AN ECONOMIC VALUATION OF ECOSYSTEM SERVICES OF THE PROTECTED AREA: A CASE STUDY OF SHIVAPURI-NAGARJUN NATIONAL PARK

HARI BHADRA ACHARYA

MASTER OF SCIENCE

IN

NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

SCHOOL OF SCIENCE

MAE FAH LUANG UNIVERSITY

2012

AN ECONOMIC VALUATION OF ECOSYSTEM SERVICES OF THE PROTECTED AREA: A CASE STUDY OF SHIVAPURI-NAGARJUN NATIONAL PARK

HARI BHADRA ACHARYA

THIS THESIS IS A PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN
NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

SCHOOL OF SCIENCE
MAE FAH LUANG UNIVERSITY
2012

AN ECONOMIC VALUATION OF ECOSYSTEM SERVICES OF THE PROTECTED AREA: A CASE STUDY OF SHIVAPURI-NAGARJUN NATIONAL PARK

HARI BHADRA ACHARYA

THIS THESIS HAS BEEN APPROVED
TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF SCIENCE
IN
NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT
2012

THESIS COMMITTEE

.....CHAIRPERSON
(Dr. Panate Manomaivibool)

.....ADVISOR
(Dr. Apisom Intralawan)

.....EXTERNAL EXAMINER
(Dr. Nantarat Tangvitoontham)

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisor Dr. Apisom Intralawan for providing me invaluable supervision of my thesis. I am always encouraged from his proactive supports and guidance which are unparalleled. I am also thankful to my Committee members Dr. Panate Manomaivibool and Dr. Nantarat Tangvitoontham for their precious comments.

I am grateful to the Thailand International Development Cooperation Agency (TICA) for granting me the scholarship. I am thankful to the staffs of Institute for the Study of Natural Resource and Environmental Management, Division of International Affairs, and Division of Graduate Coordination of Mae Fah Luang University for their timely services during my studies.

My special thanks go to Mr. Keshav Bhetwal, Mr. Rabi Ghimire, Mr. Shree Prasad Paudel, Mr. Raju Kaphley, and Mr. Bishnu Tamang, who helped me for field survey. I would like to express my cordial gratitude to Mr. Neema Sherpa, former Chairman of Sundarijal Village Development Committee, for assisting me whenever I visited the field. Likewise, I am indebted to Mr. Keshav Ghimire, and Mr. Ramesh Simkhada for their supports in finalizing the questionnaires. I am thankful to the Sivapuri-Nagarjun National Park and the Department of National Parks and Wildlife Conservation, Nepal for granting permission to conduct this research work.

At last, but not least, I would like to express my deepest love to my family members and relatives for a continued encouragement to meet the aspiration of higher studies.

Hari Bhadra Acharya

Thesis Title	An Economic Valuation of Ecosystem Services of the Protected Area: A Case Study of Shivapuri-Nagarjun National Park
Author	Hari Bhadra Acharya
Degree	Master of Science (Natural Resources and Environmental Management)
Advisor	Dr. Apisom Intralawan

ABSTRACT

The people living in the proposed buffer zone area of the Shivapuri-Nagarjun National Park, Nepal were surveyed by using the discrete 'yes/no' closed-ended contingent valuation question for assessing the economic value of protected area at local level. The econometric probit model was used to fit the data and interpretations were carried out for the qualitative analysis of relationships of various socio-economic characteristics with the valuation function. The estimated economic value of the ecosystem goods and services elicited by willingness to accept (WTA) compensation is US$ 207 per household per year. However, the protected area is established primarily to achieve the goal of protecting important ecosystems and biodiversity, it provides array of ecosystem goods and services having different kind of values—direct and indirect, use and non use, instrumental and intrinsic—for various group of stakeholders depending the location from the park at local, regional, and global level.

Nevertheless, the ecosystem services are not considered for policy decisions while designing the protected areas. However, the potential to accumulate financial supports from the beneficiaries is significantly high for this park compared to the financial support required for compensating welfare loss of the local community as the vast amount of benefits such as clean drinking water, recreation, carbon sequestration services to the adjoining city residents of Kathmandu is very high if properly evaluated.

In developing country the subsistence agrarian neighboring community has traditionally dependent on the public resources for their livelihoods and would be impacted by the park's strict rules to limit the use of these resources, thus requiring appropriate alternatives to address these issues for seeking their supports for the conservation. However, economic valuation of ecosystem services is anthropocentric approach as elicitation is based on human preferences, it provides us an opportunity to evaluate the various ecosystem services of the protected areas in terms of a common denominator, i.e., monetary that demonstrate clearly the importance of addressing the distributional issues related to share the benefit and cost among the losers and winners from the park establishment. The policy implication of economic valuation is for designing the social welfare measures such as buffer zone programs of protected areas for integrated participatory conservation programs.

Keywords: Protected area/Ecosystem services/Buffer zone/Welfare measure/ Participation

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

BZ	Buffer Zone
BZC	Buffer Zone Council
CA	Conservation Areas
CBD	Convention on Biological Diversity
CBS	Central Bureau of Statistics
CV	Contingent Valuation
CVM	Contingent Valuation Method
DEFRA	Department of Environment, Food and Rural Affairs
DNPWC	Department of National Parks and Wildlife Conservation
FAO	Food and Agriculture Organization
GNP	Gross National Product
GoN	Government of Nepal
gretl	Gnu Regression, Econometrics and Time-series Library
HH	Household
HR	Hunting Reserve
ICEM	International Centre for Environmental Management
ICIMOD	International Center for Integrated Mountain Development
IUCN	International Union for Conservation of Nature
MA	Millennium Ecosystem Assessment
MAB	Man and the Biosphere
MLE	Maximum Likelihood Estimate
NEP	New Ecological Paradigm
NOAA	National Oceanic and Atmospheric Administration
NP	National Park

ABBREVIATIONS (continued)

NR	Nepalese Rupee
NTNC	National Trust for Nature Conservation
OECD	Organization for Economic Co-operation and Development
PA	Protected Area
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SNNP	Shivapuri-Nagarjun National Park
SPSS	Statistical Package for Social Science
TEEB	The Economics of Ecosystems and Biodiversity
TEV	Total Economic Value
UC	User Committee
UG	User Group
UNESCO	United Nations Educational, Scientific and Cultural Organization
US$	American Dollar
VDC	Village Development Committee
WCPA	World Commission on Protected Area
WHC	World Heritage Convention
WR	Wildlife Reserves
WTA	Willingness to Accept
WTP	Willingness to Pay

CHAPTER 1

INTRODUCTION

1.1 Background

The term ecosystem service is relatively a new and is defined on a various ways and categorized in a number of different ways (Moberg & Folke 1999; de Groot, Wilson & Boumans, 2002; Pagiola, von Ritter & Bishop, 2004; Millennium Ecosystem Assessment, 2005). The Millennium Ecosystem Assessment (Millennium Ecosystem Assessmen, 2005) defines ecosystem services as the benefits people obtain from ecosystems; and they are broadly classified into four categories of provisioning, regulating, supporting, and cultural services (Table 1.1). The term ecosystem service is used as synonymously as environmental services or ecological services in many literatures.

Ecosystem services are the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life. They maintain biodiversity and the production of ecosystem goods, such as seafood, forage timber, biomass fuels, natural fiber, and many pharmaceuticals, industrial products, and their precursors (Daily et al., 1997, p. 3). Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions (Costanza et al., 1997, p. 253).

Natural ecosystems provide a supply of direct and indirect services to the society, a nearly limitless set of valuable attributes; many of their services remain un-priced by the market (Hanley, Shogren & White, 2007). Because ecosystem services are not fully captured in commercial markets or adequately quantified in terms of comparable with economic services and manufactured capital, they are often given too little weight in policy decisions (Costanza et al., 1997).

Table 1.1 MA Categories of Ecosystem Services and Examples

Category	Examples
Provisioning Services	Products directly obtained from ecosystem 1. Food: crops, fruits, fish 2. Fibre, fuel, timber, wool 3. Biochemical, natural medicines, and pharmaceuticals 4. Genetic resources: genes and genetic information used for animal/plant breeding and biotechnology 5. Ornamental resources: shells, flower
Regulating Services	Benefits obtained from the regulation of ecosystem processes 1. Air-quality maintenance: ecosystems contribute chemicals to and extract chemicals from the atmosphere 2. Climate regulation e.g. land cover can affect local temperature and precipitation; globally ecosystems affect greenhouse gas sequestration and emissions 3. Water regulation: ecosystems affect e.g. the timing and magnitude of runoff, flooding etc. 4. Erosion control: vegetative cover plays an important role in soil retention/prevention of land/asset erosion 5. Water purification/detoxification: ecosystems can be a source of water impurities but can also help to filter out/decompose organic waste 6. Natural hazard protection e.g. storms, floods, landslides 7. Bioremediation of waste i.e. removal of pollutants through storage, dilution, transformation and burial

Table 1.1 (continued)

Category	Examples
Cultural Services	Nonmaterial benefits that people obtain through spiritual enrichment, cognitive development, recreation etc. 1. Spiritual and religious value: many religions attach spiritual and religious values to ecosystems 2. Inspiration for art, folklore, architecture etc 3. Social relations: ecosystems affect the types of social relations that are established e.g. fishing societies 4. Aesthetic values: many people find beauty in various aspects of ecosystems 5. Cultural heritage values: many societies place high value on the maintenance of important landscapes or species 6. Recreation and ecotourism
Supporting Services	Necessary for the production of all other ecosystem services 1. Soil formation and retention 2. Nutrient cycling 3. Primary production 4. Water cycling 5. Production of atmospheric oxygen 6. Provision of habitat

From Department of Environment, Food and Rural Affairs (DEFRA). (2007). **An introductory guide to valuing ecosystem services**. London, UK: DEFRA.

Biodiversity has an important role in ecosystem function through its functional redundancy found within an ecosystem. This indicates the substitutability of species within functional groups in an ecosystem such that the impact created by the loss of one or more species is compensated for by others (Naeem, 1998). For example, in many ecosystems there are several species that fix nitrogen (known as a functional group of species). If the loss of any one of them is compensated for by the growth of others and there is no overall loss in nitrogen fixation, then there if functional redundancy in that ecosystem (Millennium Ecosystem Assessment, 2005). Some species make unique or singular contribution to ecosystem functioning, however, and therefore their loss is of greater concern (Walker, 1992). Ecosystem processes result from the life-processes of multi-species assemblages of organisms and their interactions with the biotic environment, as well as the abiotic environment itself. These processes ultimately generate ecosystem services when they provide utilities to humans (The Economics of Ecosystems and Biodiversity, 2010).

The biodiversity has a multi-dimensional character in terms of its values— both use and non-use, and anthropocentric and non-anthropocentric— associated with aspects of biodiversity (Brown, 1997). Brown (1997) emphasizes that while analyzing the economic value of biodiversity, it is important to understand the scale of these values at which they are accrued and perceived differently by different set of people at different scales.

1.2 Importance of Valuing Ecosystem Services of the Protected Area

Guidelines published by the International Union for Conservation of Nature (IUCN) and the World Conservation Monitoring Centre defines protected area as an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means which can be grouped into six categories: wilderness area, national park, natural monument, habitat/species management area, protected landscape/seascape, and managed resource protected area (Dudley, 2008).

World Commission on Protected Area (WCPA), a network of protected area specialist group, defines the main purposes of protected area management as: scientific research, wilderness protection, preservation of species and genetic diversity, maintenance of environmental services, protection of specific natural and cultural features, tourism and recreation, education, sustainable use of resources from natural ecosystems, and maintenance of cultural traditions and attitudes.

However, the international conventions, commissions, and programs provide mandate for emphasizing the importance of Protected Area (PA), the traditional funding sources for protected areas are increasingly under threat especially in developing countries. The government cannot give priority for investing to the conservation of biodiversity under the tight budget system. Therefore, we need to seek the innovative alternative sources. But what can be the new approaches? PA has a multiple costs and benefits that can that can be analyzed based on the economic values of the ecosystem goods and services provided and the cost for maintaining it; however, the stakeholders of the PA are less aware about the economic values of it. The effective management strategy should be assessing the costs and benefits to explore the potential investment opportunities on the conservation sector as well as identifying the incentives to address the neighboring community's social welfare issues. In fact, benefits from the protected areas are very high compared to the cost of conservation, for example Balmford et al. (2002) estimate that the overall benefit: cost ratio of the conservation of remaining wild nature is at least 100:1. The costs and benefits of the conservation of protected area can only be possible by applying the economic valuation approaches and knowledge developed by environmental and ecological economists.

The knowledge of total economic value (TEV) of conservation programs can be a useful conceptual framework for estimating the values of ecosystem services as well as justifying the importance of biodiversity preservation. Understanding the TEV framework protected area managers and policy makers can contribute for the preservation of the natural capital, upon which the human well-being and economic development are dependent.

On the other hand, the local people might have been facing problems such as conflict of human and wild animals, exclusion from using the forest resources, limited

access to roads and other social service centers. For the success of biodiversity conservation, these problems should be minimized or mitigated considering the local people's requirements without jeopardizing the conservation objective of the protected area. Supporting local community through buffer zone programs can be one of the economic incentives, where sustainable resource utilization can be assured maintaining the ecological integrity with due consideration of financial support from the amount of revenue collected by the protected areas.

The implication of the valuation of ecosystem services of PA can further be on the awareness build-up at local, regional, and global level gathering of additional funds and political support, addressing the conservation conflicts, making informed for planning and management, and build alliances for conservation.

1.3 Initiatives for Biodiversity Conservation in Nepal

Biodiversity conservation in Nepal was initially originated in 1960s for the protection of wildlife, especially endangered species such as rhinoceros and tiger. The National Parks and Wildlife Conservation Act, 1973 has provided the legal basis for the management of protected areas with the broader objectives of preserving the natural, historic, scenic, and cultural values. The law recognizes the following six categories of PAs in Nepal:

1.3.1 National Parks

An area set aside for the conservation and management of the natural environment, including the ecological, biological, and geomorphologic associations of aesthetic importance.

