola ko cheu, Lekhnath, Talppati, and Ghemerekuna were selected. Likewise, for non-participating area, part of Rupakot, Kirakhor, and part of Ghimerethar were selected. The total 119 questionnaires, 50 from upstream, 42 from downstream and 27 from non-participating area were confirmed. Some questionnaires were not returned and damaged during the field study.

3.4.7. Field observation

Actually, this was not separately done, it was a part of the above process but the idea of field observation was, during gathering other information as mentioned above, the local knowledge was gathered by asking local people and also by observation of the study area. Likewise, for the image classification process the ground sample points were selected according to the pre-selected area in the image.

3.4.8. Data analysis

The data collected were processed and further analyzed in Excel and SPSS. The field notes, videos and interviews were analyzed. The data analysis and land cover maps were prepared by using RS and GIS software's. ERDAS and Arc GIS were used frequently for image classification and preparation of land cover maps. The details of data analysis and results are discussed in the following chapter.

3.5. Description of Study Area

3.5.1. General overview

The case study was carried out in Rupa Lake and its watershed area, Kaski District, Western Development Region, Nepal. Rupa Lake is the third largest lake in Pokhara valley (1.35kmsq.) situated at elevation of 617m from MSL. The extent of the area is 28008'31"N, 84006'16"E and 28009'54"N, 84007'35"E. The watershed area is 30kmsq. The topography of the Rupa watershed is extended between villages from Satmuhane (600m), Begnas (1200m), Sunadari danda (900m) and Rupakot (1159m).

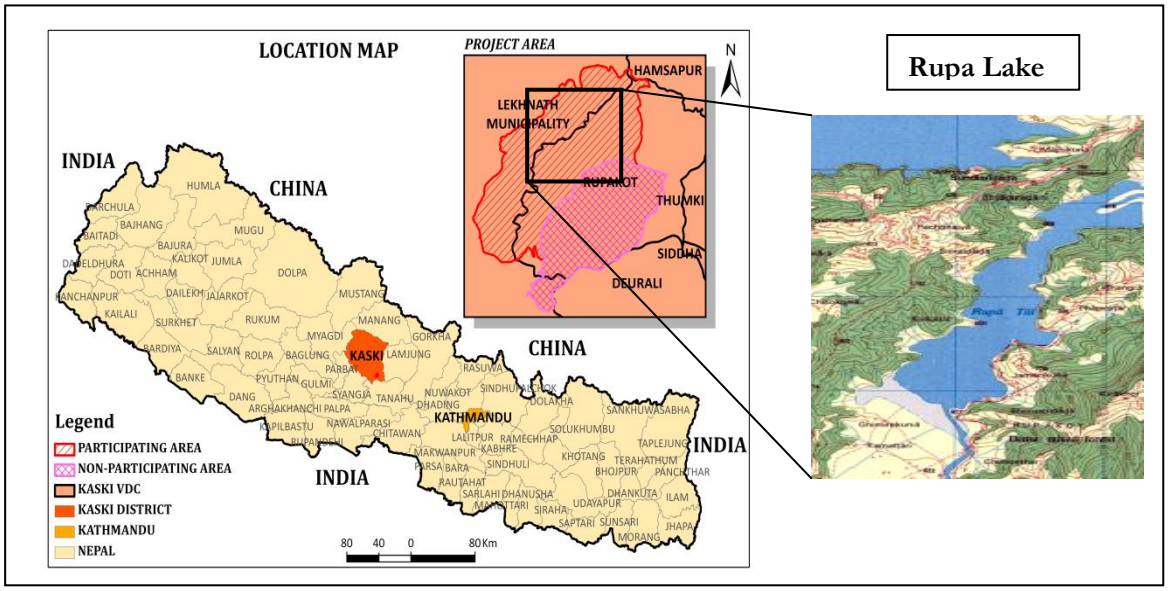

Figure 3.3: Map of study area

The major characteristics of the study area:

- The area is selected as Indigenous and Community Conservation Area (ICCAs) by IUCN.
- Rich in biodiversity: 69 species of wetland dependent plants, 22 species of indigenous bird, 36 species of water birds, and 24 species of wetland dependent reptiles are listed.
- Presence of diversity of community; ethnic groups like *Majhi, Jalahari*, (fisherman groups) and others. The majority is *Brahmin* and *Chettri, Gurung* community is dominating in Rupakot. (*Brahmin, Chettri, Gurung* , are the types of class in Nepal)

- Main crops are rice, wheat, millet and maize. Main vegetables are cauliflower, cabbage, bringal garlic, potato. Livestock found are buffalo, cows, goat and chicken. In fruits banana, pineapple, guava and orange are common.

3.5.2. PES scheme in Rupa Lake and in its watershed area

The study on a history of Rupa Lake by Paudel and Buckles(2006) showed that in 1952, the major flood and landslides changed the watershed and large amounts of sediments entered into the lake. Likewise, in 1962, 1972 and in 1976 the situation continued which in one hand, affected the livelihood of the fishermen's and on the other hand, the deforestation occurred due to the new settlements and construction of poorly planned road which threatened to bio-diversity conservation. In, 1986 government and non-government organization made a joint efforts for controlling flooding and landslides by building check dams and set up Community Forest Program to control deforestation activities (Poudel & Buckles, 2006).

Realizing these situations, Rupa Lake Rehabilitation and Fisheries Cooperatives (RLRFC) was established in 2001 by local communities for conservation of the forest and sustainable lake management. The cooperative established a benefit sharing mechanism between downstream and upstream communities. The RLRFC pay 25% of its income from fishery management to the upstream communities, 17 Community Forest User Groups (CFUGs) in the watershed. The fund is managed by Rupa Watershed Conservation Fund established by LI-BIRD and EGP, IUCN-Netherlands. The objective of the RLRFC is the conservation of the land resources of the watershed area for the lake management and also increases its fishing production. The cooperative is one of the successful cooperatives in Nepal. The 19 permanent staffs are currently working in the cooperative. Among them 11 are fisherman, 4 are watch man, 2 supervisors, 3 office staffs and net maintainer.

The executive committee is sole responsible for the Lake management. Every year general assembly decides the plan and program of the cooperative and in every two year executive committee is formed. The committee is headed by the president who is responsible for the daily activities. The interview with president and other members of executive committee mentioned that they want to extend their activities to make a cooperative as a conservation bank in the future. (Source: field survey, 2010).

The local leaders and experts informed that the cooperative is one of the best cooperatives in Nepal and playing a leading role in the watershed conservation activities within the area. The members of cooperatives have got several opportunities of foreign exchange programs in bio-diversity. All the programs were supported by LI-BIRD. One of the local leaders mentioned about the plan of integrated conservation and tourism including Begnas, lake and Rara Lake in the vicinity. During the field session, it was found that the experts were organizing the brainstorm program for PES implementation scheme in the other lakes of Kaski district. They thought that this Rupa scheme will be sustainable. The people around the lake are jointly involved for demanding the dam in lake. They have already reported and made their demand to Government of Nepal for the dam preparation in the lake.

3.5.3. Stakeholders and benefit sharing mechanism

The stakeholders of the scheme are downstream communities including fisher folks and upstream people who are conserving the community forests, resource managers. The benefit sharing mechanism is handled by RLRFC, cooperatives in downstream and CFUG's in the upstream. The payment is made directly to the different forest user groups of the upstream. The 25% of the income from fishery management is transferred to upstream communities. The payment is 15% in cash and 10% is in other supporting conservational supporting activities. RLRFC has annual income of 100000$, (data of 2009) from fishery management. Initially cooperative were established by 36 members, 360 in 2006, and now the number of members are 722. In the beginning, every member donated 70$ for the establishment of the cooperative

and now every members got profit of 275$ and annually receiving the 55$. Beside these, some of the major activities are listed below:

- 17 CFUG's are receiving 15% non-cash benefit for conservation activities
- Schools around the watershed are receiving 70$ every year
- Special arrangement for traditional fisherman families by providing fixed area for fishing, schooling for children, job in cooperative , 50 students are supported for their studying by scholarships
- Funding to community development groups around the lake.

3.5.4. Environmental conservation activities and lake management

Aside from the cash support to upstream communities, the numbers of environmental conservation activities are continuing in the region. Major activities found by field survey and also described by Regmi et.al (2009) are as follows: (Source: field survey, 2010)

- Providing Gabion boxes for landslide control
- seedlings of grasses and oranges and broom grass cultivation
- awareness raising for eco-farming, bee keeping, use of insecticides and pesticides, forage /fodder plantation for livestock improvement
- Women groups like *Unnatshil*, and *Shreejana* and are involved in cleaning grasses from lake and also in conservational activities.
- Restriction in cutting of grass and aquatic plants in breeding of species
- Thinning dense forest and gully plugging for rehabilitant the degraded lands
- Local youth club is responsible for taking care of green belt zone, buffer area with trees, grass and plants around the lake
- Organic farming in upstream, identification of medicinal plants and indigenous fishes.

3.5.5. Quality control mechanism

The overall quality control for the PES scheme has been conducting by three major institutions, namely RLFRC, CFUG's and Fisheries Research Centre, Begnas. The former two bodies are related to the PES scheme but FRC is an institution under the Ministry of Agriculture, Government of Nepal which is responsible for quality checking for fisheries management in the region, including Rupa Lake. Centre collects daily fish catch data from three lakes in the region. It is interesting to notice that though the area of the Rupa Lake is the smallest in comparison to other lakes, Rupa Lake has the highest fish production capacity.

Table 3.2: Information on Fish production

Name of lake	Area in hectare	Yield per hectare-2006/07	Yield per hectare-2007/08
Phewa lake	523	63.2 kg	64.2kg
Begnas lake	328	48.4 kg	43.6kg
Rupa lake	135	201.6 kg	317.9kg

(1 hectare=10000sq.m)

Besides these, center reports monthly testing of water sample for physical, chemical and biological parameters and water quality by 0, 1 and 2.5 m depth gradient using Vandorn water sampler (instrument used for testing water quality). The results show that Rupa Lake has the highest number of phytoplankton-27 species, which are responsible for providing good aquatic condition in the lake. For controlling fishing exploitation, the size of the fish is restricted by the hole in net size (not less than 1 kg) and fish catching is only allowed for twice a day. The RLFRC executive committee has been taking care of the fisheries management in the Lake.

In the upstream, CFUG's has been checking the forest conservation activities according to their work plan (WP). The selecting cutting of forest, thinning and distribution of the forest products for the community members are based on lucky draw (to specify the area) for collecting fire woods and also collection of timber, poles, and also dead forest products. Generally, during field visit it was reported that forest products were collected from the month of September/ October to March/April. The community members are divided into groups and they are allowed to collect the forest product under the decision of forest consumer's committee (FCC). The collection of grasses, fodder, fire woods and leaf litters are based on unbiased distribution to the members. In discussion with CFUG's , though they have not quantified data, they mentioned according to their local knowledge, that the tree density and forest covers are increasing due to grasses and tree plantation inside the forest and around the lake in buffer zone, mostly in the open public spaces. (Source: Field survey 2010 and Annual Report FY-2008/09, FRC, Begnas)

3.5.6. Issues and challenges

During field study most of the respondents highlighted the need of dam in the lake. Likewise, due to landslide from the upstream area, the sedimentation problem is increasing. The respondent reported that the depth of the lake was decreased from 12 m to 6m due to the soil deposited in the lake. The flooding from the upstream is also one of the major problems in the area. In rainy seasons, even fishes are swept away by flooding. Similarly, the interests in membership of the cooperatives from non-participating area were also raised during the discussion. They claimed that the lake is a common property inside the same local unit boundary and due to watershed boundary they are restricted for the membership in cooperative. Likewise, the people from participating area mentioned that there are problem of theft and leakage in the community forest.

3.6. Concluding remarks

This chapter mentioned about the research methods used and the description of the study area. The chapter answered the questions of the objective one by describing how the existing PES scheme was established, the stakeholders of the scheme and the benefit sharing mechanism between them. Besides these, the measures taken for environmental conservation activities and lake management and existing quality control mechanism are also presented in the chapter.

4. DATA ANALYSIS AND RESULTS

4.1. Introduction

The previous chapter described the research methodology, general overview of the study area and about the existing PES scheme. This chapter intends to analyze the data for the results, which are used for assessment in the next chapter. The subsections content the results from both secondary data and primary household survey data.

4.2. Results of Household survey

In this subsection, after analyzing the data the results of socio-economic condition, current occupation and income sources, perception towards PES scheme, participation on communities and local activities and resource manager's behavior are discussed . The results are presented separately for the upstream, downstream and non-participating area.

