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Valuation of Ecosystem Services in the Kailash Sacred Landscape

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ICIMOD Research Report 2017/2

Valuation of Ecosystem Services in the Kailash Sacred Landscape

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Foreword

The Hindu Kush Himalaya (HKH) houses one of the most diverse ecosystems, harboring numerous habitats and remarkable biodiversity. With wide range of vertical heterogeneities in topography, climate, water, and soil, this region does possess some of the most important high altitude ecosystems. These factors have also resulted in a high degree of genetic diversity in terms of crop and livestock species or varieties and their wild relatives in mountains. The provisioning, regulating, supporting, and cultural services flow provided by these mountain ecosystems contributed to the wellbeing of the mountain populations and people living in the downstream.

Hindu Kush Himalaya is also known to its high cultural diversity, but also characterized by its limited accessibility, poverty, and remoteness. Managing ecosystems in this area is challenging, with not only the reason of its remoteness and limited access, but also high dependency of local communities for their livelihoods. Managing ecosystems for sustainable supply of ecosystem services that people living downstream are enjoying needs high level of consideration to incentivize upstream farmers, as their subsistence livelihood options are based on land use practices, both agriculture and forests.

Incentivizing mountain communities for their effort in managing ecosystems, and ensuring supply of ecosystem services has been widely discussed in recent global discourse. Number of solutions such as Payment for ecosystem services (PES), have been practiced. However, institutionalizing such solutions are challenging, as this needs wider understanding of ecosystem service flow and it linkages with land use change. Understanding value of these ecosystem services is important, not only to institutionalize, such ecosystem management solutions, but also supporting enabling policy options.

The South Asia Network for Development and Environmental Economics (SANDEE) is dedicated network institution working on environmental economics in the region. ICIMOD is pleased to join hands with SANDEE on this publication to share our expertise and knowledge on understanding value of various ecosystem services in the Kailash Sacred Landscape (KSL), one of the diverse landscapes in the region. Together, we have conducted a detailed study on the state of knowledge regarding valuation of ecosystem services, possibility of streamlining incentive based mechanism, and also to understand forests-water relationship in Nepal and Indian part of KSL. We hope that these findings, and the recommendations drawn from them, will strengthen future research plans for assessing the value of ecosystem services in the region.

David J Molden, PhD
Director General
ICIMOD

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Acronyms and Abbreviations

AD	Anno Domini
ADB	Asian Development Bank
ASC	Alternative Specific Constant
BC	Before Christ
CBS	Central Bureau of Statistics
CFUGs	Community Forest Users Groups
CF	Community Forest
CS	Consumer Surplus
DADO	District Agriculture and Development Office
DDC	District Development Committee
DCE	Discrete Choice Experiment
DFO	District Forest Office
DSCO	District Soil Conservation Office
DWSDO	Drinking Water and Sanitation Division Office
ES	Ecosystem Service
FECOFUN	Federation of Community Forest User Groups Nepal
FGDs	Focus Group Discussions
FNCCI	Federation of Nepalese Chambers of Commerce and Industry
GoN	Government of Nepal
HH	Household
ICIMOD	International Centre for Integrated Mountain Development
INR	Indian Rupees
IPES	Incentive Payment for Ecosystem Services
KIIs	Key Informant Interviews
KSL	Kailash Sacred Landscape
KSLCDI	Kailash Sacred Landscape Conservation and Development Initiative
MDGs	Millennium Development Goals
MNL	Multi-Nominal Logit
NGO	Non-Governmental Organization
NPR	Nepali Rupees
NTFPs	Non-Timber Forest Products
OLS	Ordinary Least Square
PES	Payment for Ecosystem Services
RPL	Random Parameter Logit
SANDEE	South Asian Network for Development and Environmental Economics
SC/SC	Schedule Caste/Schedule Tribe
SDGs	Sustainable Development Goals
SLC	School Leaving Certificate
TC	Total Cost
TCM	Travel Cost Method
TDF	Town Development Fund
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States Dollar
VDC	Village Development Committee
WTP	Willingness to Pay
VP	Van Panchayat

Highlights

Background

- This study has been carried out to estimate the value of ecosystem services, particularly water and cultural services, and to design incentive payment for ecosystem services schemes in the selected sites of the Kailash Sacred Landscape (KSL) of India and Nepal.
- The present study focuses on the following three aspects of the KSL region: valuing the cultural services provided by the three religious sites of Patal Bhubaneswar cave, and the Hat-Kalika and Gwallek Kedar temples; estimating the water provisioning services provided by different forest types, i.e., Chir Pine vs. broadleaf in three watersheds of the KSL region; and examining the possibility of developing an incentive payment mechanism for the ecosystem services provided by the watershed for the drinking water scheme in the Baitadi township in Nepal.

Cultural Services

- About 7,900 people visit the Patal Bhuwaneshwar cave temple annually for exclusively religious purposes. On average, a representative visitor travels to the cave temple twice in a given five-year span. The visitor gains INR 13,750 (or NPR 21,947/USD 210) per trip per person as consumer surplus, which can be interpreted as the lower bound of per person per visit use value of the cultural services provided by the site.
- 50% of local households visit the Hat-Kalika temple and Gwallek Kedar about four times per year on average. The use value of cultural services per trip per person for these households ranges from NPR 1,784 to 3,413 (or INR 1,115 to 2,133/USD 17 to 33), depending on the site.
- The total annual use value of the cultural services to the 7,900 visitors and 8,917 households living around the three sample sites is NPR 300 million (or INR 187.5 million/USD 2.9 million[1]). Based on this estimation, the annual use value of the cultural services from the local pilgrimage sites, which household members frequently visit for spiritual fulfilment, is NPR 2.35 billion (or INR 1.47 billion/USD 22.6 million) for the 200,000 households living in the KSL.
- The benefits from the religious sites can be increased by introducing the possibility of home-stay and/or other facilities for instance, opportunities to visit other local cultural/natural sites so that travellers would extend their stay at the religious site to visit these other sites, and by encouraging members of local community to produce and sell local products and handcrafts as souvenirs at the cultural sites.

Water Provisioning Services

- More than 70% of the respondents taking part in the study stated that water availability has undergone a noteworthy decrease in recent years, particularly in the dry season. The dominant strategy for coping with water stress is collecting water from different sources, located far from their house compared to the one habitually/ normally used.
- Water filters and water purifiers are the more common coping strategy in Hat-Kalika (82%) and Chandak-Aunla Ghat (32%) but more households invest in water storage items in Gwallek (76%).
- Households living near Chir Pine forests seem more water stressed compared to households living near Deodar or mixed forests of broadleaf-conifers or Chir Pine-Deodar. Those households that have Chir Pine trees around their water sources spend more time collecting water and more money on water storage devices compared to the other households.
- The saving in water collection time of villagers living near Deodar or mixed forests of broadleaf-conifer or Chir Pine-Deodar varies between 27 minutes to 90 minutes per day per household depending on the type of forest and the season which comes to a wage income saving of USD 31 to USD 318 (or between INR 2,099 and INR 21, 512) in India and USD 23 to USD 238 (or between NPR 2,484 and NPR 25,704) in Nepal per year per household.