1.3.2 Strict Nature Reserve

An area of unusual ecological or other significance, set aside for the scientific study.

1.3.3 Wildlife Reserve

An area established for the conservation and management of plant and wildlife and their habitat.

1.3.4 Hunting Reserve

An area set aside for the conservation and management of wildlife to provide opportunities for legal recreational hunting.

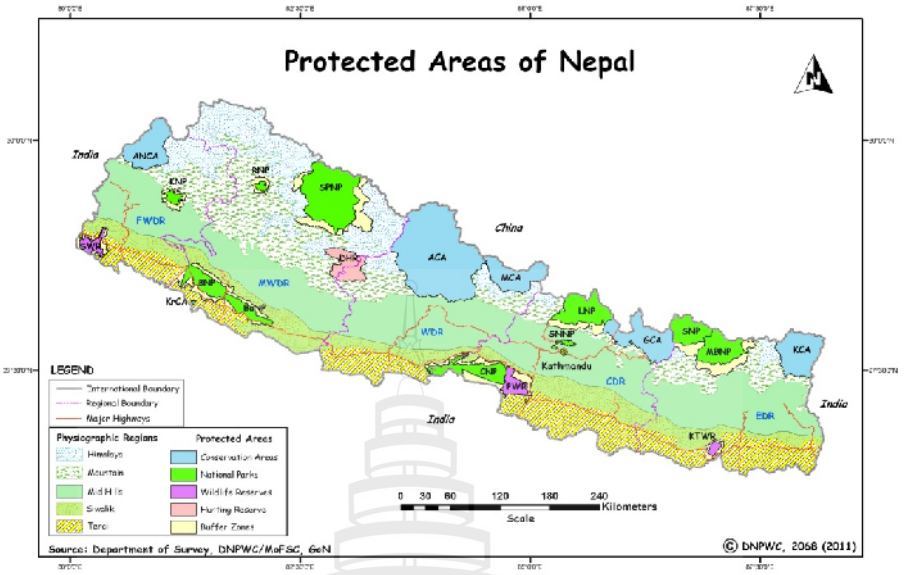
1.3.5 Conservation Area

An area managed according to an integrated plan for the conservation of the natural environment and the sustainable use of the natural resources contained within it.

1.3.6 Buffer Zone

A designated area surrounding a national park or reserve within which the use of forest products by local people is regulated to ensure sustainability.

The Department of National Parks and Wildlife Conservation (DNPWC) is the government institution responsible for the management of PAs in Nepal. Ecosystems and genetic resources are preserved in-situ within the protected area system in Nepal. At present, Nepal has protected area network of 10 National Parks, 3 Wildlife Reserves, 6 Conservation Areas, 1 Hunting Reserve, and 12 Buffer Zones (APPENDIX A). The National Parks and Wildlife Conservation Act, 1974 has enlisted 26 mammal species, 9 bird species, and 3 reptile species ensuring full protection (APPENDIX B).



From Department of National Parks and Wildlife Conservation (DNPWC). (2011). **Map of protected areas in Nepal**. Retrieved 2012, 11 July, from http://www.dnpwc.gov.np/2-uncategorised/60-welcome-to-dnpwc-website

Figure 1.1 Map of Protected Areas in Nepal

Today roughly a tenth of the world's land surface is under some form of protected area (Dudley, 2008). Nepal being one of the small landlocked countries, the protected area covers an area of 23.23% of the total land of the country (Figure 1.1). Out of 118 ecosystems identified by Dobremez in different physiographic zones of Nepal, 80 are represented in the present PA system.

However, the protection was initiated on 1960s by the top-down approach with special emphasis on preserving the habitat of important species— big mammals such as tiger and rhino—for royal family game hunting; the scope has been widened in 1980s to include representative ecosystems of the country. Later on, recognizing the importance of community participation in conservation the provision of buffer zone was incorporated in the laws in 1992.

1.4 Problem Statement

The clients of the protected area are government, donors, tourists, and local people, who are known as the real or potential 'customers' of the goods and services of it (Phillips, 1998). Accounting the costs and benefits urges to evaluate the total economic value of the protected area for which we should have knowledge on what are the ecosystem services and how these services can be estimated in the monetary term.

The beneficiaries of the protected areas, such as urban water consumers and hydropower, tourism, and other industries do not contribute to the management of protected areas or compensate the local communities which often have to live with disadvantages of PA, such as economic damage to their crops and properties by wildlife and limited road access to markets, hospitals, and other facilities. In economic term, this is a market failure (International Center for Integrated Mountain Development, 2011).

Shivapuri Nagarjun National Park is located in the upstream of Kathmandu. The park is well recognized for its rich biodiversity and watershed services. It is also an attractive site for both domestic and international tourists to enjoy its natural beauty. The common problems that the local inhabitants (inside and surrounding villages) encountered are depredation of their livestock and crops. However, Shivapuri-Nagarjun National Park (SNNP) is providing significant benefits such as water regulation, carbon capture, education, recreation, and many more ecosystem services to the local as well as downstream city Kathmandu, the potential funding opportunities from these benefits are never considered to tap and use for providing the compensation to those neighboring villages.

The government of Nepal has successfully implemented the buffer zone management programs in other parks and preparing to declare buffer zone area around the SNNP. However, the park has high potential to generate the funding from the ecosystem services provided by it such as quality drinking water to the lower catchment residents and recreation tourism, the maintenance of ecosystem is overlooked due to very low investment in the protection programs. Moreover, local

residents are also not involved in the protection of national park as buffer zone area is not declared yet and the resources use pressure on the park's forest area is still deteriorating the ecosystem health. On the other hand, neighboring community of the park put their disappointment over losing their traditional right to use forests nearby their villages after the establishment of the park. Definitely, there will be some costs to local people for the loss of access to forest resources and the agricultural and livestock damage by wildlife which can, however, be addressed through providing them the economic incentives to compensate these welfare loss. Nevertheless, we don't know how much cost is borne by the local residents for the protection of the national parks. Buffer zone programs can be an alternative policy measure for this park also to address the local issues, which can further be enhanced through the knowledge of total value of the park in terms of money price required for compensating to the local people.

If the ecosystem services provided by the SNNP is valuated in the framework of total economic value (TEV)—both direct and indirect, benefit and cost, there will be potentially a higher total benefit than the total cost because of the proximity of the park from the capital city. However, the estimation of these costs and benefits as well as the funding mechanism is not adopted in the policy framework. The study will be carried out for the economic valuation of ecosystem services at local level— which is often a cost for neighboring community to conservation— through eliciting the willingness to accept (WTA) a compensation for the protection of the park by using the stated preference surveys such as contingent valuation method.

The economic valuation provides an important basis to achieve supports from all the stakeholders for the management exploring the potential opportunities of sharing the costs and benefits of the protected areas.

1.5 Research Questions

The major research questions are:

1.5.1 What is the estimated economic value of the ecosystem services of Shivapuri-Nagarjun National Park at local level —often considered as costs borne by

neighboring community—based on the preference survey through the contingent valuation method?

1.5.2 What are the various socio-demographic parameters that influence to the possible variation in the preferences of the people for valuing the ecosystem services?

1.5.3 What are the policy implications of the economic valuation of ecosystem services of the protected area?

1.6 Objectives

This study will focus mainly to explore additional level of supports required for the people living in and around the national park and seek their positive attitude towards the conservation. The success of the protected area management has been closely linked with the support from the neighboring residents apart from the efforts from government and funding agencies. The aim of this research study is to support for developing the near future buffer zone funding mechanism of the SNNP that the manager can grab the opportunity of understanding the economic values which local people put to the protected area goods and services. The specific research objectives are:

1.6.1 To estimate the economic value through eliciting the willingness-to-accept (WTA) compensation for the protection of SNNP.

1.6.2 To study the relationships of various socio-demographic characteristics underlying the economic valuation of the ecosystem goods and services.

1.6.3 To provide the information on economic values that local people put to the park resources which can be utilized in designing the proposed buffer zone programs in new policy paradigm of sharing the costs and benefits of the national park under the TEV framework.

1.7 Scope and Limitations

The research area covers only to the proposed buffer zone area of the SNNP to survey the preferences of respondents in terms of contingent valuation, knowledge on Buffer Zone (BZ), and natural and human attitudinal questions. The findings can be utilized for the purpose of designing the buffer zone programs and developing the benefit sharing mechanism between the winners and losers due to the declaration of the national park (NP). The level of knowledge and attitude of local people towards the proposed buffer zone is quite interesting for extending the awareness for the successful participation in near future buffer zone programs. The park manager can take the findings of this research as a reference for preparing proposals for the program.

The study covers the evaluation at the local level as the questionnaire is administered to the set of people living inside and surrounding the national park; however, the research findings can be used by the policy makers at national level for setting the compensation mechanism to welfare the local community and develop an innovative sustainable and self-sufficient protected area management model, rather than putting all the NPs in the same basket of rules and regulations.

The CVM can be a useful tool for decision-makers regarding investment and policy purposes for management of biodiversity hot spots and protected areas in developing countries (Maharana, Rai & Sharma, 2000) and provides a general policy guideline through accounting the total economic values; however, it faces many critiques and controversy blaming the preference biases in hypothetical markets. Economic valuation has both strengths and limitations as a tool for decision-making (Pagiola et al., 2004).

Since the values estimated are based on the direct survey of the respondent's preferences, and the preferences thus likely to change over time. Thus the outcome can represent the values which people put to the PA goods and services at current time and can only be considered as the baseline information for the future use. A valuation study that arrives two years after decisions have been taken is irrelevant—no matter how valid the data (Phillips, editor, 1998).

The total economic value measurement by applying a particular valuation method is almost impossible because there are vast list of ecosystem goods and services of a protected area. The resources such as data collection time, human resources, money, etc are also major constraints to be considered as limiting factors in the research study. The estimated economic value of this study is limited to only the use values where access of local users to the traditional de facto use right of the forest resources are considered to be foregone due to the establishment of PA.

1.8 Conceptual Framework

1.8.1 Ecosystem Approach

The international conventions and programs such as Convention on Biological Diversity (CBD), the World Heritage Convention (WHC), the Ramsar Convention on Wetlands, the United Nation's Law of the Sea, UNESCO's Man and the Biosphere (MAB), and the Global Program of WCPA are the backbone of international policy on the establishment and management of protected areas for the biodiversity conservation and sustainable use of natural and cultural resources (Phillips, editor, 1998).

The Convention on Biological Diversity (CBD) and the Millennium Ecosystem Assessment (MA) recognize this ecosystem approach for developing their conceptual framework. The CBD defines the ecosystem approach as follows:

The Ecosystem Approach is a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of ecosystem approach will help to reach a balance of three objectives of the convention: conservation, sustainable use, and the fair and equitable sharing of the benefits arising out of the utilization of biodiversity. An ecosystem approach is based on the appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems.

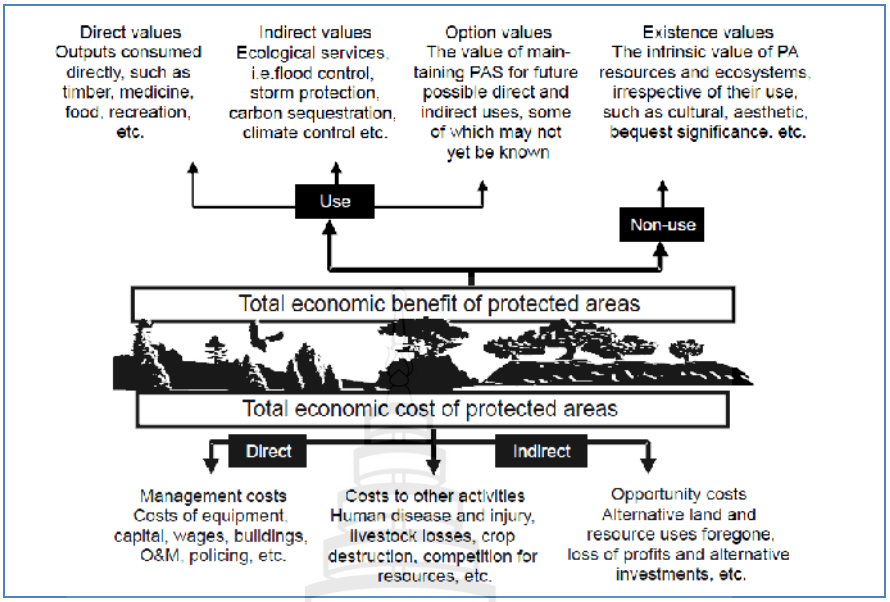
Human beings are integral parts of ecosystems and that a dynamic interaction exists between them and other parts of ecosystems, with the changing human condition

driving, both directly and indirectly, changes in ecosystems and thereby causing changes in human well-being.

1.8.2 Total Economic Valuation (TEV) Framework

The concept of total economic value (TEV) was emerged on the mid-1980s (International Centre for Environmental Management, 2003) and has been widely employed to estimate both the use and non-use values that individuals and society gain or lose from marginal changes in ecosystem services (Haines-Young & Potschin, 2009). While considering economic value of PA, it is important to include both the economic cost and economic benefit (Figure 1.2). The TEV covers all components of utility derived from ecosystem services using a common unit of measure—monetary or market-based unit that makes comparison of benefits of various goods (The Economics of Ecosystems and Biodiversity, 2010).

The total economic benefit of the protected area incorporates both use (direct, indirect, and option value) and non-use (bequest and existence) values (Pearce & Moran, 1994; White, Gregory, Lindley & Richards, 1997).



From International Centre for Environmental Management (ICEM). (2003). **Lessons learned from global experience: Review of protected areas and development in the lower Mekong river region, Indooroopilly, Queensland, Australia**. Hanoi, Vietnam: International Centre for Environmental Management.