4.2.1. Socio-economic Condition

The results obtained from the socio-economic data collected from the household survey are presented in the following sub-section

a) Type of House

Table 4.1: Type of house

Type of House	Upstream	Downstream	Non-participating
Concrete House	17(34%)	20(47.6%)	6(22.2%)
Stone and mud house	30(60%)	18(42.9%)	18(66.7%)
Hut	3(6%)	4(9.5%)	3(11.1%)

Housing is an important need of every human being. Good housing facilities have a positive effect on people's health; productivity and living standard. The type of house for living is considered as a good indicator of people's condition. Based on the housing materials three types of houses were found in the study area. The dominant is stone and mud type of house in all upstream, downstream and even in non-participating area in PES scheme. Comparatively, higher percentages of houses are hut in non-participating area whereas more concrete houses are in downstream community because of easy access of road and other facilities.

b) Household size

Table 4.2: Household size

Family members	Upstream	Downstream	Non-participating
Up to 5	16(32%)	19(44.9%)	10(37%)
6-10	29(58%)	21(49.9%)	15(55.5%)
Above 10	5(10%)	2(5.2%)	2(7.5%)

Data revealed that there are more nuclei families in downstream community than other area. Upstream and non-participating area have same pattern of household size. The majority of household size is near to national average 5.4 (CBS, 2004).

c) Household Head

In case of Nepal, household head states to the person in the household and acknowledged as a head by other members. The head has sole responsibility for household affairs (CBS, 2004).

Table 4.3: Household head

Household head	Male	Female
Upstream	37(74%)	13(26%)
Downstream	38(90.5%)	4(9.5%)
Non-participating	24(88.9)	3(11.1)

Male is dominated as a head of house in each area and interestingly more female headed are found in upstream because in most of the houses men are living outside for job, mainly in cities or in foreign countries.

d) Access to basic facilities

Table 4.4: Access to basic facilities

Basic facilities		Upstream	Non-participating	Downstream
Road	Graveled	19(38%)	9(33.3%)	23(54.8%)
	Foot-trail	31(62%)	18(66.7%)	19(23%)
Electricity		50(100%)	27(100%)	42(100%)
Telephone		45(90%)	24(88.9%)	38(90%)
Television		33(66%)	21(77.8%)	35(83.3%)
Drinking water		50(100%)	27(100%)	42(100%)
Sewerage		No	No	9(21.4%)

All houses in study area have electricity and drinking water facilities. Most of the household has telephone facilities including mobile phone. Though the sources of water vary from distributed water pipe line to own individual sources of water, each household has drinking water. In comparison with other area, majority of houses in non-participating area connected through foot-trail and down-stream communities have better access to the basic facilities.

e) Education in Household

The highest literate person in household is dominated by male whereas female percentage is highest in downstream community compared to others. Most of the people have higher secondary level education. The downstream area is near to school and some parts are more developed. The illiterate persons are basically old people in the household, who even did not participate in the community based informal education *(praud sikshya*). There are 26%, 21% and 15% people in household were found illiterate in upstream, downstream and non-participating area respectively. Likewise, in some households male and female were found same education level. In non-participating area 7.4% household have male and female same education level. The data shows that more people in upstream area were found illiterate.

Highest educational attainment in Household: The highest educational attainment in every household has been asked during the data collection. The level of education is categorized into three groups' namely higher education, higher secondary level and lower secondary level. In comparison, the highest percentage of household having higher education is on downstream community. The percentage of higher education level is nearly same in upstream and in non-participating area. The percentage of lower secondary level is low in each area.

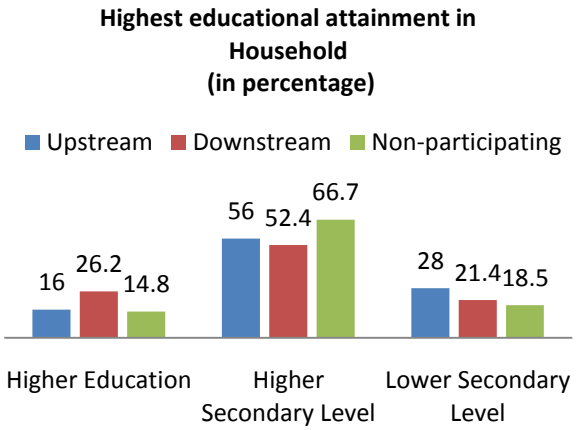

Table 4.5: Education in household

Highest literate member in the household:

Education	Upstream	Downstream	Non-participating	Remarks
Highest literate member in HH	68%(M) 30%(F) 2%(M&F)	64.3%(M) 33.3%(F) 2.4%(M&F)	70.4%(M) 22.2%(F) 7.4%(M&F)	M=Male F=Female

4.2.2. Current occupation and income sources for livelihood

The current occupation in this sub-section means the types of occupation found during the field study. The term livelihood in this case is taken as means of living, way in which one earns money (Oxford Dictionaries, 2010).The household income was calculated by asking the annual saving after consumption. The income is categorised under agriculture based and non-agriculture based. The income related to PES is constant for every household, (55$) 4000NRs and it depends upon the earning from fishery management. The every member in the cooperative has been receiving the same benefits. The rest of income structure is shown in the figure 4.1.

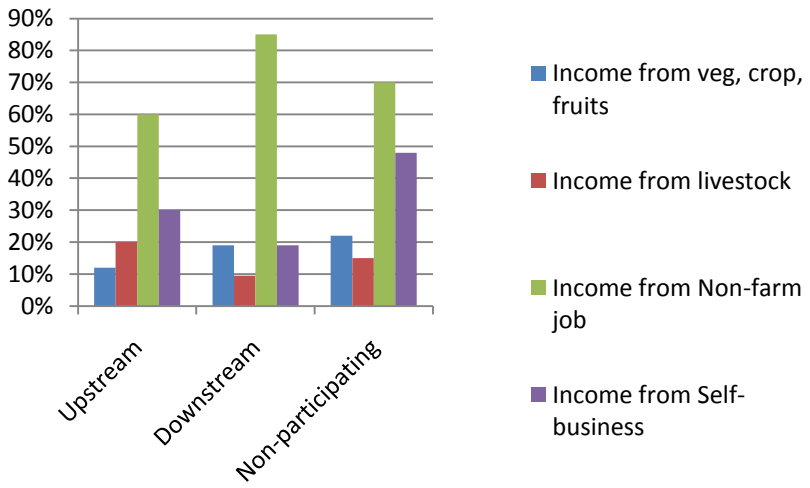

Figure 4.1: Current occupation and income sources for livelihood

The graph clearly shows that income from non-farm activities is dominated in all area. The people's livelihood is more dependent on the non-farm jobs. Their occupation varieties are government jobs, private companies and labor and pension holders to others. Farm based income is smaller portion in every region. The types of self- business occupation found are shops, mill, and restaurants. The few portion of household are engaged in livestock. The goat rearing, bee-keeping, selling milk, chicken are found more common. So, the data shows that in both upstream and in non-participating the agri-based income is around 30%, including livestock and income from fruit, vegetables and crops. The both area with PES scheme and without PES schemes are based on the income from non-agriculture sector. This is because both regions are one hour far from city centre, Pokhara, headquarter of Western Development region of Nepal. People are working in non-farm sectors and also are working in foreign countries, especially in gulf countries. Majority of the household has multiple sources of income for their livelihood activities.

a) Annual saving after consumption

The annual saving after consumption of each household in upstream, downstream and in non-participating area are presented here. The total value of income are categorised into four major groups ranges from less than 2$ per day to more than 8$ per day. It includes all types of income of household as explained above. However, World Bank categorized the income in purchasing power parity (PPP) and in Nepal 77% population (World Bank, 2005) is income less than 2$ and Nepal is the poorest in South Asia. In this case, the values are not adjusted in PPP but it is simply calculated according to Household size and used for the comparison study.

Table 4.6: Annual saving after consumption

Details	Less than 53,000NRs(2$per day)	53,000-10,6000NRs(2-4 per day)	106,000-213,000NRs(4-8 per day)	More than 213,000NRs(8$ per day)
Upstream	21(42%)	15(30%)	12(24%)	2(4%)
Downstream	7(18.5%)	12(31.5%)	15(39.5)	4(10.5%)
Non-participating	10(41.7%)	6(25%)	6(25%)	2(8.3%)

(Exchange rate: 1USD=73NRs; Nepal Rastra Bank: Jan 17 2010)

The percentage of people whose annual saving is less than 2$ per day are same (42%) in upstream and non-participating area. Comparatively, downstream people are higher annual saving than other. During household survey four people in downstream and three people from non-participating area were reluctant to inform their income.

b) Annual average saving after consumption

The data calculated for each household and per capita annual average saving is based on the household size. The downstream people have higher per house hold annual average saving and per capita annual average saving. The non-participating people have a bit more per capita annual average than of participating area because in this area more people were found in foreign job and pension holders.

Table 4.7: Annual average saving after consumption

Details	Per Household	Per capita
Upstream	78880NRs ; 1080$	11738NRs ; 160$
Downstream	115157NRs; 1577$	18700NRs ; 256$
Non-participating	91208NRs ; 1249$	14032NRs ; 192$

(Exchange rate: 1USD=73NRs; Nepal Rastra Bank: Jan 17 2010))

Thus from above data it is concluded that there are no significant differences in income between participating and non-participating group in PES scheme.

4.2.3. Information about Land

The land tenure system are mainly private, public and government and customary land mentioned by Tuladhar(2004)as same in other parts of the country. The most of the land in study area were found under public land use as community forests, schools, hospitals, and private lands are individual's land. The major types of land in study area are classified in upland land and lowland. The upland lands are land in slopes whereas lowland lands are plain land. In slopes, land uses are community forests and agriculture land. Land uses in plain area are also dominating by agricultural land and lake including small recreational land and commercial land. The majority of households have their own ownership except few cases of renting and leasing out are also found.

a) Landholding size of the HH

The landholding size is categorised in five groups' ranges from less than 0.25 hectare to more than 2.0 hectare.

Table 4.8: Landhold size

Details	Less than0.25ha.	0.25-0.5ha.	0.5-1.0ha.	1.0-2.0ha.	More than 2.0 ha.	Remarks
Upstream	12(24%)	10(20%)	16(32%)	4(8%)	1(2%)	(14%)7 landless
Downstream	8(19%)	10(24%)	15(36%)	3(7%)	2(5%)	(9%)4 landless
Non-participating	11(41%)	12(44%)	0(0%)	3(11%)	1(4%)	

(1 hectare=10,000sq.m)

However, during field study none of the sample HHs in non-participating area is found to be land less, the highest percentage of farmers having parcel size less than 0.25 hectare, even less than national average of 0.83ha. (CBS, 2004) are found in non-participating area as compared to other area. In rural area of Nepal, amount of land is the indicator of wealth of the farmers. Data shows that 85% people in non-participating area have parcel size smaller than 0.5 hectare whereas in case of upstream this is only 44%. So, comparatively farmers living in other regions are richer than farmers who are out of the PES scheme.

b) Types of Land in HH

The types of land in three areas are shown in the table. The data shows due to geographical position most of the household in downstream has higher percentage of lowland whereas the upstream and non-participating households has higher percentage of upland. Comparatively, there are not significant differences in both upstream and non-participating area, in types of land.

Table 4.9: Types of land

Details	Types of land	Less than0.25ha.	0.25-0.5ha.	0.5-1.0ha.	1.0-2.0ha.	More than 2.0 ha.
Upstream	Low land	7(14%)	12(24%)	9(18%)	2(4%)	
	Upland	24(48%)	12(24%)	2(4%)	1(2%)	
Downstream	Lowland	13(30.9%)	12(28.5%	10(23.8%)	2(4.7%)	1(2.4%)
	Upland	4(9.6%)	4(9.6%)	3(7.2%)	2(4.8%)	1(2.4%)
Non-participating	Lowland	5(18.5%)	3(11.1%)	0	2(7.4%)	
	Upland	15(55.5%)	8(29.6%)	0	3(11.1%)	0

(1 hectare=10,000sq.m)

Most of the households have both types of land in plain area and in slope. The low lands are more fertile and expensive than uplands so, in this case downstream people are richer than upstream people.

4.2.4. Food sufficiency of the HH from own agricultural products

Food sufficiency from own agricultural products is one of the indicators of food security. Food security in a household level is considered as an ability to acquire the food for the member of house (Pinstrup-Andersen, 2009). In this case food sufficiency of the household from their own agricultural products is the amount of food sufficient for the household regardless of the balance protein and nutrition needed which are described under four categories for one year.