[1] We used average exchanged rate of April 2015.

Incentive Payments for Ecosystem Services

- For water users of Baitadi town, water quality and quantity are the most important attributes. The estimated annual willingness to pay for doubling water availability by water users in the Baitadi Municipality is NPR 482,000 (or USD 4,505) and for doubling water supply that can be drunk directly from the tap is NPR 1.18 million (or USD 11,000).
- The construction of public toilets and the regularization of grazing, off-season vegetable farming and drinking-water distribution in the upstream area may contribute to maintaining the quality of water available to downstream water users. The implementation of these activities require NPR 1.17 million (or USD 11,000) in the first year and NPR 425,640 (or USD 3,978) annually from the second year onwards.
- Though the identified activities cannot guarantee an increased water yield at the water source, water users are willing to pay the agreed amount for the identified activities in the watershed area while the watershed households have agreed to implement the activities as per the agreement, which would help improve water quality and inclusive accessibility.
- The study highlights the importance and recommends the integration of the Incentive Payment for Ecosystem Services (IPES) design with the initial environmental examination of drinking water supply projects.

Executive Summary

Using behavioral economic theory and statistical methods, this study estimates the use value of ecosystem services that the households living in the three watersheds and visitors to the Patal Bhuwaneshwar Cave Temple of the Kailash Sacred Landscape (KSL) area derive from the sites under consideration. The selected watersheds (Hat-Kalika and Chandak-Aunla Ghat of India and Gwallek Kedar of Nepal) are the pilot sites of the Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI) of the International Center for Integrated Mountain Development (ICIMOD) in Nepal and India. The present study mainly focuses on estimating the value of the cultural services and the water provisioning services of the forest ecosystem along with assessing a possibility of designing an incentive payment for an ecosystem services (IPES) scheme for provisioning drinking water to one of the pilot sites. We interviewed a total of 1,418 respondents for the study, making it inclusive where women's share is about 50% of the respondents.

The literature on the valuation of the cultural services of religious sites is very thin. This research contributes to filling in some of the gaps in the literature using the landscape approach for the valuation of cultural services. It only measures the use value of three religious sites (Patal Bhuwaneshwar Temple, Hat-Kalika Temple and Gwallek Kedar) using the revealed preference approach, thus not measuring the existence or non-use value of the given landscape. We use primary survey data from the three representative sites of the Kailash Sacred Landscape (in India and Nepal) and employ the travel cost method to estimate the use value of these cultural sites to the domestic visitors and households who live in the surrounding areas and visit these sites frequently for religious and cultural purposes.

Our results indicate that domestic tourists visit the Patal Bhuwaneshwar site in India about twice every five years but that the local people visit the local cultural sites (Hat-Kalika temple or the Gwallek Kedar) about 18 times every five years. However, not all households visit these sites. In our sample, about 50% of the surveyed households visit these local religious sites at least once in five-year span. In the case of visitors to the Patal Bhuwaneshwar site, the value of the cultural services is close to NPR 22,000 (or INR 13,750/USD 215) per visit per person. For the local households, the value of the cultural services ranges from NPR 1,784 (or INR 1,115/USD 17) to NPR 3,413 (or INR 2,100/USD 33) per person per visit, depending on the sites they visit. For the sample watersheds and the Patal Bhuwaneshwar temple, per year average value of cultural services is NPR 300 million (or INR 187.5 million/USD 2.9 million). If we exclude the use value of the sites to the outside visitors, the annual estimated use value (i.e., the consumer surplus) of the cultural services from the three sites to the 200,000 households residing in the KSL area who frequently visit the nearby cultural sites for religious proposes amounts to over NPR 2.35 billion (or INR 1.47 billion/USD 22.6 million).

Mountain people in the Himalayas believe that large-scale planting of Chir Pine (*Pinus roxburghii*) in the past is the major cause of the drying up of water sources in the region. Taking this belief as the backdrop, an assessment of the link between forest type and water availability in terms of accessibility to and collection time of water in the Kailash Sacred Landscape was carried out to estimate the value of water services. The study was carried out in Hat-Kalika (Gangolihat) and Chandak-Aunla Ghat in the Pithoragarh district of Uttarakhand, India and Gwallek in the Baitadi district of Nepal. A total of 954 households were interviewed, out of which 604 households were from Indian side and 350 households from Nepalese side, in order to measure the coping cost of households faced with water stress in villages surrounded by different forest types. The value of water services was computed using the household production function approach. The results of the study indicates that households located near Chir Pine forests face more water stress compared to their neighbors living close to Deodar or mixed forests of broadleaf-conifers or Chir Pine-Deodar. Those households that have Chir Pine around their water source spend both more time collecting water and more money on storage and other devices. The saving in the water collection time of villagers living in the vicinity of Deodar or mixed forest of broadleaf-conifer or Chir Pine-Deodar varies between 27 minutes and 90 minutes per day per household depending on the type of forest which amounts to a wage income saving of USD 31 to USD 318 (or INR 2,099 to INR 21,512) in India and USD 23 to USD 238 (or NPR 2, 484 to NPR 25,704) in Nepal per year per household. Our results therefore point to the need for the gradual conversion of Chir Pine monocultures into mixed forests.

The third study on IPES was carried out to design an incentive payment for the ecosystem services scheme in the Baitadi Town Water Supply and Sanitation Project of Nepal in order to enhance the sustainability of the project by addressing the long-term impacts of water diversion to the watershed community. The project is designed to supply water to the users of the Dasharath Chand Municipality of Baitadi District, Nepal, from the Gwallek Watershed. The main intention behind the design of the scheme is to ensure the predicted flow, minimize possible obstruction from the watershed community in the form of water diversion and to maintain the current quality of water in future. The households of both watershed community and water users were interviewed using separate questionnaires for this purpose. A discrete choice experiment was used to determine the preferences of water users, which showed that, for water users, water quality and quantity were the most important attributes. The results indicate the estimated annual willingness to pay for doubling water availability to be NPR 482,076 (or USD 4,505) and for doubling water quantity that can be drunk directly from the tap is NPR 1.18 million (or USD 10,988).