Figure 1.2 Total Economic Value Framework

Direct use values are outputs that are directly consumable such as recreation, tourism, natural resources harvesting, hunting, gene pool services, education and research and indirect use values are functional benefits such as watershed protection, habitat, climatic stabilization and carbon sequestration. The option values are the values of PA that can be derived sometimes in future. The bequest value is value of knowing that others might benefit from the resources in some way at some time in the future, and the existence value related to the value of knowing that it continues to exist.

Whilst direct and, to lesser extent, indirect use values may have well-defined monetary components, option value and non-use values are typically far more difficult to define with existing markets (White et al., 1997). Although, derived values for non-market benefits may be controversial, more efforts should be made to assess them and

incorporate them into the decision-making process. Some commonly used methods for valuing protected area goods and services are market prices, effects on production, replacement costs, damage costs, avoided, mitigated or adverted expenditures, travel costs, willingness to pay and contingent valuation (Phillips, editor, 1998; Cook, 2011).

1.8.3 Buffer Zone and People's Participation

The protected area declaration was early initiated traditionally by top down decisions of the government authority to protect flora and fauna without consulting the demand and needs of the local inhabitants. In developing country local people are dependent on the public resources for their livelihoods. The establishment of protected area enforces them the restrictions to access land and forest resources use from it. In developing country, the local people wish to get direct benefits such as timber, firewood, grazing from the vicinity of public land area, while protected area rules impose the strict prohibition of collecting of forest products. The resulting situation is always a confrontation of resources use conflict with the people residing around the protected areas.

The benefits provided by a given ecosystem often fall unequally across different groups (Pagiola et al., 2004). Protected area is a long term strategy of sustaining the benefits provided by the ecosystem services, however, the beneficiaries can be from local to global level, local people feel as losers from the establishment of it (PA) because they need to fulfill the present need for livelihoods. Therefore, local people can be considered as a big threat to PA whenever no alternative policy measures are available to them for addressing the issues of livelihoods. This is the tipping point for achieving supports from local people participation in the conservation—buffer zone program is considered as a bridge to link people in conservation—in developing countries, without which protected area system cannot get success. Buffer zone programs bring into forefront the local people to dialogue together with the park authority for conservation and the government also to support for local residents through providing economic incentives by recycling back the revenue generated by the protected areas.

The policy and legal frameworks for buffer zone program in Nepal are the National Park and Wildlife Conservation Act 1973 (fourth amendment in 1993), Buffer Zone Regulations 1996, and Buffer Zone Guidelines 1999. The fourth amendment of

rules in 1993 stipulate for establishing the buffer zone area and recycling 30-50% of the revenue generated by the protected area back to the respective buffer zone area for integrated conservation programs. Buffer zone program is an important participatory conservation intervention with local institutions such as user group (UG), user committee (UC) and buffer zone council (BZC) (Paudel, Budhathoki & Sharma, 2007), where local people exercise to prepare an integrated conservation and community development plans and implement. There are ample potentials to get more financial supports for funding in protected areas through evaluating the goods and services provided by ecosystem services in term of economic values and tapping the benefits for the livelihoods improvement and better management of protected areas.

CHAPTER 2

LITERATURE REVIEW

2.1 Valuation Methods

A number of valuation techniques are available for economic valuation of the environmental goods that are deliberately used in the environmental and ecological economics literatures. These techniques are either observed behavior (revealed preferences) toward some marketed good with a connection to the non-marketed good of interest or stated preferences in surveys with respect to the non-market goods (Carson, 1999). The reason to use stated preferences survey by discrete choice CVM is that respondents find it very difficult to identify precisely their true point value of access to some resources or public good, open-ended valuation questions can be unreliable or can discourage response (Cameron, 1991). The following Table 2.1 summarizes the main techniques applied for valuation of ecosystem services.

Table 2.1 Techniques of Economic Valuation

Methodology	Approach	Applications	Data Requirement	Limitations
Revealed preference methods				
Production function (also known as 'change in productivity')	Trace impact of change in ecosystem services on produced goods	Any impact that affects produced goods	Change in service; impact on production; net value of produced goods	Data on change in service and consequent impact on production often lacking
Cost of illness, human capital	Trace impact of change in ecosystem services on morbidity and mortality	Any impact that affects health (e.g. air or water pollution)	Change in service; impact on health (dose-response functions); cost of illness or value of life	Dose-response functions linking environmental conditions to health often lacking; underestimates, as omits preferences for health; value of life cannot be estimated easily
Replacement cost (and variants, such as relocation cost)	Use cost of replacing the lost good or service	Any loss of goods or services	Extent of loss of goods or services, cost of replacing them	Tends to overestimate actual value; should be used with extreme caution
Travel cost (TCM)	Derive demand curve from data on actual travel costs	Recreation	Survey to collect monetary and time costs of travel to destination, distance traveled	Limited to recreational benefits; hard to use when trips are to multiple destinations
Hedonic pricing	Extract effect of environmental factors on price of goods that include those factors	Air quality, scenic beauty, cultural benefits	Prices and characteristics of goods	Requires vast quantities of data; very sensitive to specification

Table 2.1 (continued)

Methodology	Approach	Applications	Data Requirement	Limitations
Stated preference methods				
Contingent valuation (CV)	Ask respondents directly their WTP/WTA for a specified service	Any service	Survey that presents scenario and elicits WTP/WTA for specified service	Many potential sources of bias in responses; guidelines exist for reliable application
Choice modeling	Ask respondents to choose their preferred option from a set of alternatives with particular attributes	Any service	Survey of respondents	Similar to those of CV; analysis of the data generated is complex
Other methods				
Benefits transfer	Use results obtained in one context in a different context	Any for which suitable comparison studies are available	Valuation exercises at another, similar site	Can be very inaccurate, as many factors vary even when contexts seem 'similar'; should be used with extreme caution

From Pagiola, S., von Ritter, K. & Bishop, J. T. (2004). **Assessing the economic value of ecosystem conservation**. Washington, DC: The World Bank.

Graves et al. (2009) studied the number of different methods used for economic valuation of ecosystem services by analyzing more than 4000 recent papers published in the natural science, and found the result that contingent valuation (roughly 31%) was by far the most commonly used method (Haines-Young & Potschin, 2009, p. 50). However, this method is subject to severe criticism and the criticism revolves mainly around two aspects, namely, the validity and the reliability of the results, and the effects of various biases and errors (Venkatachalam, 2004). Most valuation methods measure the demand

for the goods and services in economic term through the consumer's willingness to pay (WTP) for the benefit or willingness to accept (WTA) compensation for the loss (Pagiola et al., 2004).

2.2 Contingent Valuation Method

The term contingent valuation is derived from the nature of the method in which responses are derived from individual's actions contingent on the occurrence of a particular hypothetical situation (Garrod & Willis, 1999). For example, tourist's willingness to pay (WTP) to enter a National Park given an entry charge is applied by creating a park; and local people's willingness to accept (WTA) a minimum compensation required to maintain the original level of utility upon the park was closed to them. The CVM for the valuation of environmental goods was first used by Davis in 1963 in a study of hunters in Maine (Hanley et al., 2007).

The contingent valuation method (CVM) is the most preferably used technique for the elicitation of the economic value of the environmental goods and services in which the customer's preference is surveyed in the context of hypothetical market scenario.

The CV survey constructs scenarios that offer different possible future government actions and respondents are asked to state their preferences concerning those actions, then choices made by respondents are analyzed in a similar manner as the choices made by consumers in actual markets (Carson, 1999). Moreover, contingent valuation (CV) involves directly questioning people through surveys about the economic value they place on a change in the quantity and/or quality of a specified resource (Kotchen & Reiling, 2000; Mitchell & Carson, 1989). This method of surveying the preferences of the respondents posing the contingent valuation questions based on hypothetical set of market scenario has gained in using for the estimation of ecosystem services in recent years. Contingent valuation is a method of estimating the values that a person places on a good or service, in which people are asked directly to put their willingness to pay (WTP) to obtain or willingness to accept (WTA) compensation to give up a specific good or service, rather than inferring them from observed behaviors in regular market places (Food and Agriculture Organization, 2001).

A range of methodologies are available to value changes in ecosystem services. These values are considered in a total economic value (TEV) framework that takes into account both the use and non-use values individuals and society gain or lose from marginal changes in ecosystem services. As many ecosystem services are not traded in markets, and therefore remain un-priced, it is necessary to assess the relative economic worth of these goods or services using non-market valuation techniques (Department of Environment, Food and Rural Affairs, 2007). The contingent valuation method is by far the most used method for biodiversity valuation because of the reason that the other valuation methods are unable to identify and measure passive or nonuse values of biodiversity (Nunes & Bergh, 2001).

The value of the ecosystem services for a group of people might be different than others. Also the preferences of individual can be dependent on various factors such as geographical location and socio-economic factors. Duffield, Neher & Brown (1992) found that the non-residents' willingness-to-pay (WTP) for recreation activities on the Bitterroot and Big Hole Rivers in Montana was higher than for the residents. International tourists' WTP was significantly different from domestic tourists' WTP at 10% level for river recreation in Puerto Rico (Loomis & Santiago, 2011) and local respondents are willing to pay less than non-residents (Kniivila, 2006); however, residents' WTP is higher than the non-residents' population for the preservation of endangered species spotted seal in Korea (Kim, J. Y., Mjelde, Kim, T. K., Lee & Ahn, 2012).

Contingent valuation methods (CVM) have considerable attraction in recent years as researchers have begun to resort to survey methods to elicit individual values for non-market goods such as environmental resources or public goods (Cameron, 1991). The CV is a promising method because it includes a broader range of societal concerns about natural environmental management (Maharana et al., 2000). White et al. (1997) also used the CVM for economic valuation of mammals such as otter (*Lutra lutra*) and water vole (*Arvicola terestris*) in Britain.

The literature using CV method for valuing the environmental amenities is mostly found from western countries using the WTP format for eliciting the economic value of ecosystem goods and services. This WTP technique is very often applicable to survey the respondents from developing countries to estimate the economic value of ecosystem

services, thus willingness to accept (WTA) a compensation format is popularly used in developing countries.

There are single-bounded and multiple-bounded types with closed-ended CV questions. One of the variety of CVM survey question formats is discrete choice (or take-it-or-leave-it, referendum, or closed ended) question originally implemented by Bishop and Heberlein in 1979 has proven to be popular (Cameron, 1991). Bishop and Heberlein in 1979 developed the single-bounded formats where respondents were asked with some dollar amount of money for a commodity whether they would be willing to pay that amount; while double-bound format first proposed by Hanemann and Carson and first applied by Carson and Steinberg and Hanemann, Loomis and Kanninen , follows up on the initial question with a second question (Hanemann & Kanninen, 1996).

Casey et al. (2008) studied to estimate the value of environmental risk of oil transport on the Amazon, USA eliciting willingness to accept compensation through surveying the people residing along the river, and revealed relatively high amount of compensation that were necessary in order to accept the potential ecosystem damages associated with oil transport, even if the people were completely compensated for direct damages such as loss of access to productive resources.

Therefore, contingent valuation method can be used for valuing a wide range of ecosystem services. The CV response can statistically be called as discrete dependent variables since they are measured on a nominal or ordinal scale—and is dependent on various socio-demographic characteristics of the respondent.

2.3 Valuation of Protected Areas

Most current species and habitat declines are largely the result of socio-economic and political forces. The biodiversity is continuously decreasing in expense of economic development, thus making it more and more scarce resource. The aim of economics is to utilize the scarce resources more efficiently and the economic value is considered based on the scarcity of the resources. However, economic valuation is based on utilitarian approach; the focus of the protected area valuation should be to establish an economic basis for preservation by pointing out to its benefits (Kassar & Lasserre, 2003). In this

basis, human preferences and values should also be taken into account in devising appropriate and effective conservation measures (Norton, editor, 1986; White, Bennett & Hayes, 2000).

Protected area approach of conservation is the most widely adopted for preserving ecosystems across many countries in the world. In the face of increasing human pressures on the environment, the benefits providing by the PA should act as powerful incentives to conserve nature, yet evaluating them has proved difficult because they are mostly grossly not captured by conventional, market-based economic activity and analysis. In 1997, Costanza et al. published a synthesis of more than 100 attempts to value ecosystem goods and services using a range of techniques including hedonic pricing, contingent valuation, and replacement cost methods. The value of world's ecosystem services and natural capital is estimated US$ 33 trillion per year on an average, which is significantly high than the US$ 18 trillion average global gross national product (GNP) per year (Costanza, et al., 1997).

Recent debates have increasingly stressed the need to differentiate benefits, services, ecological functions, and ecological structures and processes, to emphasize the mechanisms that underpin the links between natural capital and human well-being (Haines-Young & Potschin, 2009). The ecological functions provide the goods and services; however, they are either overlooked or undervalued because of the lack of understanding the relation between the natural ecosystems and the functioning of human well-being. Therefore, ecosystem services valuation can also provide the knowledge about the complex ecosystem functions that provide us goods and services. The problems of ecosystem management stem from both information and institutional failures; for example, knowledge is lacking about the contribution of ecosystem processes and biodiversity to human welfare and how human actions lead to environmental change with impacts on human welfare and institutions such as markets provide the wrong incentives (The Economics of Ecosystems and Biodiversity, 2010).

The effective management of ecosystem requires actions at all scales—local to global for which MA developed a multistage assessment framework providing a new approach for analyzing policy options for local communities to international conventions (Millennium Ecosystem Assessment, 2005).

Although many people benefit from ecosystem services, individuals or groups usually have insufficient incentives to maintain ecosystems for continued provisioning services (The Economics of Ecosystems and Biodiversity, 2010). The valuation should be used to examine the four distinct aspects—total flow of benefits from ecosystems, the net benefits of interventions that alter ecosystem conditions, how the costs and benefits are distributed, and potential financing sources for conservation—of the value of ecosystems (Pagiola et al., 2004).