Table 4.10: Food sufficiency from agricultural products

Details	Up to 3months	3-6months	6-9months.	9-12 months	Remarks
Upstream	22%	26%	6%	32%	7 landless
Downstream	23.8%	21.4%	16.6%	28.5%	4landless
Non-participating	33.3%	29.6%	18.5%	18.5%	

Comparatively, upstream people have highest food sufficiency from their own agricultural products whereas maximum of sampled households in non-participating area have food sufficiency for only three months. It implies that people in non-participating area have more dependency in other non-farming livelihood activities for food security. As around 85% of household in non-participating area have smaller size of parcel than that of upstream people, they have lower food sufficiency level

4.2.5. People perception towards PES scheme

Perception is the way in which something is understood or interpreted(Oxford, 2010). In this case, after asking a set of similar questions to the people in household survey and focus group discussion, their perception was categorized in 1-5 scale, depending upon their knowledge of PES. The questions asked were related to concepts of PES, buyer and seller relation, environmental services and benefits sharing. The field study shows that however 100% respondents are agree on continuation of the program, they have not sufficient knowledge on PES. The majority of the people who have very good knowledge are those who are working in CBO's, local leaders and also actively participate (members of executing committee) in the PES scheme. Aside from the theoretical discussion about PES design people are more interested in the scheme due to the extra benefits they are receiving.

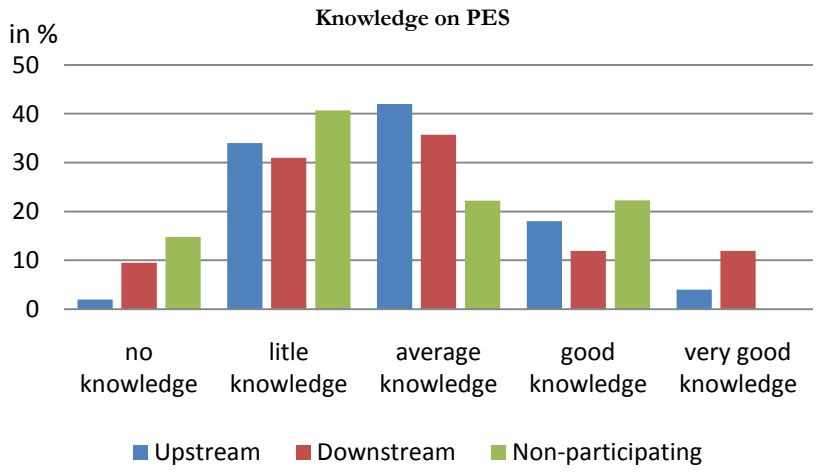

Figure 4.2: Knowledge on PES

However, the people in non-participating area have less knowledge in PES scheme, they are very conscious in the benefits that others are receiving. During the field study, some of the respondents raised the issue of membership in the cooperative should not be hindered due to PES scheme but do focus on the administrative boundary because they claimed that the lake is a common property of the region and they also belong to neighboring watershed in the same local unit.

4.2.6. Participation in Communities and local activities: Social capital formation

A wide spread sense of trust emerges from shared values and experiences among the members of communities which motivates people to participate in civic engagement and the community having dense network of voluntary association increased the participation which creates social capital(Stone, 2002).

To understand the cohesiveness and the social mobilizations inside the communities, the respondents were asked about their involvement in capacity building programs and also their participation in decision-making process of community based activities (CBA). The training on awareness raising programs, eco-friendly farming, education and health are the most common whereas some respondents mentioned about bee-keeping and goat rearing training, categorized under others for this research work. The programs are usually organized by CFUG's, LIBIRD, cooperatives, local youth groups, mother groups and other small CBO's. In most of the cases, upstream programs are funded by downstream RLRFC based on PES arrangement and also by other national and international development related projects. Nevertheless, CBA's are irrespective of the locations, due to PES scheme and cooperative activities additional programs are conducting in the participating area

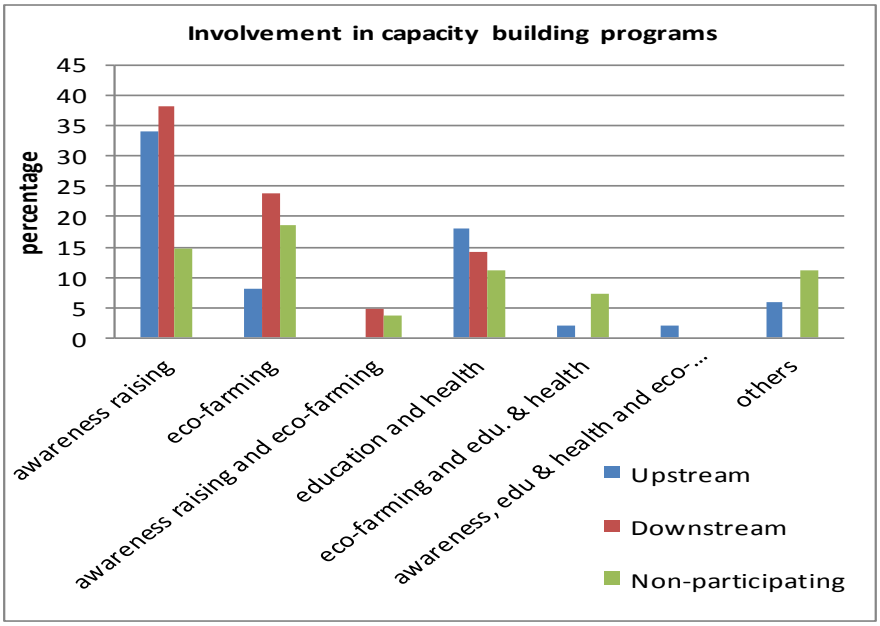

Figure 4.3: Involvement in capacity building program

In focus group discussion, people informed that INGO's and NGO's are also more interested in supporting conservation activities due to PES scheme. Thus in comparison, the area under PES scheme has more community based activities and which in turn replicates more involvement of people than in area without PES scheme. Moreover, majority of the respondents in non-participating area participated sometimes in decision making process whereas in downstream respondents were found higher percentages in frequent and rare participation. The study shows that people who already are members of CBO's are frequently participated in the decision-making process than others.

The figure below shows the participation of people in decision-making process in community based activities. The respondents were categorized in three groups according to their participation level.

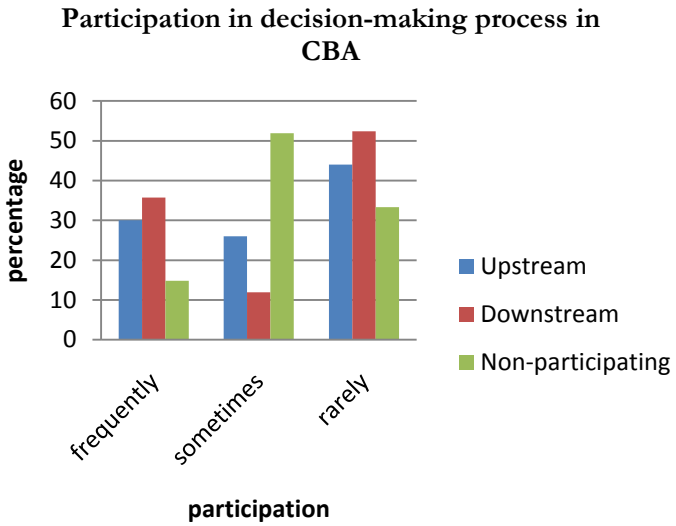

Figure 4.4: Participation in decision-making process

4.2.7. Resource Manager's behaviour

The resource manager's behavior is one of the indicators which show how far people are behaving positively towards environmental conservation. For this study, five indicators were used to describe the behavior of people in the watershed area in participating and non-participating area. All respondent replied that they have their own method of disposal for solid waste management. During the field it was clearly observed that every household has defined area for dumping their waste and later which is used for local compost for the agriculture. Majority of people in both area of watershed are partly adopting eco-friendly farming strategies, The higher percentage of people in participating area are using eco-friendly methods rather than in non-participating area. The trend of using pesticides is almost same; slightly more people in non-participating area are using pesticides.

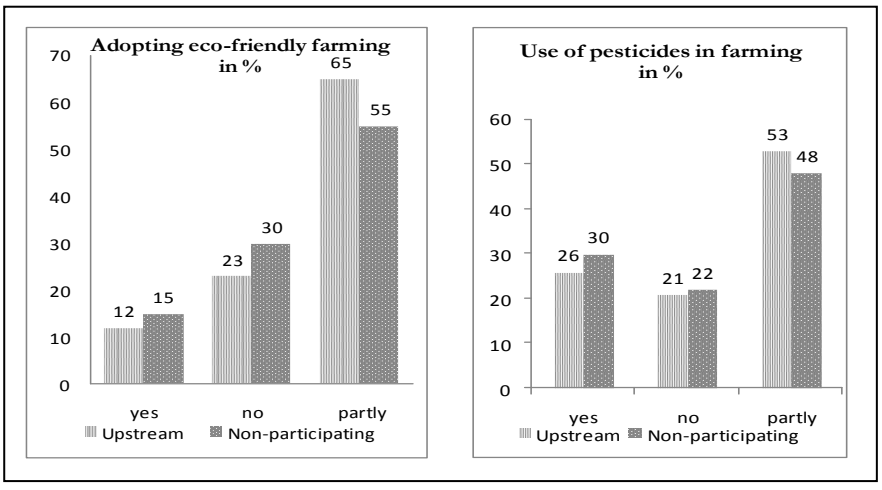

Figure 4.5: Households adopting eco-friendly farming and use of pesticides

The use of chemical fertilizer is also dominated by partly use and majority of the household has not using any soil erosion prevention strategies in both area. The field observation in the study area shows that most of the preventions are made by community approach rather than individual household. It is interesting to notice that more household in non-participating area are not using chemical fertilizers. They are using local cow dung and compost instead of fertilizers which contrast to the assumption that area having PES

mechanism has more influence in eco-friendly farming. So the comparative study does not show that area in PES scheme has larger impact in changing behavior. It implies that farmers are more conscious in their productivity of the land.

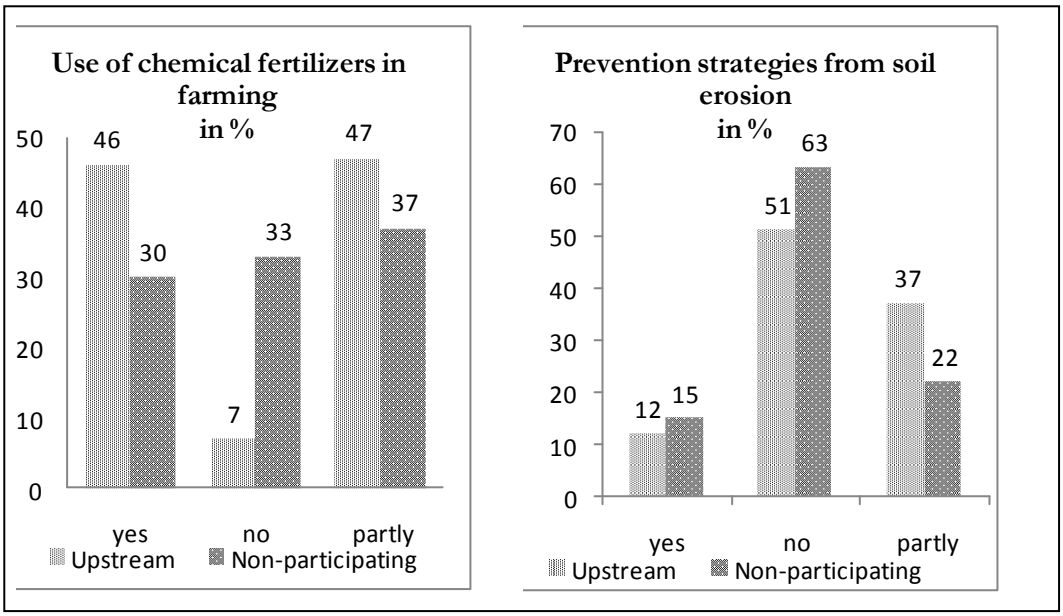

Figure 4.6: Households using chemical fertilizers and prevention strategies from soil erosion

4.2.8. Land cover changes from year 1998 to 2009

From the image classification process, land cover maps of the study area were prepared to assess the forest cover changes and also to identify lake management. For the comparative study, the forest cover changes in the neighbouring watershed, non-participating area was also observed. The land cover maps of year 1998, 2001, 2007 and 2009 in 1:35000 scales are presented below

The land cover map of year 1998 shows that before implementation of the PES scheme, the lake was clear. In the land cover map of 2001 it was covered by shrub. The forest cover was also found decreased from year 1998 to 2001. Actually in year 2001, major landslides occurred which caused also threat to settlement (Poudel & Buckles, 2006). So, the map shows that during the period the condition of the lake and its watershed area was damaged and the lake was covered by harmful water plants.