The results of the household survey with the watershed community and consultations with stakeholders indicate that construction of toilets, regularization of grazing, incentives for off-season farming, and a scheme to distribute drinking water in the upstream area may contribute to maintaining the quality and quantity of water available to downstream water users. These activities require NPR 1.17 million (or USD 10,987) in the first year and NPR 425,640 (or USD 3,978) annually from the second year on. Though the identified activities cannot ensure increased water yield at the water source, water users were ready to pay the agreed amount for these activities in the watershed area while the watershed households agreed to implement the activities as per the agreement. This indicates that implementing the IPES in the Baitadi Town Water Supply Project is financially feasible and socially acceptable. Based on the results, we recommend the integration of the IPES design into the initial environmental examination for the drinking water supply projects.

Policy Options

Based on the results of this study, the following policy options are suggested to enhance the efficacy of KSLCDI:

- Conservation of religious/cultural sites: Mountain communities living in the region have a rich history of natural landscapes, which contains myths and stories about gods and goddesses, thus endowing great value on the religious sites located in such landscapes. Conservation of such sites would bring dividends to local communities, which would in turn guarantee both their welfare and the preservation of such sites. This could be based on the concept of Incentives for Ecosystem Services, which should be part of the next phase of KSLCDI.
- Accounting for benefits of religious sites: The estimated use value of the religious sites to the local residents in the Kailash Sacred Landscape is USD 22.6 million per year. This indicates that the landscape provides an array of services, contributing to the welfare of local communities. Accounting for these values helps to understand the importance of religious sites to the local people and may enhance the conservation of the landscape.
- Improving facilities for tourists/visitors: In our sample, only 17% of the visitors purchased local products and none of them stayed overnight at local cultural sites. This may be due to the non-availability of local products to be purchased and of limited to no overnight-stay facilities. The respondents however indicated their willingness to pay for such products and services if they were made available. Therefore, KSLCDI should focus on improving facilities at the local level for visitors.
- Gradual conversion of Chir Pine monocultures into mixed forest: Mountain communities face fresh water scarcity as a result of which they spend an inordinate amount of time on collecting water. However, villagers living near mixed forest and broadleaf forest spend less time on collecting water compared to villagers living near Chir Pine monocultures. It is therefore necessary to make the CFUGs in the region aware of this issue and for the Forest Department to be sensitized on the value of mixed forests. This finding is of special significance for those concerned about the overall welfare and well-being of the women of the community who are the water collectors in 90% of the surveyed households.
- Integrating IPES with environmental impact assessment: The design of an IPES is a rigorous process, which demands substantial funds and carefully guided multi-stakeholder processes. Therefore, integrating aspects of an IPES into the project design phase, particularly into the initial environmental examination/ environmental impact assessment phase may reduce the cost while facilitating coordination among the project stakeholders.

These policy options would be useful as the Governments of India and Nepal start considering the most effective policies and measures for the sustainable development of mountain areas in the Hindu Kush Himalayas.

1 Introduction

1.1 Background to the Study

The Kailash Sacred Landscape (KSL), which comprises over 31,252 km^2 and is spread over parts of three countries - China, India, and Nepal – provides multiple onsite and offsite ecosystem services that are beneficial to both local and national consumers. The KSL area is predominantly rural and both the lives and livelihoods of people in the area are strongly tied up with the surrounding ecosystems. Ecosystems provide the context, setting and boundaries for the people's daily lives and activities. As such, their health, culture, religion, and livelihoods are influenced by the ecosystem services they receive. Furthermore, some ecosystem services such as cultural and religious services could yield off-site benefits, for people living in faraway areas as well as those nearby, both within and beyond the national boundaries.[1]

Thus, it is understood that changes in the ecosystem can have a substantial effect on the local economy by disrupting the lives and livelihoods of people. In recent times, the diversity and health of KSL ecosystems have undergone many changes because of both anthropogenic (due to over exploitation, and land-use change) and climate change drivers which have affected the flow of ecosystem services and consequently the welfare of the people (Zomer et al., 2014). Such welfare changes could have serious repercussions on the development of the KSL landscape as people in the area are overwhelmingly dependent on the ecosystems and possibilities of finding substitutes for the primary and basic ecosystem services, even provisioning services, would be difficult in such remote areas. Needless to say, cultural services have no human-made substitutes so that any loss of cultural services would pose an irreversible loss to society (MEA, 2005). In this backdrop, our study is an attempt to value some of the important ecosystem services of the KSL area on a pilot scale.

1.1.1 Importance of cultural ES of Kailash Sacred Landscape

The Kailash Sacred Landscape is rich both in terms of its biological and cultural diversity. The cultural value of the landscape is significant as this landscape possesses a number of culturally important sites, including Mt. Kailash which is a much revered place of worship for people of many religions globally (Zomer and Oli, 2011). According to current assessments, KSL, given its outstanding value as a site of unique biological and cultural significance, qualifies to be recognized as a transnational UNESCO Heritage Site. Not only do the cultural sites bind the people even across borders, they can play an important role in the economic development of the region, thus underscoring the need for protection and development of the region. As such, a valuation of cultural services that would provide a basis for evidence-based policymaking is important which would also convince policy makers to initiate long-term conservation measures for the sustainability of KSL. However, there is a lack of relevant literature on the issue. The present study is an attempt to fill the gap.

1.1.2 Need and challenges of ES valuation for a remote, less monetized area

Ecosystem valuation determines the impacts of human activities on the environment while also carrying the potential to capture the value of ecosystem services that are not traded in conventional markets. These estimated values can be used in awareness-raising, policy formulation, identifying the cost effectiveness of public policies, and developing payments for ecosystem services mechanisms. Furthermore, valuation contributes to creating a balance between development and conservation priorities, making possible mitigation measures that would make development activities more responsible towards conservation, resulting in what is understood as sustainable development. Since valuation elicits public preferences allowing people to make trade-offs between available policy options, it could help to minimize social conflicts emanating from policy interventions while enhancing human welfare (Rai et al., 2015). However, ecosystem valuation in mountain contexts, where a majority of the people live below or near the poverty line and mostly in non-monetized sub-economies, is not straightforward (Rai and Scarborough, 2015). Both ecosystem services and their valuation are context-specific. Hence, in the case of the KSL, both conceptual

[1] For detailed information on the Kailash Scared Landscape project, please refer to Pande et al. (2016a).

understandings and a good knowledge of the complexities that riddle the life-styles of people in the region are needed in order to develop a clear methodology for valuing the more important services identified with this specific ecosystem.

1.2 Objectives of the Study

The overall objective of the study is to understand, identify, and value the various ecosystem services provided by the KSL. However, at the initial stage, a few important ecosystem services would be valued from the three watersheds of the selected pilot sites in India and Nepal. The specific objectives of this study include:

- Valuation of cultural services
- Valuation of the water provisioning services of the forest ecosystem, and
- Assessing the potential for developing an incentive-based mechanism for drinking water provision in one of the pilot sites.