Protected area has a numerous kinds of values (direct and indirect, use and non-use) provided by the ecosystem services that we can study in the total economic valuation framework as discussed in previous chapter, the appropriate valuation techniques can be selected for valuing the particular value. A single study can never be a complete economic valuation of the park and needs various surveys to get the total benefits and costs of the protected areas. The CVM techniques are deliberately used by researchers to value the ecosystem services of the protected areas in various regions of the world including developing countries.

Shyamsundar and Kramer, 1996 estimated the value of tropical forest resources for rural population in Africa using CV survey with WTA elicitation format to find the welfare losses from restrictions to land-use due to the establishment of Mantadia National Park in Madagascar (Shyamsundar & Kramer, 1996).

The CV survey was conducted involving local community members, domestic and foreigner visitors to estimate the environmental value of the Khangchendzonga National Park in India using the willingness to pay (WTP); however, community members willing to pay in kind or time for park management (Maharana et al., 2000). The residents of Bombay (now Mumbai) were surveyed using CVM to elicit WTP for maintenance of Borivli National Park located near the city and socio-demographic characters: age, gender, occupation, education, income, family size, and location were also considered in the study (Hadker, Sharma, David & Muraleedharan, 1997). The result of the study showed that the willingness to pay amount was 7.5 Indian Rupees (equivalent to US$0.23 in 1995) per month per household for the next five years.

2.4 Literatures Related to Studies in Nepal

Baral et al. (2008) applied contingent valuation method to reveal the tourists' WTP for ecotourism in Annapurna conservation area, Nepal. The tourists' willingness to pay for the increased entry fee is surveyed and analyzed with other socio-economic and trip characters by administering multiple choices, dichotomous yes/no, ordered-rank responses, and few open ended questionnaires.

A feasibility study done by Forest Action and ICIMOD estimated the value of water services of Sundarijal catchment located inside the SNNP is US$ 870 per hectare per year (all revenue minus expenses for water distribution and electricity generation), while the annual cost to the park authority for managing and guarding the park was US$ 55 and the costs (damage to livestock and crops, limited access to market) for local farmers was estimated to be US$ 498 per household per year. This water use value can be considered as a small fraction of the total economic value of ecosystem services generated by the biodiversity conservation of this national park.

Cook (2011) surveyed the foreign tourists' willingness to pay (WTP) for conservation and environmental efforts of Chitwan National Park by using contingent valuation method. The valuation focuses on potential use of CVM in revision of the current entry fee of the park surveying the preferences of foreign tourists with minimal negative results on tourist numbers. This study finds that 71.5% respondents are willing to pay three times (mean value) more than the current entrance fee US$ 7 (Cook, 2011).

This research initiates to apply CVM for valuing the ecosystem services of the protected area at the local level through surveying neighboring residents eliciting their willingness to accept (WTA) a compensation for the conservation of biodiversity. Because the Shivapuri-Nagarjun NP lies in the upstream of Kathmandu— city residents get ecosystem services from the park such as clean drinking water, fresh air, recreational, carbon sequestration—the overall benefits of the park are improved, while local residents are deprived due to restricted land-use and forest resources use in the park. To assure the sustainability of the park, neighboring people's basic demands of natural resource goods need to be addressed. This is really a challenge to conserve biodiversity and protected areas in developing countries like Nepal, where government does not have enough

budgets to compensate local people as well as no information related to preferences of neighboring residents of the park. Therefore, it is imperative to survey preferences of local residents to explore social welfare measures to address these demands as well as tapping the potential funding for better maintenance of the park ecosystems from those who are most benefitted from the park.

The research, however, presents the economic value of ecosystem services at local level eliciting local residents' WTA compensation for the foregone of access to the goods and services due to restrictions imposed by park establishment, it provides an opportunity to design the model for sharing the benefits of the park among all the beneficiaries or stakeholders of the park.

2.5 Funding Mechanism

The payment for ecosystem services (PES) is one type of economic incentive for those who manage ecosystems to improve the flow of environmental services that they provide (Food and Agriculture Organization, 2010). The pioneer countries for the implementation of payments for ecosystem services (PES) and conservation incentives programs from Costa Rica, Mexico, and Ecuador have substantial experience (FONAFIFO, CONAFOR and Ministry of Environment, 2012) and now preparing for further improvement in financial mechanism through implementation of the reduced emissions from deforestation and forest degradation (REDD+).

The identification of potential beneficiaries for investing in the protected areas is important to assure the sustainability of the conservation. The clients of the ecosystem services are different from local to global depending upon the nature of the goods and services (Table 2.3). The watershed service has a local and regional importance, which can be improved by providing incentives to the farmers living in the critical watersheds for the improvement of its ecosystem services.

Table 2.3 Potential Beneficiaries of Ecosystem Services

Services	Beneficiaries	Buyers
Carbon Sequestration	Global Community	Local, regional, and national government International organization (WB-Biocarbon Fund, Community Development Carbon Fund, Prototype Carbon Fund) National carbon funds (Italian Carbon Fund, Netherlands CDM Facility) Land trusts, Corporations, Hedge funds and investment
Biodiversity	Global community	International and national NGOs Private businesses (offsets) Watershed/River Basin Committees (oversight bodies usually represented by private and public institutions) and Water Resources Management Authorities
Water Quality	Local community- potable water Fishermen- pollution reduction Farmers- salinity reduction	Municipalities Private water supplies Public water companies Bottled water companies Farming organizations Watershed/River Basin Committees and Water Resources Management Authorities
Erosion Control	Local community- potable water Dam owners- sedimentation control Fishermen- sedimentation control	Hydroelectric providers

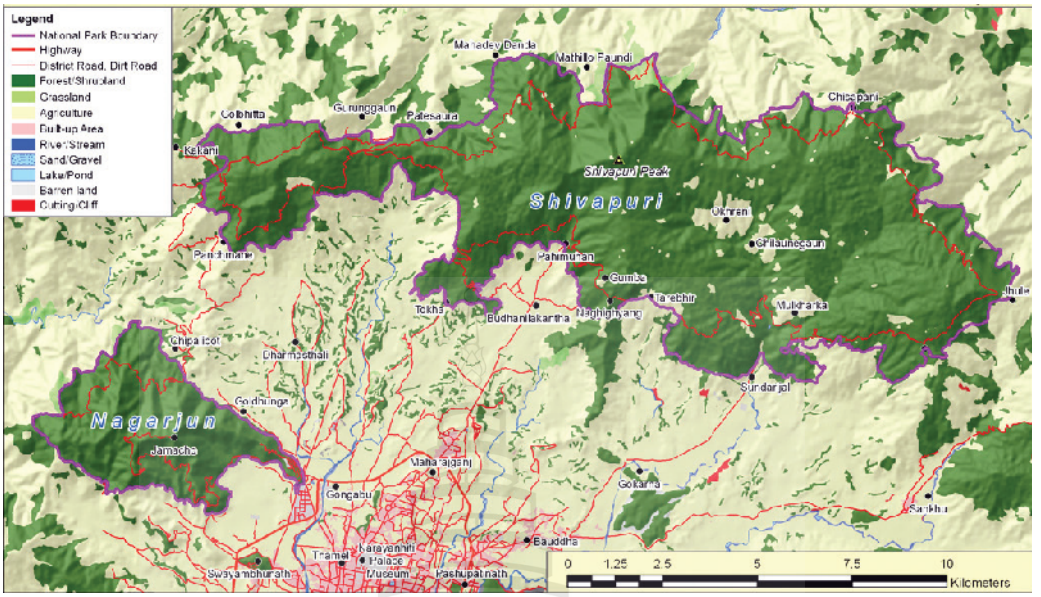
From Food and Agriculture Organization (FAO). (2010). **Payment for environmental services from agricultural land**. Retrieved 2013, 21 February, from http://www.fao.org/es/esa/pesal/ESmarkets2.html

CHAPTER 3

METHODOLOGY

3.1 Study Area

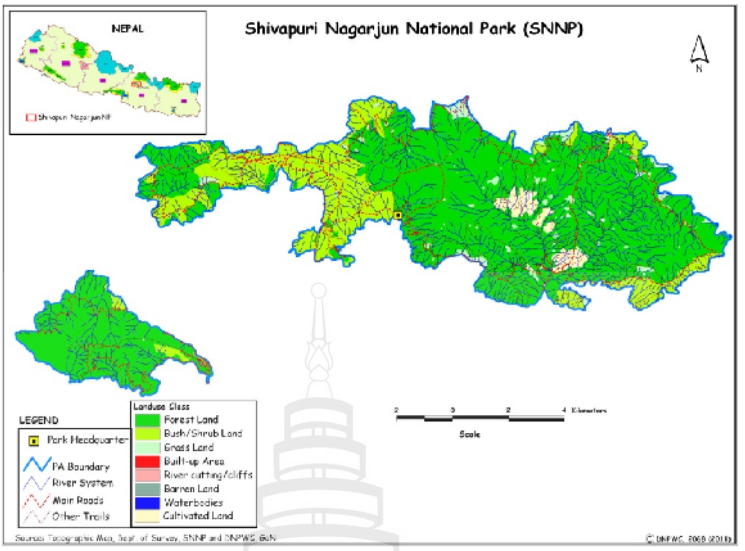
Shivapuri-Nagarjun National Park (159 sq km) is situated on the northern fringe of Kathmandu valley, Nepal and lies about 12 km away from the center of capital city Kathmandu. The name represents two areas from Shivapuri and Nagarjun. Shivapuri National Park, initially established as Shivapuri Watershed Reserve in 1976, later Shivapuri Watershed and Wildlife Reserve in 1984, was gazetted in 2002 as the national park. In 2008, it is renamed as Shivapuri Nagarjun National Park (SNNP) since the Nagarjun Forest Reserve area (15 km^2) has been incorporated in this national park.



From International Center for Integrated Mountain Development (ICIMOD). (2011). **Protected areas and payment for ecosystem services: A feasibility study in Shivapuri-Nagarjun national park**. Kathmandu, Nepal: International Center for Integrated Mountain Development.

Figure 3.1 Location Map of SNNP

It is the only protected area that falls entirely within the middle-mountain physiographic region of Nepal representing the flora, fauna, and ecosystems of the region. The location of such National Park near the capital city is significantly important for providing ecosystem services to a large population and rarely found in anywhere in the world because protected areas are mostly located in remote areas far from the cities.



From Department of National Parks and Wildlife Conservation (DNPWC). (2011). **Map of protected areas in Nepal**. Retrieved 2012, 11 July, from http://www.dnpwc.gov.np/2-uncategorised/60-welcome-to-dnpwc-website

Figure 3.2 Land Use Map of SNNP

The SNNP symbolizes high level of biodiversity and harbors 2,122 plant species with 16 endemic flowering plants; it provides the habitant for 21 mammal species including 8 threatened, 102 species of butterfly, and 177 species of birds (National Trust for Nature Conservation , 2004). This PA directly provides about 40% of the surface drinking water to the Kathmandu valley. Geologically located in the northern belt, the park serves as the recharging zone of ground water as well as the source of two major rivers—Bagmati and Bishnumati— flowing through the Kathmandu city. Shivapuri peak which is located inside the park— a holy place for both Buddhist and Hindu religions— is the attractive natural and cultural heritage site for a large number of religious and recreation tourists. The park also provides ideal place for scientific research. The air pollution caused by fossil fuel burning by cars and households in Kathmandu leaves a thick cloud of carbon dioxides in the air. In this context, SNNP plays a vital role as carbon sink and help to clean the air of the city.

The government has prepared a draft plan to declare the buffer zone with the objectives of strengthening the biodiversity conservation and the welfare of the local people through recycling back the revenue generated from the park to the buffer zone area. The park has prepared a draft sketch of the buffer zone boundaries comprising of the surrounding wards – smallest political units at the village development committee (VDC) level– from the Kathmandu, Dhading, Nuwakot, and Sindhupalchok districts. There are altogether 23 VDCs with 123 wards adjoining the Park area proposed for the buffer zone.

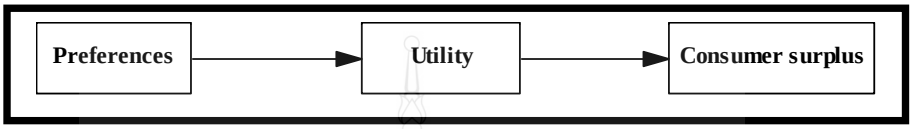
3.2 Theory and Methods

There are two branches of economics known as positive and normative economics, in which former one seeks to describe how the world works, while the other one—often referred to as welfare economics—seeks to make judgments about the desirability of having government undertake particular policies, or put in another way, how the world could work (Mitchell & Carson, 1989). A common feature of all methods of economic valuation of ecosystem services is that they are founded in the theoretical axioms and principles of welfare economics (Pagiola et al., 2004).

Pareto criterion, which stated that policy changes that make at least one person better off without making any one worse off — known as Pareto-improving— is taken into consideration as welfare criterion by the economists (Mitchell & Carson, 1989). Two key assumptions of the positive economics upon which welfare economics theory is based are: the first one is that economic agents (individuals, households, consumers, or firms), when confronted with a possible choice between two or more bundles of goods, have preferences for one bundle over another. The second assumption is that through its actions and choices an economic agent attempts to maximize its overall level of satisfaction or utility.

The utility function is an ordinal representation of preferences that allows us to express the most preferred consumption bundles by the highest level of utility, thus utility is an unobservable, continuous index of preferences (Hanley et al., 2007). If we implement a policy intervention that changes the consumption bundle such that utility

increases, then this change can be measured as consumer surplus in monetary term (Figure 3.3). Consumer surplus can be either of the willingness to pay (WTP) or willingness to accept (WTA) compensation measures.