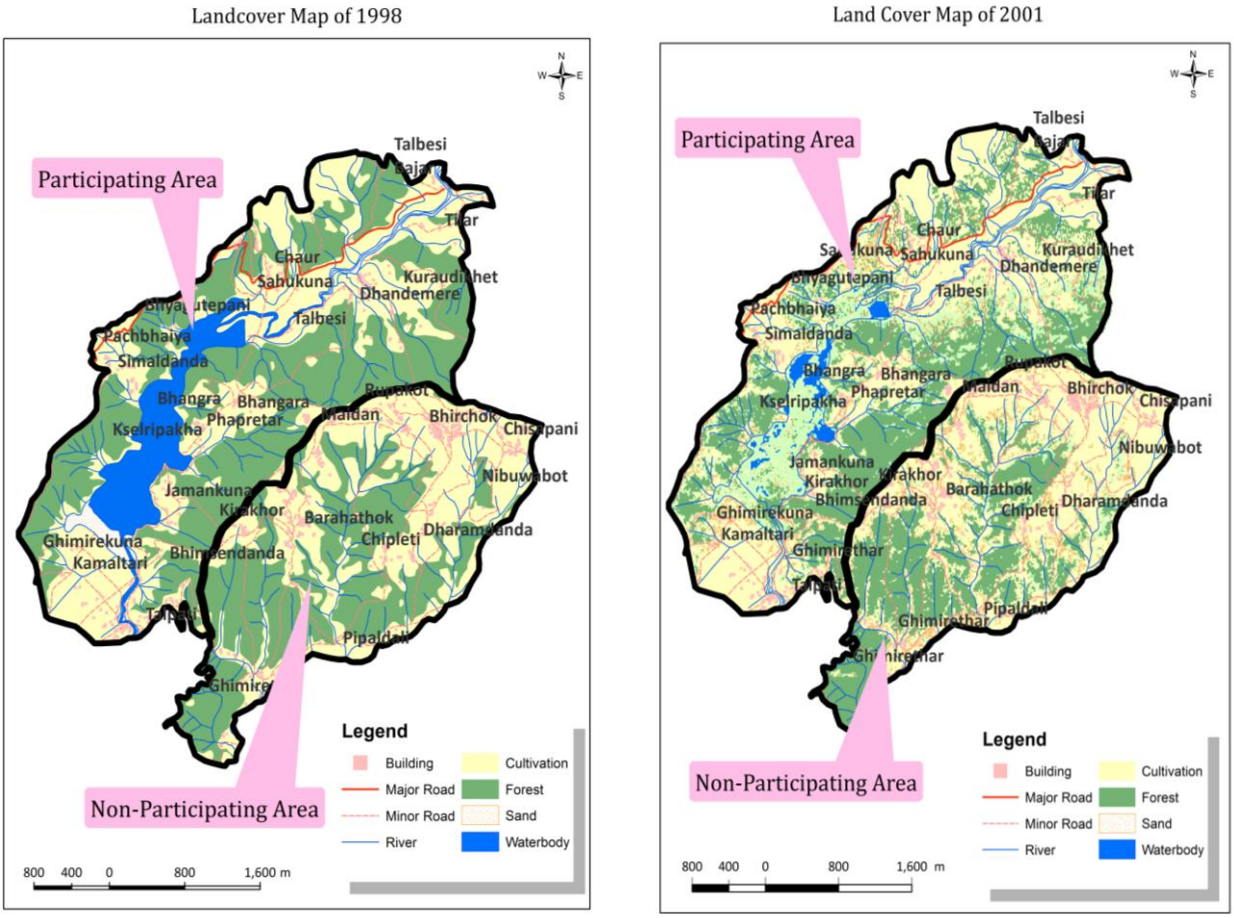

Figure 4.7: Land cover maps of 1998 and 2001

The timeline study made by Poudel & Buckles(2006) mentioned that in year 2004 ,again landslides occurred which caused a lot damage and also added sediments to the Rupa lake. Rupa Lake Rehabilitation and Fisheries Cooperative (RLRFC) established in 2001 and started the conservation activities with the support of Local Initiatives for Biodiversity, Research and Development (LI-BIRD). During the period from 2001 to 2007, the forest cover increased in both participating and non-participating area but due to the land slide and construction of green track around the lake, comparatively the rate of increase was higher in non-participating area than participating area. Furthermore in year 2005, cooperative launched a major plan for lake management (Poudel & Buckles, 2006).

The major cause of decreasing was the construction of the agricultural roads in both areas. In general, the trend was found that people are reluctant to provide their individual lands for infrastructural development so for that purposes the construction design mostly focus on public and government land. Actually in 2005/06, the construction of green track focused on eco-tourism around the lake was started and which was stopped later due to local conflict between one community forest groups (pachavaiya CFUG). The harmful water plants and shrubs were removed by the initiation of the cooperative with the help of local communities. The land cover map of 2007 shows the lake was clear and the water cover was increased in between 2001 to 2007. From year 2007 to 2009, the both forest cover and water cover were increased.

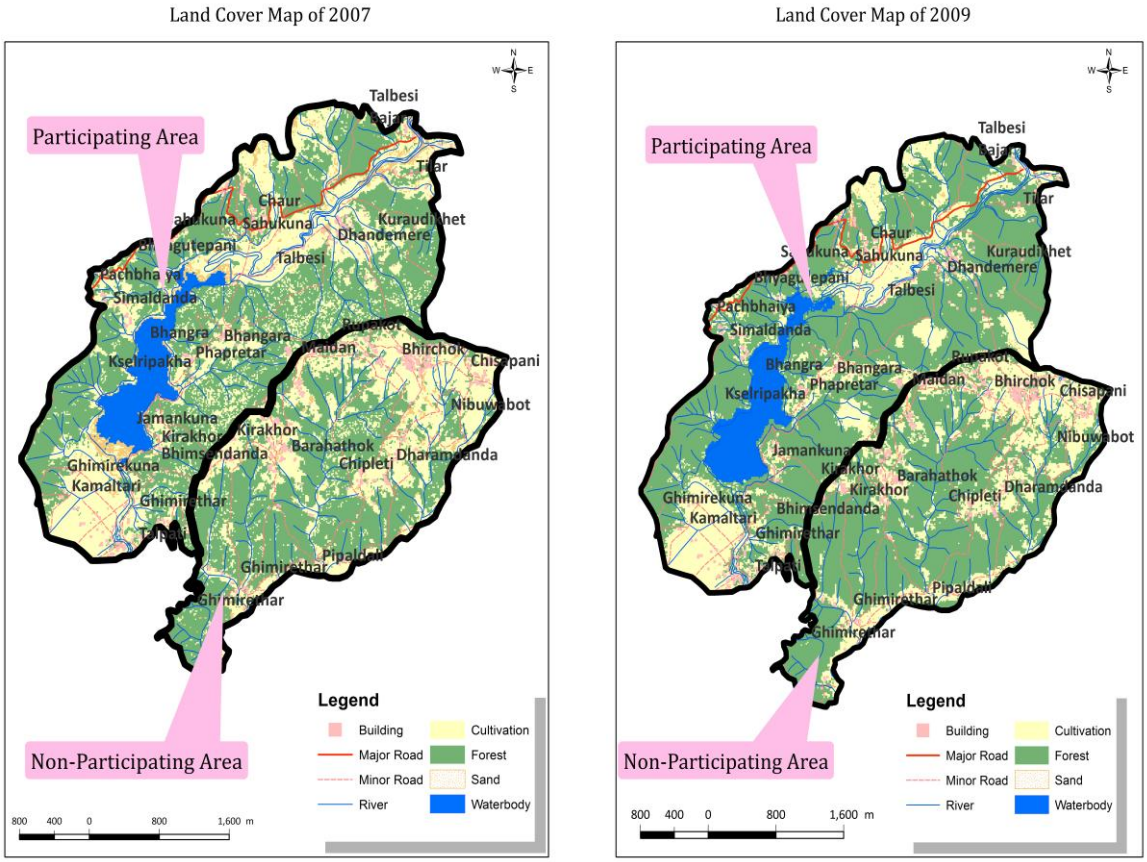

Figure 4.8: Land cover maps of 2007 and 2009

a) Changes in area for each land cover from year 1998 to year 2009

The following tables 4.11 and 4.12 show the changes in area for every land cover class from 1998 to 2009 in both participating area and in non-participating area. The rate of changes in per class was calculated by percentage change in particular class to the total area during the whole period of time.

Table 4.11: For participating area

Land Cover Class	Area in 1998 sq.km	Area in 2001 sq.km	Area in 2007 sq.km	Area in 2009 sq.km	Percentage (%) change per class from 1998 to 2001	Percentage (%) change per class from 2001 to 2007	Percentage (%) change per class from 2007 to 2009	Percentage (%) change per class from 1998 to 2009
Water	1.150	0.227	0.796	0.905	-7.6	4.7	0.9	-2.0
Sand	0.260	0.618	0.514	0.111	3.0	-0.8	-3.3	-1.2
Forest	5.643	3.907	6.233	7.760	-14.4	19.2	12.6	17.5
Cultivation	5.035	5.292	4.536	3.308	2.1	-6.2	-10.2	-14.3
Shrub	0	2.037	0.000	0.000	16.9	-16.9	0.0	0.0

In participating area, water cover changed by -7.6% from year 1998 to 2001 this was further increased by 4.7% and 0.9% in year 2001-2007 and 2007-2009. Likewise, forest cover decreased by 14.4% from 1998 to 2001 and later on it rose up by 19.2% and 12.6%. The cultivation cover was decreased by 14.3%. This implies that after the implementation of the PES scheme, the forest and vegetation cover increased. The shrub covered the lake in 2001 so it was taken for only year 2001.

Table 4.12: For non-participating area

Land Cover Class	Area in 1998 sq.km	Area in 2001 sq.km	Area in 2007 sq.km	Area in 2009 sq.km	Percentage (%) change per class from 1998 to 2001	Percentage (%) change per class from 2001 to 2007	Percentage (%) change per class from 2007 to 2009	Percentage (%) change per class from 1998 to 2009
Water	0.001	0.000	0.000	0.000	0.0	0.0	0.0	0.0
Sand	0.054	0.655	0.198	0.072	8.0	-6.1	-1.7	0.2
Forest	3.467	2.500	4.141	5.000	-12.9	22.0	11.5	20.6
Cultivation	3.934	3.928	3.117	2.385	-0.1	-10.9	-9.8	-20.8
Shrub	0	0.373	0.000	0.000	5.0	-5.0	0.0	0.0

In non-participating area, the rate of change of forest cover was -12.9% from year 1998 to 2001 and afterward it increased by 22% and 11.5% in year 2001-2007 and 2007-2009. Overall rate of change in forest area from 1998 to 2009 was 20.6%. The trend shows that in later years after 2001 the rate of change of forest cover was increasing whereas the cultivation cover was in decreasing trend. It implies the reforestation process was in increasing trend. There were negligible changes in sand cover during the period.(detail calculation is shown in appendix-7)

However, in participating area forest cover decreased during 2001-2007 due to landslides and green track construction. In comparison, the rate of forest cover changes was more in area with PES scheme than in non-participating area in the latest year from 2007-2009.

b) Trend in changes in land cover for every class

The trends in changes in land cover for every class are shown in figure:

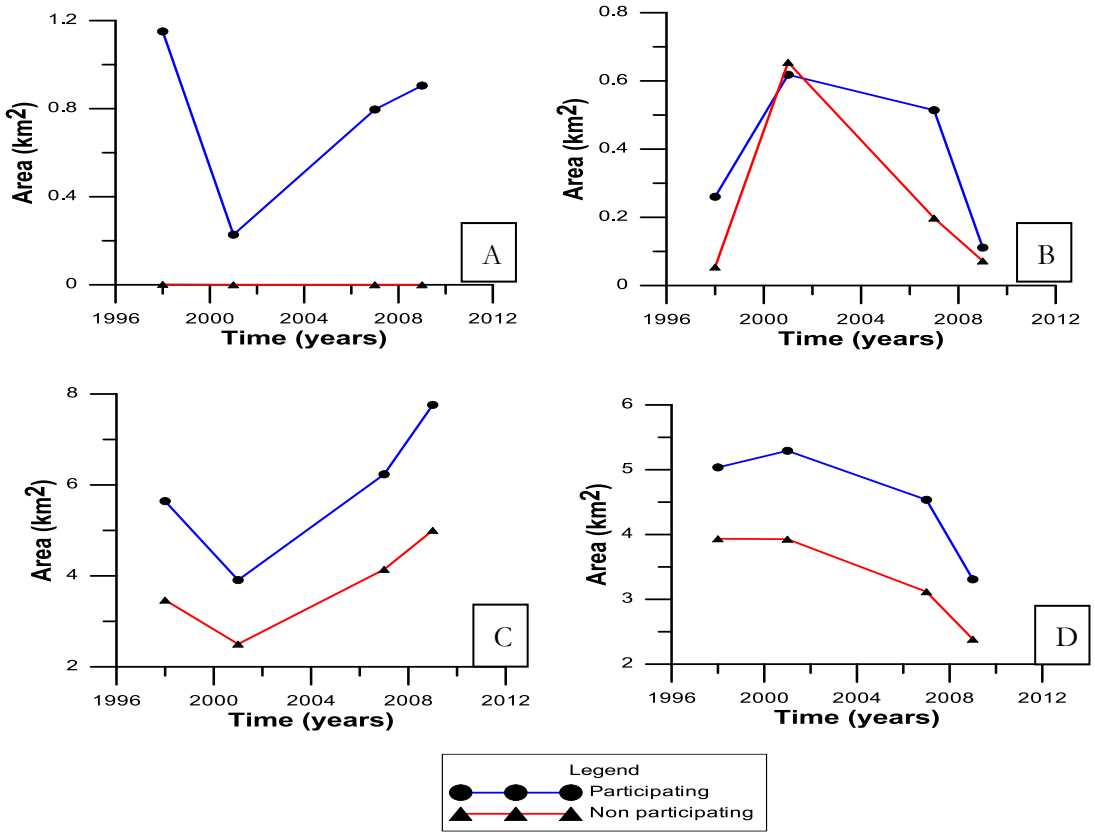

Figure 4.9: Trend in changes in land cover A=water,B=sand,C=forest and D=cultivation

As our objective of the study is to identify the land cover changes after the implementation of PES scheme, from the above graph, it is concluded that the trend of changes in forest cover was increasing in both participating and non-participating but the steep slope from 2007 onwards clearly reveals that trend was higher in the latest years. The cultivation cover decreased in both areas. However, the results show that the water cover in lake had been increasing from year 2001 to 2009; it was decreased in comparison to year 1998. In the field study it was observed that the conservation efforts towards lake management have been in increasing.

c) Accuracy Assessment Result

The accuracy assessment for the individual classified image was done using ground truth points. The total 49 points were used for the accuracy assessment. The overall accuracy and kappa statistics of the assessment report are presented here. The detais of accuracy results are mentioned in appendix: 6.