1.3 Scope of the Study

This study provides an estimate of the use value of selected ecosystem services that visitors and residents derive from the sample sites in the KSL area. Although, there are numerous cultural and religious sites in the KSL region, information and associated travel costs for those who visit the area from outside are only available for the sample site of Patal Bhuwaneshwar. Hence, the study confines itself to estimating the use value of cultural services to those who visit the cave temple of Patal Bhuwaneshwar, and Hat-Kalika and Gwallek Kedar. Moreover, though we estimate the use value of cultural services to the local households who visit the local cultural sites frequently for religious purposes, we do not consider either the existence value of the cultural services or the value of such cultural services to service providers such as hotels and restaurants. In that sense, the estimates provided in the study might be said to hover at the lower bound of the cultural services provided by the KSL area. In the case of the forest ecosystem, we consider the water provisioning services of forests to the local households. We have based the choice of the service on the feedback that the study team received during FGDs and KIIs. Keeping in mind the concerns and observations of the local residents, we estimate the relative water provisioning services of Deodar, broadleaf or mixed forests in comparison with that of Chir Pine monoculture forests. While accessing the possibility of developing IPES for provisioning drinking water services in downstream community in mountain context, we study the issue at Baitadi township in Nepal.

1.4 Choice of Pilot Sites

We selected three sites for the study; two in KSL India and one in KSL Nepal (see Figure 1.1). The selection of study sites was mainly determined by the pilot sites picked by the International Centre for Integrated Mountain Development (ICIMOD) under the Kailash Sacred Landscape Initiative. The sites selected were the Gwallek Kedar Watershed of Baitadi in KSL Nepal and the Chandak-Aunla Ghat and Hat-Kalika Watersheds of the Pithoragarh District in KSL India. In addition, the Patal Bhuwaneshwar Cave Temple and the Baitadi Municipality were also selected for this study.

Gwallek Kedar, Baitadi, Nepal: Gwallek Kedar is a religious forest covering an area of more than 5,700 hectare in Baitadi, which is one of the districts within the KSL area in Nepal and is located at a distance of 20 km from the district headquarters of Baitadi. The forest area is surrounded by 23 villages coming under 8 village development committees, with a population of 28,400 and 5,393 households (CBS, 2012). The entire forest area is devoted to the Hindu God Shiva and is called Kedar Dham, a place considered sacred and consecrated for the worship of God Shiva. The sacred site attracts a large number of visitors from both the surrounding area as well as from other parts of Nepal and India who visit the site on various occasions. Pilgrims to the top of the mountain where the main pilgrimage site is located must comply with a set of specific rules which requires devotees to consume pure foods, which excludes meat products, garlic, and onion, as per the Hindu tradition, for 15 days preceding the pilgrimage. The place is also rich in biodiversity as well as being the main source of water for all the villages in the watershed and for the district headquarters. In all, 34 community forest user groups (CFUGs) manage the forest in the area while the core forest is under government management. Since the local people share a deeply rooted belief that deities reside in the forest, they strictly abide by the norms that prohibit the haphazard harvesting of forest products and restrict entry into particular segments of the forest. In addition, the Madkhola River/Ghattigadh, which flows through the Gwallek forest, is the source of a drinking water project that is expected to serve residents of the Dasharath Chand Municipality of Baitadi, Nepal. The watershed area of the water source covers six wards of the Gwallek VDC (2, 3, 4, 5, 6 and 7).

Chandak-Aunla Ghat Watershed, Pithoragarh District, India: Chandak-Aunla Ghat Watershed covers a 23.23 sq km area with 12 Gram Panchayats and 28 Revenue Villages, which accommodate 1,774 households. Temperate Broad Leaf of Oak and Sub-tropical Temperate Conifer of Chir Pine (Pinus roxburghii) are the major forest types in the area. The watershed land-use is dominated by agriculture with scattered human settlements.

Hat-Kalika Watershed, Pithoragarh District, India: Hat-Kalika Watershed covers an area of 36.68 sq km, which is home to 1,750 households, 14 Gram Panchayats, 45 revenue villages and 5 Nagar Panchayats. The upstream area (top) of the Hat-Kalika Watershed, where sacred/cultural values are accompanied by biodiversity values is being considered for holistic planning for the purpose of heritage tourism development as well as for possible designation as a Biodiversity Heritage Site by the Government of India (SANGJU, 2015). The Temperate Broad Leaf mixed conifer (Banj, Oak-Chir Pine) and Sub-tropical/Temperate Conifer (Chir Pine) forests are the major types of forest in the landscape. Other forest types are Temperate Broad Leaf of Oak (*Quercus* species) and Sub-tropical Broad Leaf of Sal (*Shorearobusta*). In addition, Temperate Conifer forest patches of Deodar (*Cedrus deodara*) are also scattered across the landscape. The landscape is home to important cultural religious sites like the Hat-Kalika temple.