From Hanley, N., Shogren, J. F. & White, B. (2007). **Environmental economics** (2nd ed.). New York: Palgrave Macmillam. Retrieved 2012, 11 July, from: http://earthmind.net/marine/docs/economic-value-biodiversity.pdf

Figure 3.3 Preferences, Utility, and Consumer Surplus

The indirect utility function and the expenditure function provide the theoretical structure for welfare estimates (Haab & McConnell, 2002). Suppose T_0 and T_1 represent the average land area accessible to the households of local people settled around the Shivapuri-Nagarjun National Park before and after the establishment of the park; due this loss of land accessibility, there will be impact on the production and consumption of the household and thus on welfare. The household expenditure function is defined as

$$\boldsymbol{e}\ (p, U_0, T_0) \qquad (1)$$

Where U_0 is the maximum utility obtained before the park establishment, given a vector of price p and land available T_0. When the accessible land changes from T_0 to T_1, there will be a change in the minimum expenditure required to obtain the utility level U_0. One money measure of the welfare change attributable to a quantity change in a public good is the difference in the minimum expenditure required to maintain the original level of utility (Shyamsundar & Kramer, 1996). This welfare change is called as Hicksian compensating surplus, which is expressed by:

$$\boldsymbol{e}\ (p, U0, T0) - \boldsymbol{e}\ (p, U0, T_1) \qquad (2)$$

Where $\boldsymbol{e}\ (p, U_0, T_1)$ is the minimum expenditure required to obtain the same utility level U_0, given that park has been established and the area of land obtained is T_1.

Now, let WTA_i is the amount of money needed for a household *'i'* for compensating this welfare loss due to the park establishment, this can be expressed as:

$$WTA_i = \boldsymbol{e}\ (p, U_{0i}, T_{1i}; S_i) - \boldsymbol{e}\ (p, U_{0i}, T_{0i}; S_i) + \varepsilon_{1i} - \varepsilon_{0i} \qquad (3)$$

Where, S_i represents a vector of socio-economic characteristics of a household *'i'*. The household expenditure function is assumed to be known to households; however the researcher knows only with a margin of error terms ε. In the CV method of stated preferences, the investigator gets only the yes or no answers from the respondents, rather than the direct monetary amount of WTA. The unobserved dependent variable *WTA* can be stated as:

$$WTA_i = X_i\beta + u_i, \qquad u_i \sim N(0, \sigma 2\ ) \qquad (4)$$

X_i represents various socio-demographic variables including bid variable, which are also known as predictor variables used in regression equation that can predict the unobserved dependent variable *WTA*. Respondent's age, gender, education, household income and landholding are regressed with dummy index variable that represents the yes or no answer to contingent question for an offered bid amount as willingness to accept compensation. Apart from these socio-demographic variables, other variables such as individual's preference of buffer zone over national park for resources use and knowledge and attitude towards buffer zone programs are taken into consideration for regression analysis. The result is analyzed by using the ordinal probit model offered in *gretl* econometric software.

Cameron, 1988 illustrates the conventional dichotomous binary model as 'censored logistic regression' by introducing a threshold value t_i (i.e., bid amounts) to which respondents is confronted in contingent question and provide the answer only as yes or no. The true WTA is not directly observed during the survey, however, it is manifested through the discrete indicator variable I_i, such that

$$I_i = 1, \text{ if } WTA_i < t_i$$
$$= 0, \text{ otherwise} \qquad (5)$$

Where, t_i is the bid amount offered to i^{th} individual. If respondent accepts the bid, we can say the willingness to accept (WTA) amount is less than the offered bid. The researcher gets only the two possible cases either the WTA is lower or higher than the offered bid if the answer is yes or no respectively (For detailed derivation of equations for valuation function, log-likelihood, and optimization, see Cameron, 1988 and

Camerom, 1991). The likelihood function can be optimized directly using a general nonlinear function optimization computer program (Cameron & James, 1987). The point estimates of β and σ are separately produced by this procedure with their individual asymptotic standard errors.

Then, by using the iterative algorithms of a general nonlinear function optimization computer program, the log-likelihood function generated by optimization (Cameron, 1988) to derive the valuation function for *WTA* will be as:

$$E(WTA_i) = E(X_i\beta + u_i) \qquad (6)$$

Since the mean of error variable u_i is zero at the optimal parameter level,

$$E(WTA_i) = E(X_i\beta) \qquad (7)$$

The expected value of point estimation of *WTA*, which is important in policy formulation for the welfare measure identification, can be estimated from the coefficients produces by the available econometric optimization software programs such as *gretl*.

The CV for referendum data developed by Cameron (1988) and Cameron (1991) is used to estimate the expected WTA point estimate. The contingent valuation is the way of estimating the change in the expenditure function or the change in the indirect utility function (Haab & McConnell, 2002).

3.3 Compensating Variation and Equivalent Variation

The two ways of describing money welfare measures are: one is the idea of compensating variation and equivalent variation and the other is the idea of willingness to pay and willingness to accept (Haab & McConnell, 2002). The compensating variation is the amount of income paid or received that leaves the person at the initial level of well-being, and equivalent variation is the amount of income paid or received that leaves the person at the final level of well-being (Haab & McConnell, 2002).

Table 3.1 The Relationships Among Compensating Variation, Equivalent Variation, WTP, and WTA

Condition	Equivalent Variation	Compensating Variation
Utility Increased	WTA	WTP
Utility Decrease	WTP	WTA

From Haab, T. C. & McConnell, K. E. (2002). **Valuing environmental and natural resources: The econometrics of non-market valuation**. Northampton, MA: Edward Elgar.

In compensating variation, if the final well-being is worse than the initial well-being, it will be willingness to accept and if the final well-being is better than the initial well-being, it will be willingness to pay. Equivalent variation is just the opposite of the compensating variation in which willingness to pay for the utility is decreased and willingness to accept for the utility is increased.

3.4 Willingness to Accept (WTA) Compensation

However, there are numerous experiments showing the result of disparities between WTP and WTA, there should be similarity in magnitudes for most goods which are close substitutes and for which the income effect is small (Garrod & Willis, 1999). The fewer the available substitutes of environmental goods with other market and non-market goods, the greater the divergence since there are lower possibilities to make up for this loss (Hanley et al., 2007). The divergence in values measured by WTP and WTA for the same goods poses a threat on rational behavior of individuals, one of the axiomatic assumptions in economic theory. The above two approaches of substitution and income effect have been developed to answer this question.

In this research the environmental goods to be evaluated will have a substitution fulfilling from the alternative management of buffer zone area, thus the use of WTA format is convenient to estimate the ecosystem goods and services of the park. Willig's influential theoretical work in welfare economics—consumer's surplus without apology; according to his analysis, the divergence between WTP and WTA was relatively small, probably less than five percent under most circumstances (Mitchell & Carson, 1989; Hoffman & Spitzer, 1993).

In developing country, local people residing around the government forest areas depend upon heavily for livelihoods and consider the traditional use right over it (forest). They collect since long history the forest goods such as firewood, fodder, timber, and other minor products; and also enjoy many services provided by the natural ecosystem. After establishment of protected areas, government imposes the regulation of strict restriction of access to forest and of collecting the forest products and thus local people will be confronted with a welfare loss. However, the total benefits of the park establishment will be increased; local people want compensation to the loss of access to land for fulfilling basic needs of resources rather than willing to pay for indirect and non-use values such as existence and intrinsic values. In this situation, the WTA format seems appropriate to survey for local residents.

The selection of whether CV format depends in the property rights of the goods to be valued—WTA is relevant if good is owned by the respondent and conversely, WTP is useful for the good individuals do not own. To government forest land in Nepal is deliberately accessible to the traditional users who live close to it, and local inhabitants perceive as their customary rights over the forest resources. The residents living inside and surrounding the Shivapuri-Nagarjun NP are also settled there since generations before the establishment of the park. Carson suggests that the perceived property right is more important than the legal property rights (Mitchell & Carson, 1989). Therefore, WTA format can be considered appropriate to elicit the economic values in this research.

The discrete dichotomous choice method of contingent questionnaire was developed to survey the sampled population. This method is easy to respond in survey, time short for answer, response rate is high.

3.5 Survey Design and Instrument

A list of questions is prepared for the household survey in the sampled areas of the buffer zone area. Considering the geographical regions surrounding the park, the villages are selected for the research study. The questionnaire was designed into four parts—first one consisted the general information about the biodiversity and conservation as start up, second part included the background information concerning the socio-demographic data of the respondent, third part incorporated the contingent valuation question, and the last part was about the attitude and knowledge towards the buffer zone program and natural environment.

Before finalizing the questionnaire, two consecutive meetings were organized to test it and get the general idea about the monetary equivalent use value that the local people has lost from the access to the forest resources due to park's strict restriction rules established. The participants were informed about the objective of the research and the hypothetical market scenario for the resources under consideration. In this meeting, only the key informants were consulted for identifying the range of bids to be offered to the local people for the final administration of the survey.

The amount of money to be used for the bids was calculated based annual household consumption of fuel wood, fodder, timber, grazing, and other forest products. The total quantity was approximated and multiplied by the present available market price to get the monetary total value of the household consumption of these goods, which is considered as the baseline for determining the bid levels for final administration of the questionnaire to the sampled population. The finding of this groundwork is that both of the monetary amounts calculated for the restricted access of land and forest resources were nearly in the similar level. The five bid levels developed through this exercise are as: 30, 35, 40, 45, and 50 thousand Nepalese Rupees. This consultation workshop has been very useful for setting up of the questions in the appropriate sequence, reviewing the exact words translated from English to Nepali, and to get the bid amount.

First the questionnaire was developed in English. In order to conduct the survey with rural villagers, the questionnaire was translated into Nepali language and tested first

at local level to adjust if any so that respondent can understand easily while administering the interview. The contingent question in the hypothetical scenario is as:

Suppose you are asked to use only the buffer zone area and also asked not to use any more the park's forest. In order to compensate the ban of using the park's resources, suppose you are offered..... NRs each year for the welfare of your household as well as to ensure the protection of biodiversity. Would you be willing to accept this compensation?

□ Yes, Would you be satisfied with the .....bid amount? □ Yes, □ No.

□ No, Would you be satisfied with the .....bid amount? □ Yes, □ No.

The scenario set up in this survey is that people living around the park no more use the Park Forest; alternatively, they will fulfill their basic needs of forest products from the buffer zone area. A monetary equivalent of compensation is offered as bid amount whether to choose it by the respondent to keep individual at the original level of utility. In CVM the survey questionnaire includes socio-economic information about the respondent and household, general questions about the environmental attitudes, knowledge and preferences of buffer zone, and other valuable data (APPENDIX C).

The contingent valuation instrument was designed according to general guidelines recommended by the National Oceanic and Atmospheric Administration (NOAA) panel (Arrow et al., 1993). Contingent valuation technique is often used for estimating the value of environmental and public goods in western countries (Shyamsundar & Kramer, 1996) popularly using the WTP elicitation format; however in developing countries the number of literatures has significantly increased to use the WTA format.

3.6 Data Collection and Analysis

Data were collected from secondary and primary sources. The secondary data regarding the proposed buffer zone area and park information were collected from Shivapuri-Nagarjun NP and map was obtained from Department of National Park and Wildlife Conservation. The household number in the draft management plan of SNNP,

2012 was verified from Population Census of 2001 report of the Central Bureau of Statistics of Nepal.

After the survey instrument is set up the survey can be administered using different methods that includes face-to-face interview, telephone interview, or, mail. Data were collected on October to November 2012 in the proposed buffer zone area of the Shivapuri-Nagarjun National Park by face-to-face interview method with the help of park staff and local volunteers. The primary objective of the survey was to develop and test a methodology for understanding the economic linkages between the use of forest resources of the park by local residents and institutional measures taken to protect it.

Double-bound dichotomous choice model was used to record answers from the respondents in which if first response to an offered bid is 'yes', ask again offering a lower amount and record the answer. If the response to first bid is no, ask again with a higher bid amount. However, the single bound dichotomous choice answers are used to analyze in this study because of the simple statistical inferences.

Total population in the study area is from the proposed buffer zone area covering 23 VDCs identified by SNNP. Out of these VDCs, 11 were selected and survey was conducted by using the stratified random sampling technique based on representation from all the distinct geographical locations. These sampled VDCs were grouped into five categories for surveying with the assigned offers of the bid levels 30000, 35000, 40000, 45000, and 50000 Nepalese Rupees (NRs). For each category, 40 questionnaires were planned to be administered initially; however added further more questionnaires depending on the size of the settlement within the ward level. Thus a total of 225 questionnaires were presented for the survey, however, only 185 (82%) were responded with completely answered, 1 was incomplete which was later grouped in non-responded category during data analysis. Remaining 39 (nearly 17%) were unanswered and/or unusable for the analysis, thus discarded them completely for drawing any inferences. The summary of survey data is given in Table 3.2.

Table 3.2 Summary of Survey Data

Group	VDC	Bid Offered (NRS)	Yes	No	Non-response	Incomplete	Total Q
A	Jitpurphedi, Sunkhani, Samundradevi	30,000	40	2	13	0	55
B	Sangla, Jhor Mahankal	35,000	27	13	10	0	50
C	Chapali Bhadrakali, Budhanilkantha	40,000	18	19	2	0	40
D	Kakani, Talakhu, Haibung	45,000	33	2	10	1	45
E	Sundarijal	50,000	31	0	4	0	35
Total			**186**	**36**	**39**	**1**	**225**

The collected data are analyzed both qualitative and quantitative methods by using computer software: SPSS, excel, and gretl available for social and econometric analysis. Statistical tools such as mean, median, standard error, chi-square, R2 are frequently used during the analysis procedures and mean WTA value is estimated by using the econometric model—nonlinear probit from gretl. The theoretical or expected WTA value can be obtained from the parametric coefficient estimates provided by the probit model, which can be utilized as the welfare monetary measure.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 General Socio-economic Status of Survey Population

The socio-demographic characteristics of a total 185 respondents are given in the Table 4.1. The proportion of the male respondent is 74.1%, which is very high with compared to the female. The age category shows that the higher number of respondents is from 21 to 50 year age. The data on education, household income, and landholding are also grouped into different categories as shown in the table, and give the information that larger numbers of respondents have lower socio-economic status.