Table 4.13: Result of accuracy assessment

Year	Overall Accuracy	Kappa statistics
2001	81.63%	0.68
2007	85.71%	0.75
2009	77.55%	0.62

4.2.9. Livelihood impacts

After discussion with cooperative, community forest user groups, field observation and available evidences from data analysis following results were found which are represented in a Sustainable Livelihood Framework, common approach developed by DFID. In general five types of capitals are identified as a livelihood assets by DFID(2001) are human capital (the knowledge, skill, and health), physical capital (local infrastructures like road, schools and hospitals), and socio-political capital (membership of groups, networks and access to institution of the society), natural capital (stock of natural resources) and financial capital (income, saving and other financial resources). Similarly, these capitals were used for assessing the livelihood impacts of PES scheme in nine case studies in Africa, Latin America and in Asia(Tacconi, et al., 2009). In this case study also the set of information were collected under each category to know the strength of the capitals. The results are based on both quantitative and qualitative data from the field study. The related information's are categorized in financial, social, physical, human and natural capitals. The results are as follows:

a) Financial capital

The income from PES scheme, opportunity cost and additional benefits were chosen as the indicators of financial capital. The results are briefly mentioned below under two sub-headings:

Impacts of PES scheme in household income: Though the portion of money is small, every house hold has been receiving cash benefit of NRs 4000(55$) every year and are members of cooperatives. The amount depends upon the income generated by the cooperatives.

Sufficient for opportunity cost and additional income: As, there is no individual land use restriction for the environmental services, the opportunity costs is low. The changing in behavior like reduction in use of pesticides and chemical fertilizers and use of bio-gas were found in field work but there is no restriction it depends on good faith.

b) Social Capital

The social capital formation of the community was taken as an impact of PES scheme in coordination and involvement in community based activities especially in decision-making activities which creates trust and

people are motivated in civic engagement. So the dense networks of the voluntary association ultimately creates social capital as mentioned by (Stone, 2002).

Impacts of PES in community based activities: After the implementation of PES scheme, more community based activities has been performing in the region. Cooperative has been playing major role in supporting the community based activities in the upstream. Besides these the other NGO's and INGO's are also helping in community based trainings and short programs. The PES scheme has created a kind of attraction for the outsider organization.

c) Physical capital

The additional construction of local infrastructures like hospitals, schools, roads and other development activities were included under physical capital formation.

Investment in local infrastructure: Due to the established mechanism, the upstream community has been receiving extra support in development of local infrastructures. The investment in water supply, health post, schools and agricultural roads were found common. This implies that in the upstream area the physical capital has been in increasing trend after the PES scheme.

d) Human capital

Human capital refers to the capacity, skills and knowledge gains within the community after the implementation of the scheme.

Involvement in capacity building and awareness raising program: However, it is difficult to measure the impact of new knowledge and skill in the society, the data shows that after implementation of the PES arrangement more people are involving in the capacity building and awareness raising program.

e) Natural capital

The impacts of the scheme in changing the value of natural resources was considered as a natural capital

Evidence in change in natural capital: The results of land cover changes from 1998 to 2009 shows that in 2001 the lake was covered by shrub which was cleaned after the implementation of PES scheme. The conservation activities are also increasing due to which natural capital has been increasing. The forest cover data shows that from 2001, the forest had been increasing due to conservation activities. The details of forest cover and the water cover changes in the lake were discussed in the earlier sub-section of this chapter.

4.2.10. Existing Legal Instruments and Institutional Arrangements

The laws which are associated to PES scheme and governing in the case study area were analyzed for understanding the legal situation and also how the institutions are performing under their respective acts and laws are discussed in this section

a) Cooperatives Act 1992

The main objective of the cooperative act is formation and operation of various types of associations which depend upon mutual support and cooperativeness for economic and social development. In the preamble, it is clearly mentioned that associations shall be formed by low income people, farmers, labours and unemployed people or social worker of the country. The cooperative members are the person who obtained membership by subscribing shares according to the by-law of such association or society. The cooperatives shall be an autonomous body and the jurisdiction of the cooperatives is defined by by-law (chapter-3, subsection-3). The chapter 6 has a provision for collecting share and selling share to the members under its jurisdiction. The general assembly and the board of directors are the main responsible bodies in the operation of the association and the modus operandi of the cooperative is according to the by-law which must be registered under the Registrar appointed by Government of Nepal(GON, 1992)

b) Forest Act 1993, Forest Regulation 1995 and Community Forestry Guidelines 2009

In the preamble of the act it stated that the major objective is to attain social and economic development and to promote a healthy environment by conserving forest and proper utilization of the forest products. The community forests are managed by user groups under Forest Work Plan. In the case of contravening of the work plan by any user groups or adverse effect on environment, there is provision of imposing punishment according to loss and damages and also cancellation of the forest as a community forest. The forest regulation provides authority to user groups for collecting and selling forest products according to Forest Work Plan and after collection of timber, firewood and other forest product user groups are responsible for reforestation or rehabilitation in the forest area (GON, 1993) & (GON, 2009)

c) Local Self Governance Act 1999

It emphasizes the involvement of ethnic communities, indigenous people, and socially and economically backward group in the preamble for the institutionalization of development process. It also focused on balanced and equal distribution of the fruits of development in the region. The part two, chapter one of the act mention about the division of regions, basically depending on the geographical situation of the place and those administrative units are governed by local bodies under the act. In the same chapter, from clause 25-28 have a provision for maintaining all the local resources including lake, well, water bodies, road and others and also focuses on encouragement of income generating activities through cooperatives. The development activities of the local units depend upon development plan prepared by local bodies, namely village and ward development committee in case of rural areas (GON, 1999)

d) Environment Protection Act 1997

According to Environment Protection Act (GON, 1997), the main objective is to create legal provision for maintaining clean and healthy environment by minimizing adverse impacts caused from environmental degradation on human being, wild life, plants, nature and physical objects. It also emphasises on the protection of environment with proper use and management for natural resources, considering that sustainable development could be achieved by inseparable interrelationship between economic development and environmental protection. Provision of environmental inspector to check environmental quality and punishments are also in the act.

4.3. Concluding remarks

This chapter described about the results obtained from the field work and also focused on the existing provisions in the legal documents. While comparing the participating and non-participating area, the socio-economic data reveals mixed results. Results have not shown the significant differences between the two areas. The impact on the household level has not been realized from the data. However, there are capital gains within the participating area in Sustainable Livelihood Framework. This situation gives an impression that within the upstream area there are gains in capitals according to SLF framework but it does not show an effect on the socio-economic condition of the people when comparing with the non-participating area. Likewise, there are improvements in awareness raising and social activities. The chapter also deals with the comparative study of the land cover changes. The result shows that there are positive trends in forest cover changes and water cover in lake. Besides these, the provisions in existing laws are discussed in the chapter. It shows that all the legal provisions have the socio-economic development as their central theme. Meanwhile, there are overlapping and conflicts found in the Cooperative Act and Local Self-Governance Act which contradicts in the implementation level. The detail analysis of the results obtained in this chapter is discussed in the following chapter.

5. DISSCUSSION ON THE ASSESSMENT OF PES SCHEME

5.1. Introduction

This chapter presents the assessment of the effectiveness of the PES scheme based on the derived framework on the chapter two. The gathered field data and results from data analysis were used for the assessment. This chapter also highlights the issues regarding to existing PES scheme and finally concludes with the answers of the most of the research objectives

5.2. Assessing the effectiveness

For assessing the effectiveness of PES scheme, the assessment was done by comparing to the evaluation criteria and is presented in the following subsections.

5.2.1. Elements of PES

The assessment of the existing PES scheme was done by comparing with the PES elements chosen from the mostly used definition of Wunder(2005) are as follows:

a) Voluntary Transaction:

Payment for Environmental Services is a mechanism in which payments, rewards or compensations are made for conservation activities to the people or communities who are responsible for those activities. The basic principle underlies in PES framework is, the contract between the ES providers and ES buyers should be voluntary, depends upon negotiated agreements between the both parties. Thus, the transaction is voluntary, cannot be enforced and both parties (seller and buyer) have Willingness to Pay (WTP) and Willingness to Accept (WTA).

In this case study, the payment mechanism is established between downstream communities through RLRFC to the upstream communities. The transaction mechanism is voluntary and handled by RLRFC and CFUG's. The both of the parties were agreed for willingness to pay (WTP) and willingness to accept (WTA) and the program has been continuing from 2001. During the field study it was observed that all of the stakeholders interested to continue the scheme. Though the payment is voluntary, the interesting part of this scheme is that the individual service receivers are not paying directly to the service providers but the payment mechanism has been established by RLRFC. It has been collecting money from fishery management in the lake and from the income 10% in cash and 15% in other forms are annually transferred to the different user groups like CFUGs, schools and also for the community based small organizations involved in watershed management activities.

From the theoretical view, in PES scheme, there must be contract for obligations between two parties and which can be breached in the case of non-performance or in other way, up to how much degree of the performance it would be voluntary. Thus in local setting, it needs clear provisions in implementation. As, (Stone, 2002) mentioned about the issues of performance, how much performance? What are the bench marks, too little, too much or just right which demands the implicit norms. However, in this scheme, the payment mechanism is voluntary established there is lack of provision to determine the level of performance required.

b) Well-defined Environmental Services

The major aspect of any PES scheme is the standards of the services. The environmental services should have specific standards in terms of quantity, quality for a certain time and space, well-defined (Wunder, 2005).

In this scheme, the environmental service from which the downstream communities are benefited is water. The linking environmental service is the flow of water from the upstream area to the downstream lake. There is not any special provision for checking the increase in water flow quantity, except the local believe that forest and vegetation covers can help in increase the flow of water. Thus it is identified that water in lake is environmental service but it is not well-defined as like in PES language.

c) Buyers (Beneficiaries) and Sellers (Resource manager)

In every watershed PES scheme it has two major groups of participants, namely downstream service users and upstream service providers. There must be defined buyers, recipient who pays a price to seller who provides an Environmental Services (Wunder, 2005). In most of the practices , the payments are based on land use of upper communities (Pagiola, et al., 2005). In Rupa lake scheme the buyers are downstream community who are managing the lake for fishery and sellers are the upstream community who are responsible for forest conservation and supporting bio-diversity activities.

The upstream conservation activities are handled by CFUG's according to (FWP) Forest Work Plan. The working procedure is prepared for the improvement and conservation of the forests by utilizing, selling and distributing the forest based products to maintain the environmental balance and which need to be approved under Forest Act 1993, Government of Nepal (GON, 1993) Likewise, downstream activities are managed by RLRFC, under the provision of Cooperatives Act 1992, Government of Nepal. The basic principle underlies on the development of cooperativeness and mutual support for the social and economic development of the people like farmers, labours, landless and low class of people having low capital and income. Thus in this case, two separate community based institutions are handling the PES scheme in benefit-sharing mechanism. The overlapping situation is that the members of the communities in upstream and downstream are also the members in the cooperative. Likewise, CFUG's consists of members from every household. Thus from household level, individuals are members in both community based institution.