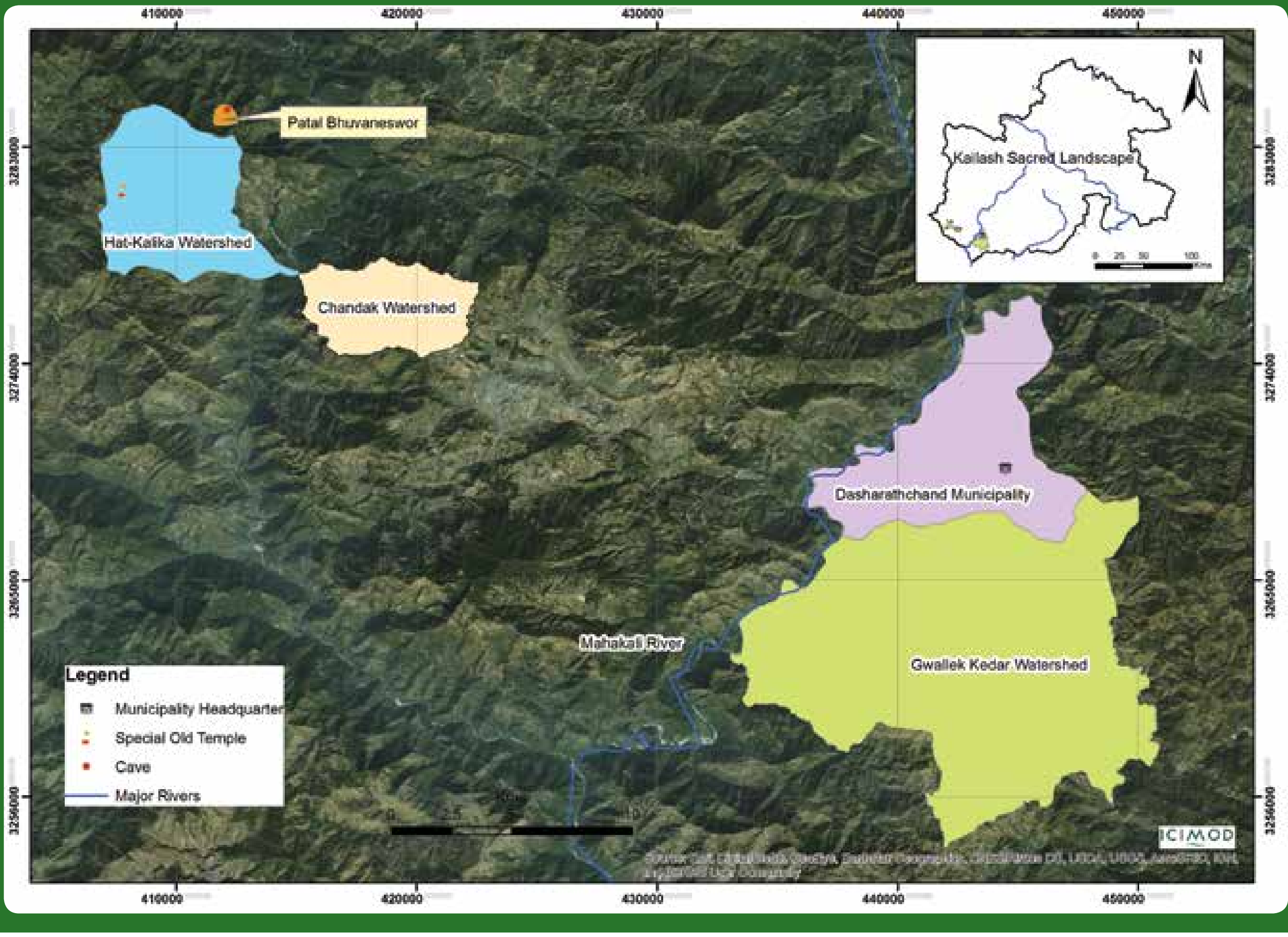
Hat-Kalika is a temple dedicated to the Shakti Peeth of the Hindu Goddess Kali located in the town of Gangolihat, which is located at a distance of 77 km from the district headquarters, Pithoragarh. The distance between the Hat-Kalika and the Patal Bhubaneswar cave temple is 14 km. According to information provided by the official website of Uttrakhand Tourism Development Board, the Adi Sankaracharya, a Hindu theologian and philosopher, chose this temple for the installation of Mahakali Shaktipeeth during his visit to the area in 12th century A.D., which has made it one of the most revered pilgrimage sites for Hindus for many centuries. The temple is located between dense forest of Deodar (*Cedrus deodara*) and Oak (*Quercus* species). The temple is also quite popular among people from nearby villages. Although people visit the temple all year round, according to locals, two big religious festivals are organized in the temple, one during the months of September-October and the other during the months of March-April. During these festivals, some of the devotees offer goats and lambs to Goddess Mahakali to appease her and to have her look with favor upon their wishes. The temple is revered by both locals as well as people from outside. In addition, some of those who visit Patal Bhubaneshwar also visit the Hat-Kalika temple. The temple is held with especial veneration by the troops of the Kumaon regiment of India, who have in fact built a guesthouse to accommodate members of the officer cadre who visit the temple.

Patal Bhuwaneshwar Temple: Patal Bhubaneshwar is a mystical cave temple in Uttarakhand, India, which is 160 meters long and 27 meters deep.[2] Modern age pilgrimages to the cave started only from the 12th century when Adi Shankaraacharya a theologian and philosopher, discovered it in 1191 AD. However, according to Manaskhand of Skand Puran, a Hindu scripter, the history of the cave dates back to the Treta Yug time-period between 6000 and 5500 BC (Mittal, 2006) and was used by the Pandavas in Dwapar Yuga, between 5500 and 4250 BC (Mittal, 2006). Its documented history only goes to underscore its religious importance. The cave, which is sacred for and revered by local residents and visitors from outside the region alike, remains one of the most visited religious destinations in Uttarakhand, which charges a modest entrance fee of INR 20/person/visit.

Dasharath Chand Municipality: The Municipality lies in the district headquarters of the Baitadi District, which accommodates a population of 16,791 and 3,788 households (CBS 2014). Currently, the municipal households face acute drinking water scarcity. In the year 2010, the water supply in the town was 155 m^3/day against a demand of 692 m^3/day (Department of Water Supply and Sewerage, 2014). Focus group discussions with municipal residents reveal that they now collect water from public taps, which are shared between 8 and 10 households. The existing water supply is also not made available to residents according to a schedule and is also not regular since it is available mostly once a day and sometimes once in two days. Moreover, the water supply never exceeds 100 liters per household. The user committee treats water reservoirs during the rainy season while some households use either filters or tablets to purify the water. During the dry season, most households fetch water from alternative sources

[2] Uttarakhand Tourism Development Board (http://uttarakhandtourism.gov.in/)

Map 1.1: **Kailash Sacred Landscape and Study Sites**



(i.e., springs) which are available at a walking distance of one hour (one way) while some buy water from a tanker at a cost of up to NPR 2.5/liter.

In 2014, the Government of Nepal, with support from the Asian Development Bank (ADB), initiated a new drinking water project which is expected to serve 7,366 people (or 1,473 households) of the Dasharath Chand Municipality of the Baitadi district headquarters. Ghattigadh/Madhkhola is the source of the proposed drinking water project, which is located 5 km away from the water storage reservoir. The design calls for water from Madhkhola to be collected in the storage reservoir by gravity flow, a part of which will then be pumped to the service reservoir of two sub-schemes at a higher elevation while the rest will be supplied through gravity to a lower elevation for supply to the Municipality. The project's target is the supply of water to 7,366 people (~1,473 households) of six wards (1,2,4,5,6 and 9) of the Dasharath Chand Municipality of the Baitadi District in 2014. While the estimated water demand for the year 2014 is 1,004 m^3/day, it is 1,340 m^3/day for the year 2029 (Department of Water Supply and Sewerage, 2014), out of which 9.5% (or 95 m^3/day) is for non-domestic use. Since the project collects only 12 liters per second of the available 20 liters per second from the source for the drinking water supply, the chances are that the diversion of water for drinking water will not undermine the availability of water to the watershed community.