Table 4.1 Socio-demographic Characteristics of the Respondents

Characteristics	Number	Percentage	Characteristics	Number	Percentage
Gender			Yearly HH income		
Female	48	25.9	(Nepalese Rupees*)		
Male	137	74.1	<= 50000	28	15.1
			50001 – 100000	31	16.8
Age			100001 – 150000	63	34.1
Less than 20 Year	3	1.6	150001 – 200000	35	18.9
21-30 Year	51	27.6	200001 – 250000	16	8.6
31-40 Year	53	28.6	250001 – 300000	4	2.2
41-50 Year	43	23.2	300001+	8	4.3
51-60 Year	19	10.3	*1 USD= 87.5 NR (Rate of 2013 Jan)		
61-70 Year	12	6.5			
More than 70 Year	4	2.2			

Table 4.1 (continued)

Characteristics	Number	Percentage	Characteristics	Number	Percentage
Education level attended			Landholding (Ropani**)		
Elementary	45	24.3	<= 1.0	13	7.0
Middle	69	37.3	1.1 - 5.0	68	36.8
Secondary	40	21.6	5.1 - 10.0	54	29.2
Higher Secondary	16	8.6	10.1 - 15.0	22	11.9
College Bachelor	15	8.1	15.1 - 20.0	13	7.0
			20.1+	15	8.1
Income source			**1 Ropani = 508.74 sq. m.		
Agriculture	128	69.2			
Business	30	16.2			
Service	27	14.6			

The Statistical Package for Social Science (SPSS) version 16.0 and the Gnu Regression, Econometrics and Time-series Library (gretl) version 1.1 free software package for econometric analysis were utilized for data analysis and modeling.

The main income source of the people living in the proposed buffer zone is agriculture which comprises 69.2%.

Table 4.2 Income, Household Size, and Schooling Year Distribution of Sample Population

Variable	Mean
Yearly HH income (NRs)	150,270
Household size	6.1
Number of year attending school	6.9

On an average, the mean yearly income of the household is NRs. 150270 (equivalent to US$ 1717). The area, however, is located near the capital city; the average education level is only 6.9 years of schooling and the household size 6.1 also looks larger compared to the national average of 4.8.

The average number of cattle, goat, and chickens owned by the sample population are given in the following table.

Table 4.3 Cattle, Goat, and Chicken Owned by the Sample Population

Variable	Mean	Minimum	Maximum
Cattle	1.2	0	10
Chickens	6.4	0	700
Goat	3.2	0	20

In a rural subsistence agriculture system, cattle and goat farming depend directly on the nearby public forest areas because they do not have enough private land to support for grazing and fodder tree plantation.

4.2 Use of Forest Goods and Services

Respondents were asked what were the forest goods and services they use since tradition before the establishment of the national park. These are the basic forest resources important for the livelihoods and part of the subsistence agriculture system. These questions also make them clear what kind of goods and services are considered for the evaluation by this research study. These include the direct use values obtained from the public forest such as fuel wood, grass, timber, grazing and other products (Table 4.4).

Table 4.4 Forest Goods and Services Use Before NP Establishment

Forest Goods and Services	Unit	Total Quantity Per Year	Mean	Standard Deviation
Fuelwood	Bhari*	23940	129	147
Grass and Fodder	Bhari**	27370	148	175
Timber (Pole)	Number	590	3	11
Grazing (Cattle and Goat)	Number	293309	1585	2867

Note. *1 Bhari of fuelwood = 30 kg, ** 1 Bhari of grass and fodder = 25 kg (Approx.)

The other minor forest products used by the local resident are wild vegetables, fruits, flowers, mushroom, leaf litter, medicinal plants, and small size woods for making agriculture tools.

4.3 Knowledge and Attitudes towards Nature and Buffer Zone

The key attitudinal questions were adapted from new ecological paradigm (NEP) approach to assess the respondent's attitude towards the natural environment (Kim et al., 2012). The first three are related to the environment oriented attitudinal questions associated with the natural environment, whereas the last three are the human oriented attitudinal questions. The Table 4.5 shows that the sample population has high level of positive attitude towards the environment since more than 70% are strongly agreed to the first three questions.

These questions give stress for the preservation of natural environment. On the other hand, the remaining last three questions represent the human oriented attitudes. The result is that respondents are aware to the nature conservation and the role of humans for preserving it. However, this shows that people are positive to the preservation of nature and they think that other species have also right to exist on the earth; these data are not

taken into consideration for the statistical inferences in the model. The Chronbach's alpha (α) was used to examine the internal consistency of the Likert questions. The Chronbach's alpha for the first three questions is 0.50 and the last three questions is 0.25. These alpha levels are less than the minimum required reliability coefficient of 0.70 recommended by Nunnally and Bestein, 1994 (Kim et al., 2012).

Table 4.5 Percentage respondent's answer to the environmental and human oriented attitudinal questions in 1-5 likert scale*

Key Questions	5	4	3	2	1	Mean
The natural environment is very sensitive to human activities and vulnerable to be destroyed	70.8	23.8	3.8	0.5	1.1	4.63
Humans should live in harmony with nature	71.9	25.4	2.7	0.0	0.0	4.69
Destroying to nature by humans can lead to a tragic result	73.5	23.2	2.7	0.5	0.0	4.7
Humans intend to destroy nature	38.9	33.0	16.2	8.1	3.8	3.95
Plants and animal exist for the sake of humans	2.2	10.8	9.7	43.8	33.5	2.04
Humans have a right to modify nature to meet their needs	3.8	6.5	8.1	38.9	42.7	1.9

Note. *Likert scale 5= Strongly Agree, 4= Moderately Agree, 3= Neutral, 2=Moderately Disagree, and 1= Strongly Disagree.

Respondents were put question whether they know the provision of supporting the buffer zone in government rule that 30-50% of the revenue collected by protected area shall be provided to respective buffer zone fund upon its declaration; if they respond yes, then further asked who decides to develop programs to use this fund.

Only about 36% people have known about this information indicating a large proportion of households are not well aware about the future buffer zone program of the government (Table 4.6). For the successful, it needs further intensive buffer zone extension programs which can be expected only after officially declaration of the buffer zone by then park rangers can be involved on these activities.

Table 4.6 Respondents' Knowledge on Basic Buffer Zone Rules

Response	Frequency	Percentage
Yes	66	36
No	119	64
Total	**185**	**100**

The survey includes the respondent's attitude towards the buffer zone programs by asking whether buffer zone is beneficial to him or her and what benefits do they think from it. People are very positive towards buffer zone accounting 83% of the survey population express several benefits they think to get from it. These benefits are summarized as follow:

i. Awareness and education on environment,

ii. Income generation, eco-tourism, skill development, job creation,

iii. Protection of crops from wildlife, compensation available, fuelwood and forest products available,

iv. Community development,

v. Participation in conservation, forest protection, water source protection, protection of wildlife and national park.

Table 4.7 Respondent Attitude Towards Buffer Zone Program

Response	Frequency	Percentage
Yes	154	83
No	31	17
Total	**185**	**100**

However, very few proportions (17%) showed negative attitude towards buffer zone program and stated that they cannot get benefits from it because they will further loss the accessibly to forests resources.

4.4 Defining the Variables

The response to contingent question provides us the information about the willingness to accept (WTA) value in terms of either Yes or No answer to the offered bid, which is in the form of discrete dichotomous or binary variable. It does not directly provide the point estimate of WTA amount, however gives us the idea that the true value is either less or greater than the bid amount based on the answer whether it is yes or no. This discrete variable obtained from contingent answers is dependent on various characteristics such as socio-demographic factors and the size of the size of the bid amount. The true WTA, the latent variable which is not directly observable in the survey but indicated by yes or no response, is called as dependent variable. The other characteristics variables which influence for choosing yes or no are independent or explanatory variables. The modeling, where we try to evaluate the magnitude and direction of influence of explanatory variables regressing with the dependent variable by using probabilistic link function, is often very important to interpret the qualitative and quantitative relationships of the variables.

The WTA is indicated by a dummy variable I_i which is represented only by two values: 1 for a case if respondent accepts the offered bid t_i and 0 otherwise. The variables

except bid variable are expressed as dummies 1 or 0 for making the model simple and easy to interpret the results. The dummy variable gender is given 1 for female and 0 for male respondent. Similarly, other dummy independent variables age, income, income source, household size, education is also categorized into 1 and 0.

Table 4.8 Summary Statistics, Using the Observations 1 – 185

Variable	Mean	Median	Std. Dev.
t_i = Bid offered in thousand Nepalese Rupees (30, 35, 40, 45, and 50)	39.2432	40	7.01088
WTA Response I_i = 1, if yes 0, otherwise	0.805405	1	0.396963
Gender (Female=1 and Male=0)	0.25946	0	0.43953
Age (More than or equal to 40 years=1, otherwise=0)	0.470270	0	0.500470
Income (More than or equal to NRs 150000=1, otherwise=0)	0.497297	0	0.501350
HH Size (More than 5 members=1, otherwise=0)	0.508108	1	0.501291
Landholding (More than 5 Ropani=1, otherwise=0)	0.464865	0	0.500117
Education (More than or equal to 10 schooling years=1, otherwise=0)	0.335135	0	0.473319
Income source (Agriculture=0, otherwise=1)	0.30811	0	0.46296
Preference (Buffer zone=1 and National park=0)	0.632432	1	0.483451
Knowledge on provision of BZ rules (Yes=1 and No=0)	0.356757	0	0.480342
Attitude towards BZ benefits (Yes=1 and No=0)	0.832432	1	0.374495

To see the influence of income source on WTA, a dummy variable income source is defined as: agriculture is categorized as 0 and otherwise is given as 1 category.

Respondent's preference to buffer zone over national park for resources collection and use, their knowledge of the buffer zone fundamental rules about budget allocation, and attitude towards buffer zone whether it is beneficial to local community are also defined by respective dummy variables as shown in following table.

The bid variable, which has five different levels are randomly offered to individuals in five different groups, is directly inserted in the regression equation. The Table 4.8 gives summary of variable names with their respective mean, median, and standard deviation.

4.5 Maximum Likelihood Estimation (Probit)

The gretl econometric software is utilized for analyzing the data in which various independent 'explanatory' variables are regressed with the dependent WTA variable by using the nonlinear probit model. The Table 4.9 is the output summary of the maximum likelihood estimates of coefficients, standard error, z-score, and p-value for the respective variables. In this table the first column represents the variable name, the second column gives the intercept and maximum likelihood estimate (MLE) coefficients of explanatory variables, the third one represents the standard error of probit coefficients, the fifth column is the z-score, and the sixth column gives p-value of the individual coefficients.

In probit model, the coefficients of explanatory variables provide some information about the effect of this variable on dependent variable (Adkins, 2012). The positive or negative signs of the coefficients provide the direction of effect of explanatory variables to the dependent variable, but the magnitude tells us little, particularly when the variables are in different measurement units. If the sign is positive, the utility of choice 1 relative to choice 0 increases when the value of the variable increases.

This model fits the data well as the likelihood ratio chi-square 47.9511 [p = 0.0000 < 0.001] is significant in 99% confidence interval. The percent correctly predicted 84.9% is the percentage for which predicted value of WTA matches with its observed value. Theoretical validity involves assessing the degree to which the results of a CV study are consistent with theoretical expectations. For theoretical validity, Mitchell and Carson (1989) suggest that a CV study which has an R2 of less than 0.15 might be

deemed unreliable (Garrod & Willis, 1999). In the result, the model has McFadden R2 as 0.26, which is acceptable. The goodness of fit measures, indicative sign of coefficients, significant coefficients, and the probit model fits well in explaining variations in contingent valuation question.

Table 4.9 MLE Values of Probit Coefficients of Independent Variables

Model: Probit; Dependent variable: WTA

QML standard errors

	Coefficient	**Std. Error**	**z**	**p-value**	
Constant	-2.35491	0.803696	-2.9301	0.00339	***
Gender	0.345196	0.322106	1.0717	0.28386	
Age	0.398308	0.295036	1.3500	0.17701	
Income	0.029756	0.268932	0.1106	0.91190	
HH Size	-0.405059	0.268674	-1.5076	0.13165	
Landholding	0.204371	0.276677	0.7387	0.46011	
Education	-0.327152	0.255409	-1.2809	0.20023	
Income source	0.125688	0.258522	0.4862	0.62684	
Preference	0.088874	0.255204	0.3482	0.72766	
Knowledge	-0.117168	0.278849	-0.4202	0.67435	
Attitude	1.9049	0.369123	5.1606	<0.00001	***
Bid	0.044525	0.017737	2.5103	0.01206	**

Mean dependent var	0.805405	S.D. dependent var	0.396963
McFadden R-squared	0.262973	Log-likelihood	-67.19561

Number of cases 'correctly predicted' = 157 (84.9%)

f(beta'x) at mean of independent vars = 0.397

Likelihood ratio test: Chi-square(11) = 47.9511 [0.0000]

		Predicted	
		0	1
Actual	0	18	18
	1	10	139

Test for normality of residual -

Null hypothesis: error is normally distributed

Test statistic: Chi-square(2) = 4.40641

with p-value = 0.110448

In this empirical study the variables household size, education, and knowledge on buffer zone regulations have a negative effect on the dependent variable WTA. The probability of accepting the bid amount is smaller with bigger family size, higher education level, and more knowledge. This indicates that the utility of choice 1 relative to 0 decreases for the respondent having more members in a household, which means that the utility from the quantity of forest products consumption is higher than the amount of compensation offered. For those who are well educated can take protected area management for the sake of intrinsic value of biodiversity conservation. Based on field discussion, respondents with higher education level put their views that human being should protect biodiversity, control illegal activities to protect the park. Thus, said that they do not need any monetary compensation, and this money is rather better to invest in the conservation.

The variables gender, age, landholding, income, and income source have positive effect to dependent variable. Female and aged respondents have shown more chance to accept the compensation, thus agree to stop the collection of forest goods from the park area and they want to protect the park if they get some compensation. Likewise, the probability of answering yes is more for respondent whose household's major source of income is business or job than those of agriculture. We can interpret this as: people have to be dependent more on public land for their subsistence agricultural systems. Respondents with more landholdings have a higher chance of accepting the bid as they can fulfill their demand for resources such as fuelwood, fodder, and grasses from the private land.