Furthermore from the theoretical view of PES scheme, there must be a land use planning which spatially interlinked the buyers and sellers. The linkage between individual service providers with the benefit they received like payment per hectare. In this particular case, the missing element of PES is land use based payments system. The payment is not based on the parcel holding size of individuals but mainly focus on changing the resource manager's behaviour towards land use and community forest preservation activities. Thus in one hand from equity perspective, it is good for poor farmers who have smaller piece of land or landless to share the same benefits as others but on the other hand this missing element hinders the efficiency of environmental conservation practices, the primary goal of PES concept. Thus there is lack of relationship between land use in individual level and environmental services, so the payment is not for individual land use but for the community land use with forest cover.

In this case, the percentage based payment mechanism on the income generated from the lake creates the backward relationship to the upstream communities which is quite different from normal PES arrangement where service providers are paid what they provided and the upstream communities are not depend on the downstream community activities.

d) Mechanism for transferring payments/compensation (conditionality)

The mechanism for transferring the payments, compensation or rewards is the important aspect of PES scheme because it secures ES sellers is paid what they provided and ES buyers are paid what they received. The institutions involved in PES scheme have a role for maintaining stakeholder's benefits and

environmental conservation. The provision of implementation, distribution mechanism, monitoring and evaluation are the central issues underlies in PES scheme. The scientific and realistic basis are necessary to measure environmental services which only ensures the rationality of payments (Wunder, 2005). There are strict examples in monitoring mechanism in PES, like in Equador, where monitoring results are reported to Fund Committee for final decision. There is provision of payment suspension for 1-3 months depends upon non-compliance with the rules. For example, starting with 23 families in PES scheme in first year, 9 families were excluded in second year due to infraction. Thus the system is truly conditional and participants have learned over time (Wunder & Alban, 2008).

In case of this PES scheme, arrangements are made on local requirements, based on existing legal acts and regulations of cooperatives and CFUG's. There are provisions of monitoring in fishing, quality check control, forest management but not strict suspension provision in the scheme like in Equador. The cooperatives developed a standard for net size which restricts the size of fish smaller than 1 kg to avoid the exploitation of fishing in the lake. The time of fishing is limited in morning and evening and fish catch are collected twice a day. For the transparency and control the financial irregularities, the cooperative members directly sell the fishes to the contractor in the presence of the executive members. Fish catch data are daily collected for monitoring the exploitation. The Fisheries Research Centre, in Begnas is regularly monitoring the quality of the water and also species of fishes in the lake. It is an organisation under the Ministry of Agriculture and responsible for the fisheries management in the area. So, in this case also this mechanism for checking quality is not a part of the scheme, but it has been working in Rupa Lake like other lake in the vicinity. Monthly testing of water sample for physical, chemical and biological parameters has been conducting by the centre for 0, 1 and 2.5 meter depth gradient using Vandorn Water Sampler (VWS). These provisions help to maintain healthy water for fish by observing the number of phytoplankton (around 27 species) in the lake.

In upstream, CFUG's are responsible for forest conservation and promoting bio-diversity activities in the watershed. The overall forest conservation activities, including rules and regulations for using forest products are controlled by Forest Consumer Committees (FCC) under the provision of Forest Act and regulations and Community Forestry Guidelines. This existing rules and regulations and indigenous practices has a significant role in conservation activities. Aside from these, the benefits received by the community members in cash and in other form of development activities based on PES scheme are motivational factors for conservation of the watershed area. The payments or benefits are made for supporting conservation activities rather than based on specific and quantified ES. However, the distribution of benefits, quality control measures and monitoring of the scheme are the positive part of the scheme, there are not any strict conditionality introduced after the implementation of the scheme. It is supported by the established institutions working from the long time in the region.

Thus the most interesting part of this scheme is found it has also downward-upward relationship. In one hand, the payment is based on the percentage of income generated in lake by fisheries management. The provision of 25% annual payment by cooperative to community forest user groups implies that the payment depend upon the amount of income generated from fisheries management in downstream. On the other hand, participation in the cooperative through membership creates the stake of the upstream people in the downstream lake. So, in this scheme both the upstream and downstream communities are mutually benefited by sharing of resources. The backward linkage through the stake in the lake created more responsibilities to the upstream people.

5.2.2. Resource manager's behaviour

The results show that all the households in the upstream and non-participating area are partly using eco-friendly methods. The organic farming, use of bio-gas, and local compost were found common. In comparison to non-participating area, more households are using chemical fertilizers. The most of the prevention strategies for soil erosion are based on community approach. The use of gabion boxes for

landslide control, gully plugging and plantation of grasses and trees were found during the study. Thus in this case, some of the positive results were come out in changing communities' behaviour in using resources but the relationship between the levels of transfers or rewards are not relied on the changes in individual habit but in good faith.

5.2.3. Socio-economic condition and Current livelihood

While, PES concepts was emerged as a purely market based approach-focusing on efficiency for payments in environmental conservation, the issue of just distribution and how it would be more effective in supporting socio-economic condition for the livelihood of the resource manager are the challenging aspects in implementation of PES in developing countries. Though the main goal of PES is not poverty alleviation, several cases reveal that it helps in improving livelihood security of the environmental service providers (Wunder, 2005). Pro-poor PES schemes assist people to participate in the program(Pagiola, et al., 2005). Thus the comparison of socio-economic condition of the areas, participating in PES scheme and not participating in PES scheme is chosen as one of the criteria for assessing the effectiveness of the scheme. It provides whether the particular program has an additional effect on the livelihood of the people.

There are mixed results obtained in socio-economic condition of the households. The data reflects that in education level and in household income, there are not major differences between participating and non-participating area but higher percentages of households having low housing condition; small size parcel holders and also food sufficiency level up to 3months are living in non-participating area in comparison to other region. However, the Livelihood Framework shows that there are additional economic, social and environmental activities are helping in livelihood within the area. Actually, the scheme creates more attraction for the INGO's and NGO's which in turn has got more chances for the development activities in the participating area.

5.2.4. Land cover changes and Land use practices

After implementation of PES scheme, it is necessary to look at the changes in land cover for the certain time interval. Assessing forest cover changes is the popular way to see the forest conservation practices(Pagiola, 2008) which provides the impacts of the PES scheme. The environmental services are linked with land users vary from the hydrological flows to biodiversity conservation and carbon sequestration. The land uses, providing environmental services are decreasing due to deforestation and the major cause is that the people who uses land are receiving no compensation or incentives for the services they generated, which led to the concepts of providing incentives to those land users as a PES scheme (Pagiola, et al., 2005). This implies the necessity of linkage between environmental services and land use. The PES scheme approaches are also to provide additional income to the poor land users and support their livelihood. Many countries have been experiencing the concepts of PES with World Bank(WB) assistant(Pagiola, et al., 2005).

In this case, the results of forest and water cover changes shows that there are positive changes in lake management and forest conservation activities after the implementation of the scheme but the land use has not any direct link with the environment services due to the absence of land use planning.

5.2.5. Sustainability

In case of PES scheme, if payments is sufficient of the costs of undertaking a desired activity, the receivers may feel inherent responsibility to respond (Farley & Costanza, 2010). For the sustainability of the program it is essential to maintain opportunity costs otherwise their motivation of conservation might be decreased. The sustainability of PES mechanism depends upon the opportunity cost of the program. The roles of the involving institutions are also important factor for the sustainability of the scheme. The institutional design and performance are important aspects of the PES scheme (Corbera, et al., 2009).

Thus from the sustainability perspective following criteria were used for assessing the particular PES scheme.

a) Opportunity cost and Additional benefits

The land users often received negligible benefits from environmentally benign land uses like conservation of forest. This tends to individual land users interest to convert their forest land for other purposes which in turn costs on downstream population. Thus the payment must be more than the benefit from alternative land use-the opportunity cost (Pagiola, et al., 2005).

In this scheme, there are negligible individual land users having forest, most of the forest area is under the community forest. The individual land use activity is not taken as a determining factor for payment. Thus, the opportunity cost in an individual land use level is low. The conservational practices are mostly based on the indigenous/local knowledge. Likewise, the cooperative is providing additional benefits to the community through the memberships. The opportunity cost in this case is more likely depends upon the people's traditional practices towards forest conservation activities. The CFUG's have sole responsibilities for managing forest, based on indigenous knowledge. Thus, the whole upstream communities are agreed on the continuation of PES scheme because of the extra benefits they are receiving.

b) Equity and Poverty issues

In PES mechanism, Lebel & Daniel (2009) highlighted the issue of who is benefited and who is disadvantaged from PES mechanism because poor, marginalized and vulnerable are more reliant on ecosystem services and has relatively low opportunity costs than others. If the compensation is not enough to compensate for the opportunity cost of conservation, then PES might be counterproductive (Gómez-Baggethun, et al., 2010). In most of the watersheds in rural area, poor people are living in steep slope of the upper watershed and lands are important from environmental perspective, riparian land has positive role in preserving water quality and stepper slopes to avoid sedimentation (Pagiola, et al., 2005).Thus targeting on efficiency only for environmental services cannot reach to the expected results by neglecting equity and poverty issues. This implies the importance of who are the stakeholders in PES and how the benefits are distributed in the community. For the just distribution of payments it requires non-voluntary approaches, the case of real life PES scheme (Farley & Costanza, 2010). Majority of the PES schemes in developing countries are supporting poverty with targeting in environmental conservation. Mainly the Rewarding the Upland Poor for Ecosystem Services (RUPES) program in Asia has its focus on upland poor for providing ecosystem services. RUPES has been supporting in establishing PES mechanism in China, Vietnam, Indonesia, Philippines, Laos and Nepal.

In Rupa Lake the downstream lake management and benefit sharing solely depends on the cooperative. The special arrangements for fishermen like permanent job, providing enclose: fixed area for individual fishing, schooling for children of *Jalaharies* and *Majhis* (fisherman communities)and scholarship supports are the positive distributional mechanism of this scheme.

c) Institutional setting and PES scheme

It is essential to understand while designing PES in a ways so that it will not ruin cooperative will (Vatn, 2010). According to the Millennium Ecosystem Assessment (MEA), to understand the ecosystem services, the interaction of social and environmental aspects must be considered without focusing on discipline-bound approaches that focus on one constant component and varying the others that lead to incomplete and incorrect answer (Carpenter et al., 2009). Besides these, the role of institutions and their performance is important for the successful implementation of PES scheme(Corbera, et al., 2009).

Many ecosystem services are established cooperatively rather than competitively, providing benefits to one individual does not reduce the benefits for others(non-rival)(Farley & Costanza, 2010). The case of Rupa Lake and its watershed is also an example of cooperative behaviour. This study reveals that in Rupa Lake

and in its watershed area, the PES scheme is linked with the cooperative activities of RLFRC and forest management activities of CFUG's, two leading institutions involved in the watershed conservation. Income from fishery management, which is the major economic activity in the area, has been observed in recent years to be increasing. The provision of membership in cooperative depends on watershed boundary, determined by PES arrangement which hinders the membership to the cooperative for other people in neighbouring area, out of the PES scheme.

After analysing the existing acts and regulation, the legal provisions contradict with the arrangement of the PES scheme. The main objective of the Cooperative Act 1992 is to maintain cooperativeness and mutual trust in the society by forming associations for the economic and social development. Likewise, the Local Self Government Act 1999 highlights the balanced and equal distribution of the fruits of the development for the region. Moreover, in the preamble of the Forest Act 1993, to attain social and economic development and to promote a healthy environment by conserving forest and proper utilization of the forest products is clearly stated. The Forest Regulation 1995 provides authority to CFUG's for the management of community forest according to the Forest Work Plan. Similarly, Environment Protection Act 1997 also made provision for maintaining a clean and healthy environment for sustainable development and stated clearly that it could be attained by inseparable interrelationship between economic development and environmental protection. However, the Forest Act and Environment Protection Act are more command and control types, all of the laws have the social and economic development on their central theme.

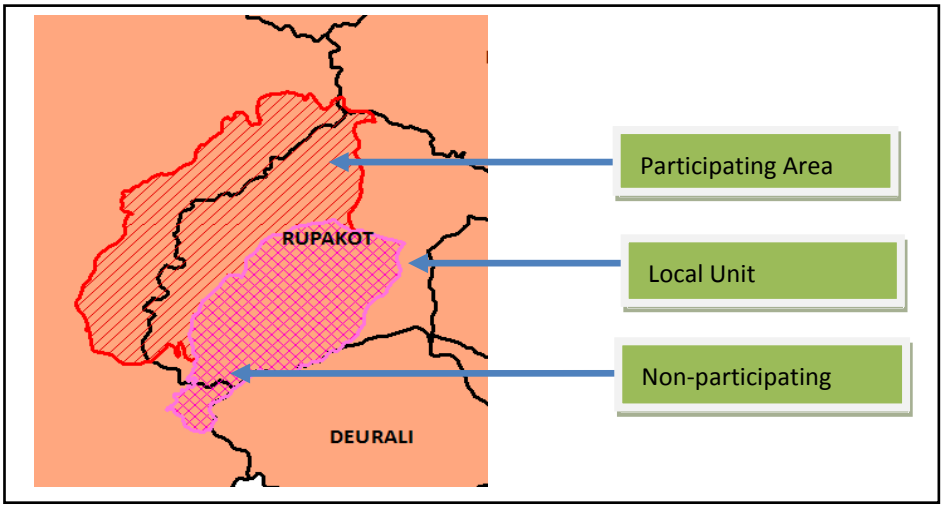

Figure 5.1: Showing local boundary

The LSGA has a provision to local bodies for maintaining all the local resources including lake, well, water bodies and others and also focus on the encouragement of income generation activities through cooperatives. Thus in this case the restriction of the membership according to watershed boundary based on PES scheme contradicts the provision of LSGA which focuses on the balanced and equal distribution of the fruits of development within the region(GON, 1999). Another noticeable issue is that though the cooperative has autonomy for defining its jurisdiction according to its bye-law, it has to comply with its main objective stated in its preamble to maintain cooperativeness and mutual trust in the area(GON, 1992).