The project has been designed following the participatory approach, which ensures community participation in the entire process. While the total cost of the project is estimated at NPR[3] 148.57 million, the Asian Development Bank has contributed 50% of the construction cost while the rest is contributed by the Municipality (6%), the Users (5%), the District Development Committee (4%) and a loan (35%) from the Town Development Fund. In addition, the beneficiary households pay NPR 5,000, which is collected by the Water User Committee. The loan is to be paid back by raising water tariff. Since the water-user committee is responsible for distributing water and managing the project, it will decide on the tariff after the completion of the project. The project's' target is to distribute drinking water to households at the rate of at least 100 liter/person/day during the dry season for the next 15 years.

[3] NPR is Nepalese Currency. 1 USD~ NPR 107.00

1.5 Study Methods

1.5.1 Focus group discussions and key informant interviews

The data collection involved several related activities such as focus group discussions, consultations, questionnaire development, training of enumerators, pretesting of questionnaire, and household and visitor surveys. In order to help identify the most important ecosystem services to the local people, the study team conducted eight focus group discussions (FGDs) with the watershed communities (4 in India and 4 in Nepal) between 28th September and 6th October 2015 in the pilot KSL sites of India and Nepal. The discussions mainly focused on the status and changes in the local ecosystem, benefits accruing from the forest, and existing management practices with regard to the forest ecosystem. We also met more than 10 key informants including owners of nearby hotels, government officials, researchers, villagers, leaders and representatives of NGOs. Appendix 1 gives the major findings of the FGDs and KIIs. Based on the FGDs and discussions with local NGOs, researchers, relevant stakeholders and key informants, we were able to identify the following issues to be of importance to the three areas of the study:

- Cultural services
- Water provisioning services
- Incentive Payment for Ecosystem Services (IPES)

FGDs with different groups of people in the Indian and Nepali sites made it clear that they are highly dependent on forest ecosystems for livelihood requirements. The discussions also showed people in general to be poor, deeply religious, and to believe in living in harmony with nature. Though the study sites offered scope to value different ecosystem services, given the one-year duration of the project and the seasonality in religious and cultural travel, our study focused on cultural services (religious tourism), water provisioning services (water from the forest ecosystem), and the development of an IPES scheme to protect the Gwallek watershed which provides drinking water to the Dasharath Chand Municipality residents of Baitadi, Nepal. The ecosystem services considered in this study are discussed below.

Cultural value of religious sites

There are numerous cultural and religious sites in the KSL region. Of these, we selected three for this study based on the ongoing activities under KSLCDI: i) Patal Bhuwaneshwar cave temple, ii) Hat-Kalika temple, and iii) Gwallek Kedar. While the first two sites are located in the Pithoragarh district of Uttrakhand, India, the third site is located in the far-western Baitadi district of Nepal. We found thousands of visitors from both near and far to visit the sacred sites in search of spiritual fulfillment. We also found there to be strong religious/cultural attachment to the religious sites in all of the pilot sites and for pilgrims to make repeated visits to these sites despite difficulties associated with travel and the lack of facilities to stay overnight. Thus, estimating the value of such cultural services will highlight the scope they hold for generating resources and reinforce the demand for investing in the development of these religious sites that would in turn act as a catalyst for rural development. Such valuation of cultural services could also help suggest policy options via economic instruments in case a decline in provisioning services poses difficulty to the visitors or visitors cause degradation of the ecosystem. One potential strategy is to determine the willingness-to-pay of potential visitors for improved facilities and improving facilities in those sites.

Measuring the coping cost of water stress with forest degradation

In the study sites, households obtain water from different sources (piped water and natural springs) depending on the season with increased dependence on natural springs during the dry season. However, forest degradation and deforestation may lead to a drying up of natural springs with people forced to travel far to collect water. In such situations, people tend to resort to other coping methods too such as cutting down on water use and cleaning. These coping strategies could, in turn, have adverse impacts on the health and daily activities of members of the community such as a greater risk of falling ill, children forced to miss school due to ill-health, or women whose task it is to collect water for the household spending more time on water collection neglecting other tasks they may have to perform, including childcare. Under the valuation of provisioning services, our study estimates the coping costs of households to obtain water and values the water provisioning services of different types of forests in the pilot sites.

Incentive Payment for Ecosystem Services

The water quality in many watersheds in the KSL area is deteriorating due to expansion of agriculture, increasing use of fertilizer and pesticides, over-grazing, and open disposal of human and animal waste. Protection of watersheds for maintaining water quality has thus become a matter of great importance. This study uses the discrete choice experiment to measure the willingness to pay of water users of the downstream area of Gwallek watershed for the provision of clean drinking water through protecting the sources of their drinking water. It also examines the possibility of developing and implementing an incentive payment for ecosystem services (IPES), taking into account the costs that upstream community need to bear for protecting water sources. This study also proposes an institutional mechanism that can be developed for implementing an IPES scheme in this watershed. The focus group discussion and KII identify attributes of the drinking water project that water users are interested in and what can be done in order to bring about compliance on the part of watershed communities to achieve the expected levels of those attributes.

1.5.2 Visitors and household surveys

Based on the FGDs and KIIs, we developed three sets of survey instruments.

- Survey instrument for Patal Bhuwaneshwar visitors for valuation of cultural services;
- Survey instruments for surveying rural households from the three watersheds (Gwallek, Chandak-Aunla Ghat and Hat-Kalika) for valuation of water provisioning services and cultural services; and
- Household survey instruments for conducting a discrete choice experiment in the Dasharath Chand Municipality, Baitadi, Nepal for developing a PES mechanism for drinking water.

We pre-tested the draft questionnaire in Patal Bhuwaneshwar, the nearby village of Hat-Kalika watershed, and the Gwallek watershed (outside the actual study sites). Based on the visitors and villagers' responses to the draft questionnaire, we revised the questionnaires before using it for the surveys. We surveyed a total of 1,418 respondents.

Patal Bhuwaneshwar: We interviewed a total of 202 visitors in Patal Bhuwaneshwar. We used a visitor intercept survey for 12 days (between the 3rd and 14th of April, 2016) where the enumerators requested visitors who were intercepted at the cave temple site to participate in the survey and selected one visitor from each group as respondent. The questionnaire was divided into two broad sections. While the first section elicited general information about the respondents, the second section elicited information on the visit to the site and to other locations, including information on costs of traveling, accommodation, refreshment and other expenses, travel time from their home to the site, site quality, purpose of the visit, etc.

Watersheds: We interviewed a total of 604 households in the Hat-Kalika and Chandak-Aunla Ghat watersheds and 350 households in the Gwallek watershed. The selected sample size was 17% and 14% of the total watershed households in India and Nepal respectively.[4] At the Indian site, all habitat villages having more than 10 households were selected from both the watersheds. Since both watersheds have a near-equal number of households – 1,750 in Hat-Kalika and 1,774 in Chandak-Aunla Ghat -we interviewed 303 and 301 households respectively from the two watersheds. We then selected a number of sample households proportionately based on the total number of households of the village. A similar procedure was followed in the Gwallek watershed of Nepal. In all, we looked at a total of 954 households from the three watersheds.