Preference of forest products collection from buffer zone over national park area has also an increased chance of accepting WTA compensation, which indicates that people favor to fulfill their demand of forest products managing the buffer zone area and want to preserve the park resources. The respondents who have positive attitude about the buffer zone, i.e., these programs have benefits to the community and individual living in buffer zone after declaration of it, chose more 'yes' answer to the contingent question of WTA compensation. This is significant explanatory variable for predicting the dependent variable even at 1% significant level (99% confidence interval). The other very important explanatory variable known as bid that has a positive effect to the choice of yes answer of the contingent valuation question indicating that the probability of WTA increases with a higher level of bid offers, which is also significant at 5% significant level (95% confidence interval). The result is as expected that if the bid amount is increased there is a higher chance to be accepted by the respondent.

Those who know primary government rules related to the buffer zone provision—that 30-50% of the revenue collected by the park goes to community living in the buffer zone area—has a probability of answering no to the contingent question. This variable also has the similar influence as education has on dependent variable.

Respondents were asked to select one of the means through which payment of the WTA compensation amount is better to be available to their household. These means of payment are buffer zone management committee (BZMC) account, national park (NP) account, environment conservation trust fund (ENVTRUST), job in park or buffer zone (JOB), and (Table 4.10).

Table 4.10 Means of Payment of WTA Compensation Amount

Means	Frequency	Percentage
Buffer Zone Management Committee	54	36
National Park	43	29
Job in NP or BZ	31	21
Environment Trust Fund	21	14
Total	**149**	**100**

They were informed that after declaration of the buffer zone, buffer zone management committee will have a bank account and proposed that the compensation amount will be paid to the household through the committee account is one of the means for payment. The next option can be payment to the household through the national park's bank account directly. The environment conservation trust fund was also proposed as the means of paying the compensation amount, where a trust fund will be established and all the amount of money received as compensation is managed as a trust fund. The annual interests of this trust fund can only be utilized for the welfare of the community by their collective decisions. The fourth option of payment was proposed as jobs equivalent to the amount of money accepted for compensation.

The respondent selected different means of payment accounting for 36% through buffer zone management committee account, 29% national park, 21% jobs in the park or buffer zone, and 14% environmental trust fund.

4.6 Willingness to Accept Compensation

Expected value of the WTA can be obtained from the fitted values of probit parameter coefficients. Cameron (1988) illustrated the method of computing the point estimates of WTP or WTA by introducing a threshold value 't_i' in the valuation function in the censored referendum data. The probit coefficients can be used to estimate the expected value of the WTA. For this procedure the estimated probit coefficients are re-parameterized to get the marginal effect of individual independent variables on dependent variable for computing the point estimation of WTA as suggested by Cameron (1988) and Cameron (1991).

The estimated WTA value is the total of sum of the mean marginal effects calculated from all parameter coefficients and the constant coefficient, which is 18.07 thousand NRs (US$ 207 equivalent) per household per year for five years (see APPENDIX D for calculation). Since the frequency of 'yes' answer to the bid amount of lower level is also higher, the true WTA of these individuals might be lower than this bid, thus the expected value of true WTA estimated from the fitted model is at a lower point than the offered bid levels can be considered as justifiable.

Alternatively, we can evaluate the offered bid levels and the frequency of 'yes' or 'no' response for selecting the WTA as welfare measures. However, the true WTA value is significantly dependent on the size of bids; it is equally possible to be influenced by other variables as well. The different bid levels were offered to respondents in different groups, of which the frequency and percentage of observed count and expected count, is as follows (Table 4.11). However, the real count does not exactly converge with the expected ones; the 'yes' answer is observed more for the higher bid levels.

Table 4.11 Cross-tabulation of Expected and Observed Response to Offered Bid Levels

Bid (Thousand NRs)	**Counts**	**Respondent's Answer to CV Question**		**Total**
		No	**Yes**	
30	Observed	2	40	42
	Expected	8.2	33.8	42.0
35	Observed	13	27	40
	Expected	7.8	32.2	40.0
40	Observed	19	19	38
	Expected	7.4	30.6	38.0
45	Observed	2	32	34
	Expected	6.6	27.4	34.0
50	Observed	0	31	31
	Expected	6.0	25.0	31.0
Total	**Observed**	**36**	**149**	**185**
	Expected	**36.0**	**149.0**	**185.0**

After regressing the bid variable with the contingent answer along with other socio-economic variables, the probit coefficient is used to find the probability of answering 'yes' with conditional of these bid levels. The bid levels are converted into z-

score: $\varphi(z_i) = \varphi(\beta X_i)$, where β=0.044 and X_i represents the bid variable; probability is obtained from standard normal table, then plotted the curve by using excel. A curve is drawn for the probability of accepting a bid against the offered bid levels (Figure 4.1).

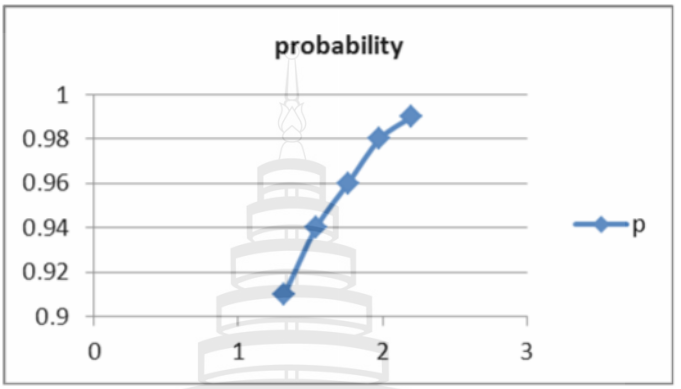


Figure 4.1 Probability Curve for Bid Levels

This indicates that the probability of accepting the offered bid increases as the bid level is increased performing a logistic curve. The curve follows the expected shape for the different bid levels.

4.7 Aggregating and Selecting the Welfare Measure

The estimated WTA amount is aggregated for the households living in the proposed buffer zone of SNNP. The total number of households is 7663 (Central Bureau of Statistics, 2001). The aggregate amount has a total value of US$ 1,586,241 per year (US$ 207 per year per HH). Alternatively, we can interpret the result as the economic value of the park's goods and services (use value) at local level is estimated to be US$ 99.76 per ha per year. Moreover, since highest proportion of respondents selected buffer zone for compensating means and has a significant role of attitude towards buffer zone program, the implementation of BZ can be a participatory program that addresses the welfare loss of the local people living around the park.

REFERENCES

REFERENCES

Adkins, L. C. (2012). **Using gretl for principles of econometrics** (4th ed.). Oklahoma: Oklahoma State University.

Arrow, K., Solow, R., Portney, P. R., Leamer, E. E., Radner, R. & Schuman, H. (1993). **Report of the NOAA panel on contingent valuation**. Retrieved 2012, 11 July, from http://www.cbe.csueastbay.edu/~alima/courses/4306/articles/NOAA%20on%20contingent%20valuation%201993.pdf

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R. E., Jenkins, M., Jefferiss, V., Jessamy, V., Madden, J., Munro, K., Myers, N., Roughgarden, J., Trumper, K. & Turner, R. K. (2002). Economic reasons for conserving wild nature. **Science, 297**(5583), 950-953.

Baral, N., Stern, M. J. & Bhattarai, R. (2008). Contingent valuation of ecotourism in Annapurna Conservation Area, Nepal: Implications for sustainable park finance and local development. **Ecological Economics, 66**(2-3), 218-227.

Brown, K. (1997). The political ecology of biodiversity, conservation and development in Nepal's terai: Confused meanings, means and ends. **Ecological Economics, 24**(1), 73-87.

Cameron, T. A. (1988). A new paradigm for valuing non-market goods using referendum data: Maximum likelihood estimation by censored logistic regression. **Journal of Environmental Economics and Management, 15**(3), 355-379.

Cameron, T. A. (1991). Interval estimates of non-marker resource values from referendum contingent valuation surveys. **Land Economics, 67**(4), 413-421.

Cameron, T. A. & James, M. D. (1987). Estimating willingness to pay from survey data: An alternative pre-test-market evaluation procedure. **Journal of Marketing Research, 24**(4), 389-395.

Carson, R. T. (1999). **Contingent valuation: A user's guide**. San Diego, UC: Department of Economics, UCSD.

Casey, J. F., Kahn, J. R. & Rivas, A. A. F. (2008). Willingness to accept compensation for the environmental risks of oil transport on the Amazon: A choice modeling experiment. **Ecological Economics, 67**(4), 552-559.

Central Bureau of Statistics (CBS). (2001). **Population census-2001 Nepal. number of households, population by sex for districts, village development committees and wards**. Thapathali Kathmandu, Nepal: Government of Nepal, National Planning Commission Secretariat, CBS.

Cook, J. M. (2011). **Valuing protected areas through contingent valuation: A case study of Chitwan national park, Nepal**. Retrieved 2012, 11 July, from http://digitalcommons.ryerson.ca/dissertations/684

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G. & Sutton, P. (1997). **The value of the world's ecosystem services and natural capital**. Nature, 387, 256.

Daily, G. C., Alexander, S., Ehrlich, P. R., Goulder, L., Lubchenco, J., Matson, P. A., Mooney, H. A., Postel, S., Schneider, S. H., Tilman, D. & Woodwell, G. M. (1997). **Ecosystem services: Benefits supplied to human societies by natural ecosystems**. Washington, DC: Ecological Society of America.

de Groot, R. S, Wilson, M. A. & Boumans, R. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. **Ecological Economics, 41**(3), 393-408.

Department of Environment, Food and Rural Affairs (DEFRA). (2007). **An introductory guide to valuing ecosystem services**. London, UK: DEFRA.

Department of National Parks and Wildlife Conservation (DNPWC). (2011). **Map of protected areas in Nepal**. Retrieved 2012, 11 July, from http://www.dnpwc.gov.np/2-uncategorised/60-welcome-to-dnpwc-website

Dudley, N. (Ed.). (2008). **Guidelines for applying protected area management categories**. Gland, Switzerland: IUCN Publications Services.

Duffield, J. W., Neher, C. J. & Brown, T. C. (1992). Recreation benefits of instream flow: Application to Montana's big hole and Bitterroot rivers. **Water Resource Research, 28**(9), 2169-2181.

FONAFIFO, CONAFOR and Ministry of Environment. (2012). **Lessons learned for REDD+ from PES and conservation incentive programs**. Costa Rica, Mexico: FONAFIFO, CONAFOR and Ministry of Environment.

Food and Agriculture Organization (FAO). (2001). **Applications of the contingent valuation method in developing countries**. Retrieved 2012, 11 July, from ftp://ftp.fao.org/docrep/fao/003/X8955E/X8955E03.pdf

Food and Agriculture Organization (FAO). (2010). **Payment for environmental services from agricultural land**. Retrieved 2013, 21 February, from http://www.fao.org/es/esa/pesal/ESmarkets2.html

Garrod, G. & Willis, K. G. (1999). **Economic valuation of the environment: Methods and case studies**. Cheltenham, UK: Edward Elgar Publishing.

Graves, A., Morris, J., Chatterton, J., Agnus, A., Harris, J., Potschin, M. & Haines-Young, R. H. (2009). **Valuation of natural resources: A NERC scoping study**. Cranfield, Bedford, UK: Natural Resources Management Centre Department of Natural Resources School of Applied Science Cranfield University.

Haab, T. C. & McConnell, K. E. (2002). **Valuing environmental and natural resources: The econometrics of non-market valuation**. Northampton, MA: Edward Elgar.

Hadker, N., Sharma, S., David, A. & Muraleedharan, T. R. (1997). Willingness-to-pay for Borivli national park: Evidence from a contingent valuation. **Ecological Economics, 21**(2), 105-122.

Haines-Young, R. H. & Potschin, M. B. (2009). **Methodologies for defining and assessing ecosystem services**. Nottingham: Centre for Environmental Management, University of Nottingham.

Haneman, M., Loomis, J. & Kanninen, B. (1991). Statistical efficiency of double-bounded dichotomous choice contingent valuation. **American journal of agricultural economics, 73**(4), 1255-1263.

Hanemann, W. M. & Kanninen, B. (1996). **The statistical analysis of discrete-response CV data**. Oxford: Oxford University Press.

Hanley, N., Shogren, J. F. & White, B. (2007). **Environmental economics** (2nd ed.). New York: Palgrave Macmillam. Retrieved 2012, 11 July, from: http://earthmind.net/marine/docs/economic-value-biodiversity.pdf

Hoffman, E. & Spitzer, M. L. (1993). Willingness to pay vs. willingness to accept: Legal and economic implications. **Washington University Law Review, 71**(1), 59-114.

International Center for Integrated Mountain Development (ICIMOD). (2011). **Protected areas and payment for ecosystem services: A feasibility study in Shivapuri-Nagarjun national park**. Kathmandu, Nepal: International Center for Integrated Mountain Development.

International Centre for Environmental Management (ICEM). (2003). **Lessons learned from global experience: Review of protected areas and development in the lower Mekong river region, Indooroopilly, Queensland, Australia**. Hanoi, Vietnam: International Centre for Environmental Management.

Kassar, I. & Lasserre, P. (2003). Species preservation and biodiversity value: A real option approach. **Journal of Environmental Economics and Management, 48**(2), 857-879.

Kim, J. Y., Mjelde, J. W., Kim, T. K., Lee, C. K. & Ahn, K. M. (2012). Comparing willingness-to-pay between residents and non-residents when correcting hypothetical bias: Case of endangered spotted seal in South Korea. **Ecological Economics, 78**, 123-131.

Kniivila, M. (2006). Users and non-users of conservation area: Are there differences in WTP, motives and the validity of responses in CVM surveys?. **Ecological Economics, 59**(4), 530-539.