The boundary map shows that in the same local unit there are CFUG's, and cooperative acting according to their respective acts and regulations. The Lake is a local property and the people from the non-participating area, in the same local unit have a claim to participate in the benefit sharing through the membership in the cooperative. Likewise, in the participating area the upstream and downstream communities are the members of the cooperative. The cooperative activities are limited inside the

watershed boundary due to the PES scheme. The restriction of the membership to others in the same local unit in one hand contradicts with the main objective of the cooperatives to maintain cooperativeness and mutual trust in the area and on the other hand, it is also against the LSGA provision of balanced and equal distribution of the fruits of the development. This situation leads to a governance challenge.

The aforementioned legislations, PES arrangement and existing geographical settings are one of the most interesting parts of this research. The various spatial units defined by their geographical settings and the governing institutions are shown below in Figure. 5.2. The cooperative defined its jurisdiction by bye-laws. It delineated its working area according to watershed area. Inside that watershed area there are other smaller geo-components like community forest area and individual lands. One member from each household in upstream communities is a member of Community Forest User Groups. This provision is the same for non-participating area. Their activities are based on indigenous practices and existing acts and regulations. All CFUG's have their Forest Work Plan. On the other hand, in downstream lake and its surrounding are engaged in fisheries management handled by the cooperative. Initially when the PES scheme was introduced in 2001, there were only 36 members in the cooperatives. In the later years, the cooperative has been involved in lake management, and the productivity of the lake increased due to its efficient management.

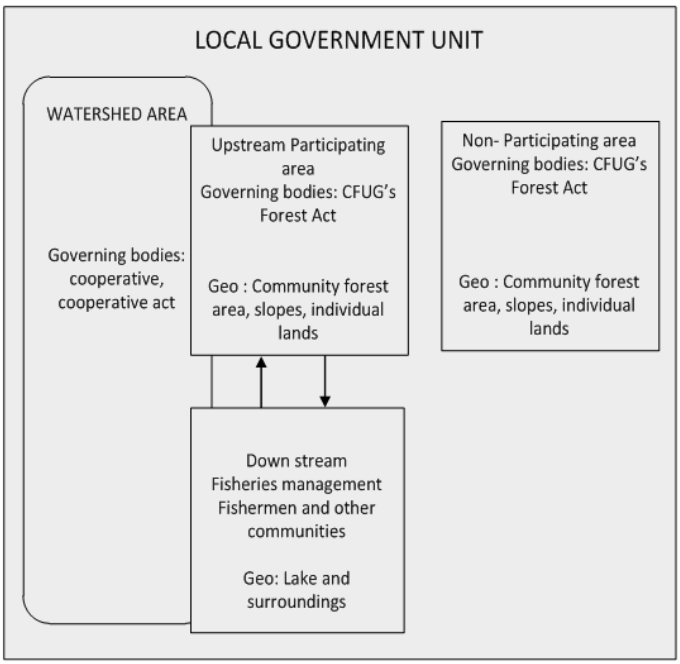

Figure 5.2: The existing geo-components and institutions

Meanwhile, in the recent years the income generation by cooperative has been increasing and all people in the watershed area are attracted and day by day the number of members is increasing. The upstream households are also members of the cooperative. This situation points out an interesting setting in PES scheme. The provision of 25% of the annual income from fisheries management to the upstream according to PES agreement shows that there is a backward-forward or downstream-upstream relation. In a normal PES scheme, the activities of the downstream people have no relationship to the upstream because they are getting paid for the environmental service. In this case, the upstream people have also a stake in the lake and the income from fisheries management also affects the upstream people. So, this situation brings new insights in PES concepts. In a nutshell, it emerged like a PES and now adapted in a different way of benefit-sharing.

5.3. Concluding remarks

This chapter described the assessment of the PES scheme based on the developed framework and the results obtained from the previous chapter. The key part of the chapter is it provides the answers of the research objective. The major objective of the study is to assess the effectiveness of the PES scheme. A summary of the answers to the four sub-objectives are described here.

The first sub-objective: *To assess the existing PES scheme with the common PES elements*

The common PES elements were derived from Wunder's five criteria (Wunder, 2005).Those are voluntary transaction, well-defined environmental service, buyers and sellers, and payment mechanism (conditionality) The water in the lake is identified as the environmental service but it is not well-defined in the PES language. The quality, quantity for certain time and space are not specified. The research shows that though the mechanism was established voluntarily between the cooperative and the community forest user groups, the scheme lacks the provision to determine the level of performance required, up to how much degree of the performance it would be voluntary. Likewise, the absence of land use planning is also the missing element of the scheme which affects the mechanism of payment. It is important in any PES scheme to define what the ES sellers are providing and what the ES buyers are paying for. The study also revealed that the existing institutions, community forest user groups, rules and regulations and indigenous practices have a major role in conservation activities. Most interestingly, the percentage based payment mechanism from the income generated from fishing and the membership of the upstream household in the cooperative creates a downstream-upstream relationship, which differs from other PES schemes. Furthermore, the conflicts in laws in the same local unit create governance challenge.

The second sub-objective: *To assess the contributions of PES scheme in the current livelihood of the stakeholder*

The assessment of contributions is based on a comparative study between the participating and non-participating area in the PES scheme. The non-farm based livelihood system dominated upstream, downstream and non-participating area. The income from farming and livestock has a smaller share in the income. The non-farm income sources are public and private jobs. However, there are little gains in the capitals like physical infrastructures and community-based activities were found. The comparative study between participating and non-participating areas does not show any significant differences in socio-economic condition in the household level due to PES scheme.

The third sub-objective: *To assess the role of PES scheme in supporting the conservation of lake and forest.*

The result shows that there are positive results in awareness raising activities. Most of the conservation activities were conducted by community based approach and supported by outsider organisations. The conservation activities in upstream are managed by community forest user groups according to the Forest Act and regulations. The cooperative has a major role in lake management activities. The quality checking of water for fish is maintained by Fisheries Research Centre, as normal like in other lakes. There are no extra mechanisms of evaluation and monitoring except indigenous practices of CFUGs and payments are made based on good faith.

The fourth sub-objective: *To assess the changes in land cover types in the study area due to the PES scheme.*

The use of remote sensing methods to compare the participating area with the non-participating area in the neighbouring watershed was done to assess the land cover changes especially the forest cover and water cover in the lake. The study shows that during the period from 1998 to 2001, the lake was covered with harmful grasses which were removed by the cooperative after the initiation of the PES scheme. Similarly, water cover in the lake had an increasing trend from 2001 to 2009. Furthermore, the forest cover changes were increasing in both participating and non-participating area. The rate of changes from 2007 onwards is more in the participating area than in the non-participating area. This implies that the PES scheme has positive impacts on water and land cover changes.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The comparative study between participating and non-participating areas in PES scheme shows that there is a positive effect on the infrastructural development of the upstream communities. The attempts made in order to change the behaviour of resource managers through cash and kind support are worth noting. However, the scheme has not made significant impacts on the socio-economic condition of the people in participating area as compared to non-participating areas. On the other hand, the comparative study of land cover change using remote sensing technology shows that the region with PES scheme has an increasing trend in forest cover. It also reveals that the condition of the lake has been improving after the implementation of the PES scheme.

The major driving force of the economic activities of the cooperative is fishery management and data show the large income generation from fish catch. Indeed, the payment/benefit for upstream seems to have positive impacts on watershed conservation by creating awareness. Meanwhile, the contribution to environmental conservation is difficult to quantify. The existing institution in the local area, like LI-BIRD working in the field of bio-diversity conservation has been supporting the RLRFC and CFUG's for the conservation. The conservation practices by CFUG's upstream depend mostly on their past experiences and indigenous knowledge.

The study shows that while there are provisions of equitable distribution of the benefits, the existing scheme has not been complying with the common PES criteria. In this case study, the linkages between service providers and receivers are observed to be weak and depended more on good faith rather than specific and defined standards of environmental services. The most interesting part of this scheme is that it has also a downward-upward relationship. On one hand, the payment is based on the percentage of income generated in the lake by the fisheries management and on the other hand participation in the cooperative through membership creates the stake of the upstream people in the downstream lake. This provides new insights in the market based PES concepts where sellers of environmental service are only paid for the services they provided.

Aside from these, from discussions with non-participating people and by analysis of the existing legal instruments during the assessment of the scheme, another issue came out in the implementation level of the PES scheme. Conflict arose in regard to how benefits should be shared within the region. The restriction of the membership according to watershed boundary contradicts the provision of LSGA. While, the cooperative has the autonomy to define its jurisdiction according to its by-laws, it has to comply with the main objective stated in its preamble which is to maintain cooperation and mutual trust in the area. Thus existing laws are conflicting within the same local unit.

6.2. Recommendations

This research work was done to assess the effectiveness of the PES scheme based on the evaluation criteria developed from the common elements of PES and related concepts. The comparison based on the activities performed rather than quantified values. So, further research can be done by developing framework using cost-benefit analysis and management and operational aspects by elaborating the number of criteria's.

This scheme has a downward upward relationship which is different from the market based PES concepts so further research can be done from institutional aspects to assess the effectiveness of the scheme.

The study shows that inducement of PES as a market scheme can create conflict with existing legal instruments. Therefore, an institutional and policy analysis is necessary to fit the PES scheme and laws together in a local setting.

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APPENDICES

Appendix 1: Household survey questionnaires (Upstream)

Household Survey Questionnaires (Upstream) **ID:**

1. Gender: Male / Female Date:
2. Address:
3. VDC…….. Ward…….

4. Household Status: Head of House –M/F

5. Household size: ……..

6. Type of House: concrete house /mud house /hut/other

7. What type of basic facilities you have?: road access, electricity, telephone, water supply, sewerage

8. Education in HH:

Number	Level of Education					Remarks
	Illiterate	Highest literate M/F	Lower secondary	Higher secondary	Higher education	

9. Please provide information about your land:

Type	Ownership pattern	Area	Remarks
Forest/Kharyan	Owned/Leased/Lease out		
Upland/Bari	Owned/Leased/Lease out		
Lowland/Khet	Owned/Leased/Lease out		
Total			

10. Occupation and / sources of income and saving after consumption

Activities	Average income: annual Rs)	Remarks
Income from crops/veg/fruits		
Non-farming/job		
Self-employment/business		
From livestock		
From forest/NTFP		
From PES scheme		
Others		
Total		

11. Do you have any knowledge about PES?(1-5 scaling) (perception: ES, Seller, Buyer, PES concepts)
……
12. Do you want to continue to participate in PES program? (WTA): Yes, No, I do not care.

13. Did you receive any capacity building program after implementation of PES program?
    a) Awareness-raising
    b) Eco- farming process
    c) Education and health
    d) Others (if any)……

14. Did you participate in the decision meetings activities? Frequently/sometimes/rarely
    …….....
15. How you fulfill your need from forest products after PES program? Does the compensation is sufficient to support your need?
    …….
16. Do you use eco-friendly farming? Yes, No , partly

17. Do you have any prevention strategies in your field?

    - Soil erosion/land slide Yes/No/partly
    - Use of pesticides Yes/No/partly
    - Use Fertilizers Yes/No/partly
    - Solid waste management Yes/No/partly

18. Do you find yourself benefited than others who are not involved in PES program? If yes why? And if not why not?
    ……
    ……

19. Do you have any relatives downstream who has been involved in PES program? Yes/No

20. How the decisions are carried out? …general meetings/ representatives of CFUG's/ any other provision?

    ……..
    ……..

21. Do you have any personal opinion about the PES program? Any agreements that are not fulfilled?
    ……
    …….
    ……
    …….
22. Any other expectations from the implementation of PES program? Or any other issues you want to mention:
    ……
    …….

Signature of Respondent……. …….. Signature of interviewer……..