In the selection of the sampled households, we followed the systematic random sampling method, which meant that while the first household in the locality was selected randomly, other households were selected at specific intervals based on the ratio of total household to sample size. We interviewed household heads, of either gender, of the approached households using the questionnaire. All approached households agreed to participate in the survey.

Dasharath Chand Municipality: We selected a total of 262 water user households for the interview, which is 11 % of the total municipal drinking water user households. Again, we adopted systematic random sampling to select the first household for interview while the interval for the selection of the other households for interviews was decided

[4] There are 1,750 households in Hat-Kalika, 1,774 households in Chandak-Aunla Ghat, and 5,393 households in Gwallek watershed.

based on the number of households in the ward. Since local enumerators were employed to conduct the household surveys after rigorous training and observation, we were able to carry out the survey in the local dialects of the approached households. All approached households agreed to participate in the survey.

1.5.3 Data analysis

Of the total 1,418 observations yielded from the survey, the study on cultural services uses data from Patal Bhuwaneshwar and a sub-set of households from the three watersheds while the study on water services uses data from the three watersheds, and the study on IPES uses data from the Dasharath Chand Municipality and 150 households from the Gwallek watershed. With regard to the type of valuation method adopted, while the cultural services study follows the travel cost method, the study on water services adopts the coping cost approach, and the study on IPES uses the choice experiment method to value ecosystem services. The three chapters that follow offer detailed descriptions on the method used for the valuation of ecosystem services in each respective study.

1.5.4 Major findings and policy options

Cultural services

- Roughly, 7,900 people visit the Patal Bhuwaneshwar cave temple annually for spiritual purposes. On average, visitors travel to the cave temple twice in a given five-year span. The visitors gain INR 13,750 (or NPR 21,947/ USD 210) per trip per person as consumer surplus, which could be seen as a lower bound of per person per visit value of the services provided by the site.
- For the households who visit the Hat-Kalika temple and the Gwallek Kedar (4 times per year on average), the value of cultural services per trip ranges from NPR 1,784 to 3,413 (or INR 1,115-2,133/USD 17-33), depending on the site.
- For the three sample sites taken together, the total annual value of cultural services for the 7,900 visitors and 8,917 households is NPR 300 million (or INR 187.5 million/USD 2.9 million).
- For the 200,000 households living in the KSL area (31,252 km^2), the annual use value of cultural services, from the local pilgrimage sites which household members frequently visit for spiritual fulfilment, is NPR 2.35 billion (or INR 1.47 billion/USD 22.6 million).
- Very few respondents reported that they had visited Mt. Kailash in the past or were planning to visit it in the near future. This could be attributed to the high costs (both monetary and time) associated with travel to the site as well as its remoteness. Therefore, the use value of the KSL area can be improved by enhancing the quality of local cultural sites with overnight-stay facilities and developing travel infrastructures connecting multiple religious sites so that visitors can extend their travel to these sites.
- Since the religious sites do not offer overnight stay facilities, the benefits to the local economy are minimal from cultural visits to these sites. This can be changed by promoting overnight accommodation facilities in some of the sites and by developing tourism circuits linking several sites so that more visitors would come and spend more time at the sites, thus yielding benefits to the local people from cultural tourism.

Provisioning services

- Broadleaf and Chir Pine mixed broadleaf forests are the major forest categories surrounding 74% of the sample households in Hat-Kalika and 80% of the households in Gwallek whereas 79% of the households had bush type (degraded broadleaf) forest in Chandak-Aunla Ghat. Nearly 25% of the households in Hat-Kalika, 10% in Chandak-Aunla Ghat and 3% in Gwallek had pine monocultures surrounding their villages. Deodar is scarcely present in the study area.
- More than 70% of the households stated that water availability and other ecosystem benefits from forests have gone down in recent years. When it came to coping with water stress, collecting water from different sources and spending more time on water collection, especially during the dry season, turned out to be the dominant coping strategies of the people. In addition, water filters and water purifiers were more in use in Hat-Kalika (82%) and Chandak-Aunla Ghat (32%) while they were least in use in Gwallek (5%) though more households in Gwallek (76%) were investing in water storage items.

- The dry season gap between the demand for and availability of water is seen to be marginal in Chandak-Aunla Ghat (21 liters/person/day) and Hat-Kalika (27 liters/person/day) while it is zero in Gwallek. However, the dry season water collection time is more than double that of other season water collection time in all the watersheds. On average, households spend nearly 1.4 minutes to collect a liter of water in Chandak-Aunla Ghat and Hat-Kalika and 0.5 minutes in Gwallek.
- The opportunity cost of time or foregone income to collect water daily is NPR 43 (or INR 26.87), NPR 30 (or INR 18.75) and NPR 23 (or INR 14.37) in Chandak-Aunla Ghat, Hat-Kalika and Gwallek respectively in the dry season and NPR 20 (or INR 12.5), NPR 9 (or INR 5.62), and NPR 6 (INR 3.75) respectively in other seasons. Thus, the daily additional income loss caused by dry season water shortage is NPR 23 (or INR 14.37) in Chandak-Aunla Ghat, NPR 21 (or INR 13.12 in Hat-Kalika) and NPR 17 (or INR 10.62) in Gwallek.[5]
- Drinking water collection takes less time in villages having deodar, bush mixed broadleaf, or pine mixed broadleaf, or pine mixed deodar forest compared to villages having only Chir Pine forests. Therefore, wage income loss is more in villages having Chir Pine than in villages with other forest types.
- The water collection time difference between Chir Pine and other forest types (i.e. broad-leaf; mixed Chir Pine and broad leaf; deodar; and deodar and Chir Pine mixed) is larger in the dry season compared to other seasons which means that during the dry months those with Chir Pine forests in the vicinity of their villages face more hardship and spend more time on collecting water than those with other forests in the vicinity of their villages.
- The saving in water collection time of villagers living in the vicinity of Deodar or mixed forests of broadleaf-conifers or Chir Pine-Deodar varies between 27 minutes and 90 minutes per day per household depending on the type of forest which translates into a wage income saving of USD 31 to USD 318 (or INR 2,099-INR 21,532) in India and USD 23 to USD 238 (or NPR 2,484-NPR 25,704) in Nepal per year per household.