Kotchen, M. J. & Reiling, S. D. (2000). Environmental attitudes, motivations, and contingent valuation of non-use values: A case study involving endangered species. **Ecological Economics, 32**(1), 93-107.

Loomis, J. & Santiago, L. E. (2011). Testing differences in estimation of river recreation benefits for international and domestic tourists as a function of single-versus multiple-destination day trips. **Journal of Hospitability Marketing & Management, 20**(2), 143-165.

Maharana, I., Rai, S. C. & Sharma, E. (2000). Environmental economics of the Khangchendzonga national park in the Sikkim Himalaya, India. **GeoJournal, 50**(4), 329-337.

Millennium Ecosystem Assessment (MA). (2005). **Ecosystems and human well-being: A framework for assessment**. Washington, DC: Island Press.

Mitchell, R. C. & Carson, R. (1989). **Using surveys to value public goods: The contingent valuation method**. Washington, DC: RFF Press.

Moberg, F. & Folke, C. (1999). Ecological goods and services of coral reef ecosystems. **Ecological Economics, 29**(2), 215–233.

Naeem, S. (1998). Species redundancy and ecosystem reliability. **Conservation Biology, 12**(1), 39-45.

National Trust for Nature Conservation (NTNC). (2004). **Shivapuri national park management plan**. Jawalakhel, Lalitpur, Nepal: National Trust for Nature Conservation.

Norton, B. G. (Ed.). (1986). **The preservation of species: The value of biological diversity**. Princeton, NJ: Princeton University Press.

Nunes, P. A. L. D. & van den Bergh, J. C. J. M. (2001). Economic valuation of biodiversity: Sense or nonsense?. **Ecological Economics, 39**(2), 203-222.

Pagiola, S., von Ritter, K. & Bishop, J. T. (2004). **Assessing the economic value of ecosystem conservation**. Washington, DC: The World Bank.

Paudel, N. S., Buthathoki, P. & Sharma, U. R. (2007). Buffer zones: New frontiers for participatory conservation?. **Journal of Forest and Livelihood, 6**(2), 44-53.

Pearce, D. & Moran, D. (1994). **The economic value of biodiversity**. London: Earthscan Publications.

Phillips, A. (Ed.). (1998). **Economic values of protected areas: Guidelines for protected area managers**. Retrieved 2012, 11 July, from: http://data.iucn.org/dbtw-wpd/edocs/PAG-002.pdf

Shyamsundar, P. & Kramer, R. A. (1996). Tropical forest protection: An empirical analysis of the costs borne by local people. **Journal of Environmental Economics and Management, 31**(2), 129-144.

The Economics of Ecosystems and Biodiversity (TEEB). (2010). **The economics of valuing ecosystems and biodiversity** (chapter 5). Geneva, Switzerland: The Economics of Ecosystem and Biodiversity.

Venkatachalam, L. (2004). The contingent valuation method: A review. **Journal of Environmental Impact Assessment Review, 24**(1), 89-124.

Walker, B. H. (1992). Biological diversity and ecological redundancy. **Conservation Biology, 6**(1), 18-23.

White, P. C. L., Bennett, A. C. & Hayes, E. J. V. (2000). **The use of willingness-to-pay approaches in mammal conservation**. Heslington, York: Environment Department, Universoty of York, UK.

White, P. C. L., Gregory, K. W., Lindley, P. J. & Richards, G. (1997). Economic values of threatened mammals in Britain: A case study of the otter *Lutra lutra* and the water vole *Arvicola Terrestris*. **Biological Conservation, 82**(3), 345-354.

APPENDICES

APPENDIX A

PROTECTED AREAS OF NEPAL

Table A1 Protected Areas of Nepal

S.N.	Name	Year	Area (km2)
1	Chitwan NP	1973	932
2	Sagarmatha NP	1976	1148
3	Langtang NP	1976	1710
4	Rara NP	1976	106
5	Khaptad NP	1984	225
6	Shey Phoksundo NP	1984	3555
7	Bardia NP	1988	968
8	Makalu Barun NP	1991	1500
9	Shivapuri Nagarjun NP	2002	159
10	Banke	2010	550
11	Koshi Tappu WR	1976	175
12	Shukla Phanta WR	1976	305
13	Parsa WR	1984	499
14	Dhorpatan HR	1987	1325
15	Annapurna CA	1992	7629
16	Kanchanjungha CA	1997	2035
17	Manaslu CA	1998	1663
18	Blackbuck CA	2009	16.95
19	Api Nampa CA	2010	1903
20	Gaurishankar CA	2010	2179
Buffer Zones (BZ)			
21	Chitwan NP	1996	750
22	Bardia NP	1996	507
23	Langtang NP	1998	420
24	Shey Phoksundo NP	1998	1349
25	Makalu Barun NP	1999	830
26	Sagarmatha NP	2000	275
27	Shukla Phanta WR	2004	243.5
28	Koshi tappu WR	2004	173
29	Parsa WR	2005	298.17
30	Rara NP	2006	198
31	Khaptad NP	2006	216
32	Banke NP	2010	344
	Total Area		**34,186.62**

APPENDIX B

LIST OF PROTECTED WILDLIFE SPECIES OF NEPAL

Table B1 List of Protected Wildlife Species of Nepal

SN	Scientific Name	Local Name	Common Name	Status	
				IUCN	CITES
Mammals:					
1	*Ailurus flugens*	Habre	Red panda		I
2	*Antilope cervicapra*	Krishnasar	Black buck	V	III
3	*Bos gaurus*	Gauri gai	Gaur	V	I
4	*Bos grunniens*	Yak nak	Wild yak	E	I
5	*Bubalus bubalis*	*Arna*	*Wild water buffalo*	E	III
6	*Canis lupus*	Bwanso	Tibetan wolf	V	I
7	*Caprolagus hispidus*	Hispid kharayo	Hispid hare	E	I
8	*Cervus duvaucelii*	Barasinghe	Swamp deer	E	I
9	*Elephus maximus*	Jangali hatti	Asiatic elephant	E	I
10	*Felis lynx*	Lynx	Lynx	E	II
11	*Hyaena hyaena*	Hundar	Striped hyena	E	
12	*Macaca assamensis*	Asamese rato bandar	Asamese monkey		II
13	*Manis pantadactyla*	Salak	Chinese pangolin		II
14	*Moschus chrysogaster*	Kasturi	Himalayan musk deer	E	I
15	*Ovis ammon*	Nayan	Great Tibetan sheep	I	I
16	*Panthera tigris*	Bagh	Royal Bengal tiger	E	I
17	*Panthera uncia*	Hiun chituwa	Snow leopard	E	I
18	*Pantholops hodgsonii*	Chiru	Tibetan antelope		I
19	*Pardofelis nebulosa*	Dhwanshe chituwa	Clouded leopard	V	I
20	*Platanista gangetica*	Saus	Gangetic dolphin	V	I
21	*Prionailurus bengalensis*	Chari bagh	Leopard cat		II
22	*Prionodon pardicolor*	Silu	Spotted linsang		I
23	*Rhinoceros unicornis*	Gainda	Greater one-horned rhinoceros		
24	*Sus salvinus*	Sano/pudke bandel	Pigmy hog	EXN	I
25	*Tetracerus quadricornis*	Chausingha	Four-horned antelope		III
26	*Ursus arctos*	*Himali rato bhalu*	Brown bear		I

Table B1 (continued)

SN	Scientific Name	Local Name	Common Name	Status	
				IUCN	CITES
Birds:					
27	*Buceros bicornis*	Thulo dhanesh	Great pied hornbill		I
28	*Catreus wallichii*	Cheer	Cheer pheasant	E	I
29	*Ciconia nigra*	Kalo saras	Black stork		II
30	*Ciconia ciconia*	Seto saras	White stork		II
31	*Eupodotis bengalensis*	Khar majur	Bengal florican	E	I
32	*Grus grus*	Saras	Common crane		
33	*Lophophorus impejanus*	Danfe	Impeyan pheasant		I
34	*Sypheotides indica*	Sano khar mujur	Lessar florican		II
35	*Tragopan satyra*	Munal	Crimsom-horned pheasant		
Reptiles:					
36	*Gavialis gangeticus*	Ghadial	Gavial crocodile	E	I
37	*Python molurus*	Ajingar	Asiatic rock python	V	I
38	*Varanus flavescens*	Sun gohoro	Golden monitor lizard	I	I

From Department of National Parks and Wildlife Conservation (DNPWC). (2011). **Map of protected areas in Nepal**. Retrieved 2012, 11 July, from http://www.dnpwc.gov.np/2-uncategorised/60-welcome-to-dnpwc-website

APPENDIX C

QUESTIONNAIRES

Part I. Start up*: warm-up, delivery of maps and leaflet that provide the information on the importance of biodiversity conservation, proposed buffer zone program, assurance of that the use of collected data will be confidential and be used for the purpose of this research only.*

Part II: Background Information (Respondent)

1. Home address:

   Village Development Committee: ....

   Ward No.: ..... . Hamlet: .....

2. Age: ..... Year

3. Gender: □ Male □ Female.

4. Major source of income:

   □ Agriculture □ job □ Business

   How much income/Household per year? ..... NRs.

5. Household size: ..... Number;

   Land holding (Ropani): Irrigated ..... , Non-irrigated:.....;

   Livestock (Unit): Cattle....., Goat ....., Chicken.....

6. Number of years attended in school?.....year.

7. Are you a member of any conservation organizations and clubs?

   □ Yes □ No

   If yes, please name: .....

8. What are the goods and services that you were getting from the Park Forest Area before declaring it as national park? How often/year did you go to forest for that?

Items	Frequency	Total Quantity	Remarks
Fuelwood			
Grass			
Timber			
Grazing			
Non-timber forest products and others			

9. Where do you prefer for collecting the forest products:

□ Buffer Zone □ Park

Part III: Contingent valuation question.

10. Suppose you are asked to use only the buffer zone area and asked not to use any more the park's forest. In order to compensate the loss of using the forest resources, suppose you are offered..... NRs each year for the welfare of your households as well as to ensure the protection of biodiversity in SNNP. Would you be willing to accept this compensation?

□ Yes, Would you be satisfied with the .....bid amount?

□ No, Would you be satisfied with the .....bid amount?

11. Which one do you prefer as a compensating vehicle among the followings?

□ Buffer zone committee fund

□ SNNP account

□ Environmental trust fund

□ Jobs in the park/buffer zone

Part IV: Knowledge to Buffer Zone/Attitude towards Biodiversity Conservation

12. Do you know that 30-50% of the total revenue collected by the SNNP can be allocated for its buffer zone area management?

    □ Yes □ No

    If yes, who handles this fund? .....

13. Do you think that buffer zone program provides benefits to you?

    □ Yes □ No

    If yes, what do you think to get from it?.....

14. Please rate '5' to'1' scales whether you agree on each of the following questions depending upon your motivation?

Key Questions	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree
The natural environment is very sensitive to human activities and vulnerable to be destroyed	5	4	3	2	1
Humans should live in harmony with nature	5	4	3	2	1
Destroying to nature by humans can lead to a tragic result	5	4	3	2	1
Humans intend to destroy nature	5	4	3	2	1
Plants and animal exist for the sake of humans	5	4	3	2	1
Humans have a right to modify nature to meet their needs	5	4	3	2	1

APPENDIX D

RE-PARAMETERIZED COEFFICIENTS AND MARGINAL EFFECTS

Table D1 Re-parameterized Coefficients and Marginal Effects

Variable	coefficients	Re-parameterization (b)	Mean	Marginal effect based on mean	Median	Marginal effect based on median
Constant	-2.35491	52.88997				
Gender	0.34520	-8.94578	0.26	-2.321	0.00	0.00
Age	0.39831	-0.66831	0.47	-0.314	0.00	0.00
Income	0.02976	-0.66831	0.50	-0.332	0.00	0.00
HH Size	-0.40506	9.09740	0.51	4.622	1.00	9.10
Landholding	0.20437	-4.59006	0.46	-2.134	0.00	0.00
Education	-0.32715	7.34765	0.34	2.462	0.00	0.00
Income source	0.12569	-2.82288	0.31	-0.870	0.00	0.00
Preference	0.08887	-1.99605	0.63	-1.262	1.00	-2.00
Knowledge	-0.11717	2.63153	0.36	0.939	0.00	0.00
Attitude	1.90490	-42.78299	0.83	-35.614	1.00	-42.78
Bid	0.04452	-1				
Total				**-34.82**		**-35.68**

1. Compute by re-parameterized coefficients to get the value b of the valuation function by $b = -(\boldsymbol{\gamma}/\alpha)$, where $\boldsymbol{\gamma}$ is the vector of estimated coefficients except the estimated coefficient of bid variable and α is the estimated coefficient of the bid variable.

2. Marginal effect = re-parameterized coefficients multiplied by respective mean (or median) value of the respective independent variable.

3. Then expected value of WTA is: E(WTA) = constant + total marginal effect of the all the variables. In this example,

Mean WTA = 52.89 + (-34.82) = 18.07 thousand NRs, and

Median WTA = 52.89 + (-35.68) = 17.21 thousand NRs.

CURRICULUM VITAE

CURRICULUM VITAE

NAME	Mr. Hari Bhadra Acharya
DATE OF BIRTH	16 December 1969
ADDRESS	Ichangu Narayan VDC-9 Kathmandu District, Bagmati Zone, Nepal 44600

EDUCATIONAL BACKGROUND

1995	Bachelor of Science Forestry Tribhuvan University
1991	Bachelor of Science Physics Tribhuvan University

WORK EXPERIENCE

2010-Present	Under Secretary Department of National Parks and Wildlife Conservation, Nepal
2009-2010	District Soil Conservation Officer District Soil Conservation Office, Jhapa
2006-2009	Assistant Conservation Officer Shivapuri-Nagarjun National Park, Kathmandu
1997-2006	Assistant Soil Conservation Officer Department of Soil Conservation and Watershed Management, Nepal