Appendix 2: Household survey questionnaires (Downstream)

Household Survey Questionnaires (Downstream) **ID:**

1. Gender: Male / Female Date:
2. Address:
3. VDC…….. Ward…….

4. Household Status: Head of House –M/F

5. Household size: ……..

6. Type of House: concrete house /mud house /hut/other

7. What type of basic facilities you have?: road access, electricity, telephone, water supply, sewerage

8. Education in HH:

Number	Level of Education					Remarks
	Illiterate	Highest literate M/F	Lower secondary	Higher secondary	Higher education	

9. Please provide information about your land:

Type	Ownership pattern	Area	Remarks
Forest/Kharyan	Owned/Leased/Lease out		
Upland/Bari	Owned/Leased/Lease out		
Lowland/Khet	Owned/Leased/Lease out		
Total			

10. Occupation and / sources of income and saving after consumption

Activities	Average income: annual Rs)	Remarks
Income from crops/veg/fruits		
Non-farming/job		
Self-employment/business		
From livestock		
From forest/NTFP		
Others		
Total		

11. Do you have any knowledge about PES?(1-5 scaling) (perception: ES, Seller, Buyer, PES concepts)

……

12. Do you want to continue to participate in PES program? (WTP): Yes, No, I do not care.

13. Did you receive any capacity building program after implementation of PES program?
 a) Awareness-raising
 b) Eco- farming process
 c) Education and health
 d) Others (if any)……

14. Did you participate in the decision meetings: frequently/sometime/rarely
15. How far is the fish market and who is managing?
 …….
16. Do you have limitation of fishing?.....

17. Prevention strategies in lake management?

- Sedimentation in lake Yes/No/partly
- Cleaning of grasses Yes/No/partly
- Water quality checking Yes/No/partly
- Solid waste management Yes/No/partly

18. Do you find yourself benefited than others who are not involved in PES program? If yes why? And if not why not?
 ……
 ……

19. Do you have any relatives in upstream who has been involved in PES program? Yes/No

20. How the decisions are carried out? …general meetings/ representatives of RLRFC/ any other provision?

 ……..
 ……..

21. Do you have any personal opinion about the PES program? Any agreements that are not fulfilled?
 ……
 ……
 ……
22. Any other expectations from the implementation of PES program? Or any other issues you want to mention:
 ……
 …….

23. Signature of Respondent……. …….. Signature of interviewer……..

Appendix 3: Household survey questionnaires (Non-participating group)

Household Survey Questionnaires (Non-participating group) **ID:**

1. Gender: Male / Female Date:
2. Address:
3. VDC…….. Ward…….

4. Household Status: Head of House –M/F

5. Household size… ……

6. Type of House: concrete house /mud house /hut/other

7. What type of basic facilities you have?: road access, electricity, telephone, water supply, sewerage

8. Education in HH:

Number	Level of Education					Remarks
	Illiterate	Highest literate M/F	Lower secondary	Higher secondary	Higher education	

9. Please provide information about your land:

Type	Ownership pattern	Area	Remarks
Forest/Kharyan	Owned/Leased/Lease out		
Upland/Bari	Owned/Leased/Lease out		
Lowland/Khet	Owned/Leased/Lease out		
Total			

10. Occupation and / sources of income and saving after consumption

Activities	Average income: annual Rs)	Remarks
Income from crops/veg/fruits		
Non-farming/job		
Self-employment/business		
From livestock		
From forest/NTFP		
Others		
Total		

11. Do you have any knowledge about PES?(1-5 scaling) (perception: ES, Seller, Buyer, PES concepts)
……
12. Do you know about PES program in Rupa Lake?

13. Did you receive any capacity building program?
    a) Awareness-raising
    b) Eco- farming process
    c) Education and health
    d) Others (if any)……

14. Did you participate in the decision meetings, in communities' activities? Frequently/ sometime /rarely
    …….
15. Do you use eco-friendly farming? Yes, No , partly

16. Do you have any prevention strategies in your field?

    - Soil erosion/land slide Yes/No/partly
    - Use of pesticides Yes/No/partly
    - Use Fertilizers Yes/No/partly
    - Solid waste management Yes/No/partly

17. Do you have any personal opinion about the PES program? Any issues?
    ……

Signature of Respondent……. …….. Signature of interviewer……..

Appendix 4: Focus Group Discussion: Issues for Upstream CFUG's

Focus Group Discussion: Issues for Upstream CFUG's **ID:**

Date: ……

Place…… **Name of group (if specific)……**

Number of people attended….. **Facilitator …….**

1. Knowledge about what PES is?
2. Do you want to continue it? If not why not?
3. What are the legal provisions for supporting conservation in implementation of PES?
4. What are the benefits provided from RLFRC? Does it sufficient to compensate?
5. Are there any special provisions for landless, marginalized or those who are most forest dependent?
6. Are there any promises for supporting by external bodies after LI-BIRD support If so how?
7. What kind of measures is taken to avoid resource exploitations?
8. Any program for preventing soil erosion, land slide, fire,
9. Any other program for rural infrastructures? Hospitals, schools, roads etc.
10. How the government offices support for the program?
11. How many times the meeting has been conducted with RLFRC?
12. What about the participation of people in meetings in quantity ?(1-5)
13. Who check the quality of water in the lake? Any specific standards are set?
14. What are the monitoring mechanisms?
15. Do you think this program will be sustainable?
16. Any suggestions or opinion about the PES program?

Appendix 5: Discussion with cooperatives /experts and local leaders

Meeting with cooperatives and also questions to the experts /local leaders
Date: ……
Number of people attended ……

1. Knowledge about PES
2. Lake management
3. Legal provisions for supporting conservation in implementation of PES?
4. What are the benefits provided from RLFRC? Does it sufficient to compensate?
5. Are there any special provisions for landless, marginalized or those who are most forest dependent?
6. Are there any promises for supporting by external bodies after LI-BIRD support If so how?
7. What kind of measures is taken to avoid resource exploitations?
8. Any other program for rural infrastructures? Hospitals, schools, roads etc.
9. How the government offices support for the program?
10. How many times the meeting has been conducted in RLFRC?
11. Who check the quality of water in the lake? Any specific standards are set?
12. What are the monitoring mechanisms?
13. Do you think this program will be sustainable?
14. Any suggestions or opinion about the PES program? Challenges?
15. Future plan?

1. Sustainability of the scheme?
2. Future plan?
3. Issues and challenges?
4. Coordination with other organizations?
5. Do you think PES scheme is effective? And conserving the nature?

Appendix 6: Error matrix from accuracy assessment

1. Error matrix: year 2001

Classified data	unclassified	water	sand	forest	cultivation	shrub	Row total
Unclassified	0	0	0	0	0	0	0
Water	0	2	0	0	0	0	2
Sand	0	0	0	0	0	0	0
Forest	0	0	0	15	1	0	16
Cultivation	0	0	4	3	23	0	30
Shrub	0	1	0	0	0	0	1
Column total	0	3	4	18	24	0	49

Accuracy totals

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy
----------	----------	----------	-------	---------	-----
Unclassified	0	0	0	---	---
water	3	2	2	66.67%	100.00%
sand	4	0	0	---	---
Forest	18	16	15	83.33%	93.75%
Cultivation	24	30	23	95.83%	76.67%
Shurb	0	1	0	---	---
Totals	49	49	40		

Overall Classification Accuracy = 81.63%

2. Error matrix: year 2007

Classified Data	Unclassified	Cultivation	Forest	Sand	Water	Row Total
Unclassified	0	0	0	0	0	0
Cultivation	0	22	1	3	0	26
Forest	0	2	17	1	0	20
Sand	0	0	0	0	0	0
Water	0	0	0	0	3	3
Column Total	0	24	18	4	3	49

Accuracy totals

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy
----------	----------	----------	-------	---------	-----
Unclassified	0	0	0	---	---
Cultivation11	24	26	22	91.67%	84.62%
Forest8	18	20	17	94.44%	85.00%
Sand4	4	0	0	---	---
Water11	3	3	3	100.00%	100.00%
Totals	49	49	42		

Overall Classification Accuracy = 85.71%

3. Error Matrix: year 2009

Classified Data	Unclassified	Water	Forest	Cultivation	sand	Row Total
----------	----------	----------	----------	----------	----------	----------
Unclassified	0	0	0	0	0	0
Water	0	3	0	0	0	3
Forest	0	0	16	6	0	22
Cultivation	0	0	2	18	3	23
sand	0	0	0	0	1	1
Column Total	0	3	18	24	4	49

Accuracy totals

Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy
----------	----------	----------	-------	---------	-----
Unclassified	0	0	0	---	---
Water	3	3	3	100.00%	100.00%
Forest	18	22	16	88.89%	72.73%
Cultivation	24	23	18	75.00%	78.26%
sand	4	1	1	25.00%	100.00%
Totals	49	49	38		
Overall Classification Accuracy = 77.55%					

Appendix 7: calculation of percentage changes in land covers classes

For non-participating area

Land Cover Class	Area in 1998 (Sq. Km)	Number of Pixel In 2001	Number of Pixel In 2007	Number of Pixel In 2009	Change in term of Pixel Number as per class from 2001 To 2007	Change in term of Pixel Number as per class from 2007 To 2009	Change in term of Area (In Sq. Km) as per class from 1998 To 2001	Change in term of Area (In Sq. Km) as per class from 2001 To 2007	Change in term of Area (In Sq. Km) as per class from 2007 To 2009	Change in term of Area (In Sq. Km) as per class from 1998 To 2009	Percentage (%) change per class from 1998 To 2001	Percentage (%) change per class from 2001 To 2007	Percentage (%) change per class from 2007 To 2009	Percentage (%) change per class from 1998 To 2009
Water	0.001603	0	0	0	0	0	-0.0016	0.000	0.000	-0.00160271	-0.021	0.000	0.000	-0.021
Sand	0.054253	2909	879	320	-2030	-559	0.600272	-0.457	-0.126	0.0177468	8.051	-6.126	-1.687	0.238
Forest	3.467418	11111	18406	22221	7295	3815	-0.96744	1.641	0.858	1.53230682	-12.975	22.013	11.512	20.551
Cultivati	3.93442	17459	13854	10600	-3605	-3254	-0.00614	-0.811	-0.732	-1.54941999	-0.082	-10.878	-9.819	-20.780
Shurb	0	1658	0	0	-1658	0	0.37305	-0.373	0.000	0	5.003	-5.003	0.000	0.000
Total	**7**	**33137**	**33139**	**33141**	**2**	**2**		0.000	0.000					

Area for every classes are calculated by using formula = pixel area * no of pixel from image classification
= 15m*15m* no of pixels for every class (where 15m*15m is the area of per pixel in the ground

Change in area in every class= difference in area between the years

Change in term of area (in sq. km) for every class= change in area /1000*1000

Percentage change in per class to = change in area sq. km for every class/total area *100 (where, total area = 7 sq km for non-participating)

For Participating area

Land Cover Class	Area in 1998 (Sq. Km)	Number of Pixel In 2001	Number of Pixel In 2007	Number of Pixel In 2009	Change in term of Pixel Number as per class from 2001 To 2007	Change in term of Pixel Number as per class from 2007 To 2009	Change in term of Area (In Sq. Km) as per class from 1998 To 2001	Change in term of Area (In Sq. Km) as per class from 2001 To 2007	Change in term of Area (In Sq. Km) as per class from 2007 To 2009	Change in term of Area (In Sq. Km) as per class from 1998 To 2009	Percentage (%) change per class from 1998 To 2001	Percentage (%) change per class from 2001 To 2007	Percentage (%) change per class from 2007 To 2009	Percentage (%) change per class from 1998 To 2009
Water	1.150561	1011	3538	4021	2527	483	-0.92309	0.569	0.109	-0.2458	-7.640	4.706	0.900	-2.035
Sand	0.260248	2747	2285	494	-462	-1791	0.357827	-0.104	-0.403	-0.1491	2.962	-0.860	-3.335	-1.234
Forest	5.643203	17366	27701	34490	10335	6789	-1.73585	2.325	1.528	2.117	-14.368	19.247	12.643	17.523
Cultivation	5.035568	23521	20158	14702	-3363	-5456	0.256657	-0.757	-1.228	-1.7276	2.124	-6.263	-10.161	-14.299
Shurb	0	9055	0	0	-9055	0	2.037375	-2.037	0.000	0	16.863	-16.863	0.000	0.000
Total		**53700**	**53682**	**53707**	**-18**	**25**		-0.004	0.006					

Area for every classes are calculated by using formula = pixel area * no of pixel from image classification
= 15m*15m* no of pixels for every class (where 15m*15m is the area of per pixel in the ground

Change in area in every class= difference in area between the years

Change in term of area (in sq. km) for every class= change in area /1000*1000

Percentage change in per class to = change in area sq. km for every class/total area *100 (where, total area = 34.65 sq km for non-participating)
Note: Rate of change of cover for every class with respect to the total area were calculated separately for participating and non-participating area