Incentive payment for ecosystem services

In the Dasharath Chand Municipality, the estimated annual willingness to pay for doubling water availability is NPR 482,076 (or USD 4,505) while it is NPR 1.18 million (or USD 10,988) for doubling the water quantity and supply of clean water that can be consumed directly from the tap without further treatment or filtering. The estimated annual cost of watershed management activities is NPR 1.17 million (or USD 10,987). This indicates that the local people are in favor of an IPES scheme that is socially acceptable and financially feasible. Since the existing scheme has no provisions to design and administer the proposed IPES, consultation with all relevant stakeholders would be necessary prior to designing and implementing the new scheme.

Designing an IPES scheme is a rigorous process, which demands substantial funds. Therefore, integrating the IPES design into the drinking water project design phase, particularly into the initial environmental examination or environmental impact assessment phase (IEE or EIA), may reduce the cost as well as involving resource managers in the entire process of the project;

Output based payment may put service providers at risk because of the uncertainty in relationship between land-use practices and the production of ecosystem services (drinking water in this instance). Payments based on activities identified through discussions among multiple stakeholders may reduce the risk to service providers;

A tripartite institution may contribute to enhancing the efficacy of the IPES design and implementation, where government agencies, local bodies and civil society organizations may perform the role of a monitoring team to facilitate the scheme.

1.6 Plan of the Study

The study is divided into five chapters. Chapter 1 provides the background information and objectives of the study including the selection of study sites, rationale for choosing ecosystem services for valuation, and methods used for data collection and analysis. This chapter also provides a summary of the major findings and proposes options that policy makers could potentially use in order to arrive at evidence-based policies. The three chapters that follow comprise the main body of the study. They highlight thematic issues in the valuation of ecosystem services though the chapters are designed in such a manner as to be read independently depending on the interest and preference

[5] The corresponding USD amount would be 1 cent for 1 NPR (approximately).

of the reader. While Chapter 2 discusses the rationale, method and results of the valuation of cultural services in the KSL pilot sites, Chapter 3 provides a detailed description of the valuation of water provisioning services of forest ecosystems and the major findings of the study. Chapter 4, on the other hand, reports the findings of a study to design an IPES scheme in the Dasharath Chand Municipality of Baitadi. It describes the methods used for eliciting the willingness to pay of water users for an improved drinking water supply through the management of specific activities of communities in the vicinity of the watershed from where the Municipality gets its water supply and discusses the institutional issues and requirements for the successful implementation of the IPES mechanism in the Gwallek watershed. The final chapter summarizes the major findings and offers some practical recommendations in order to better manage the ecosystem services in the KSL area.

2 Valuation of Cultural Services at the Kailash Sacred Landscape Cultural Sites

2.1 Introduction

Mt Kailash (6,714 m) and its surrounding area constitute a sacred cultural site in the Himalayas that lies at the intersection of China, India, and Nepal. The mountain is worshipped by devotees of different religions such as Hindu, Buddhist, Bon and Jain, who travel to the site each year from China, India and Nepal. In 2010, the three neighboring countries, with facilitation from the International Centre for Integrated Mountain Development (ICIMOD), delineated the Kailash Scared Landscape (KSL), with the aim of conserving and mainstreaming its ecosystem services and for promoting the landscape as a trans-boundary cultural and natural heritage site for the purpose of improving the livelihood of the people living in the area while maintaining the site in its natural state (Pandey et al., 2016) .

Although the mainstreaming of ecosystem services into landscape management is desirable, it is challenging due to difficulties in the identification of appropriate services, their quantification, valuation, and trade-offs (De Groot et al., 2010). Among four types of ecosystem services (provisioning, regulating, supporting, and cultural) that the Millennium Ecosystem Assessment has identified (MEA, 2005), there is little mention of cultural services in mountain contexts perhaps because mountain landscapes are challenging and cultural ecosystem services are both intangible and difficult to measure in such contexts (Daniel et al., 2012; Berkel and Verburg, 2014). In contrast, cultural ecosystem services in urban contexts are relatively visible and directly experienced (e.g., urban parks), making it easier to estimate the cultural (mostly recreational) value of the ecosystem services and incorporating it into ecosystem management and planning decisions (e.g., Barthel et al., 2005).

In this research, we use cultural and religious services interchangeably and we intend to understand and estimate the use value of the cultural services that the domestic visitors and local residents derive from the Kailash Scared Landscape, a difficult mountainous terrain with sparse to no human settlement in a large portion of the landscape. There are numerous cultural and religious sites within the KSL area and thousands of domestic visitors visit these sites each year for cultural and religious purposes despite difficulties in travelling due to cold weather, lack of overnight-stay facilities, and difficult trails. Pandey et al. (2016) have provided a framework for assessing the non-monetary value of cultural services based on space-specific knowledge in the KSL area while Daily et al. (2009) have outlined an alternative conceptual framework for valuation of ecosystem services as a part of the natural capital project. In this study, we examine the use (monetary) value of cultural services from three such sites in two of the three countries (India and Nepal).

Our research design entailed intercepting domestic visitors to the Patal Bhuwaneshwar cave temple, which is one of the cultural sites within the KSL, India, and interviewing them to understand the visitation rates, travel time and costs, visitors characteristics, and their perception of the quality and other facilities of the site in order to arrive at estimates of the use value of the cultural services that the site provides to visitors. We also surveyed local residents in three watersheds, Hat-Kalika and Chandak-Aunla Ghat in Uttarakhand, India, and Gwallek in the Baitadi district of Nepal in order to obtain household characteristics, household members' visitation rates to the local cultural sites, travel time, and associated costs. Our data reveal that households living in these study sites frequently visit the nearby Hat-Kalika Temple and Gwallek Kedar, respectively, for cultural and religious purposes.

We estimated the visitation rates and welfare gains of visitors who visited the Patal Bhuwaneshwar cave, Hat-Kalika temple, and Gwallek Kedar using the behavioral economic model and the travel cost method (Parsons and Wilson, 1997). We found that visitors travel to the Patal Bhuwaneshwar cave roughly twice, on average, in a five-year span.

On the other hand, the local residents from the Hat-Kalika and Chandak-Aunla Ghat watersheds had travelled more than 15 times to the Hat-Kalika temple while the residents of the Gwallek watershed had travelled to the Gwallek Kedar site more than 20 times, on average, in the past five years. Our survey included roughly 200 visitors from the cave area, 600 households from the Hat-Kalika and Chandak-Aunla Ghat watersheds, and 350 households from the Gwallek watershed.

The estimated per person per trip welfare gain, which is a measure of the use value of religious sites to the visitors (consumer surplus), is about INR[6] 13,750 (or NPR 21,947/USD 215) for Patal Bhuwaneshwar visitors, INR 1,115 (or NPR 1,784/USD 17) for Hat-Kalika visitors, and NPR 3,300 (or INR 2.063/USD 32) for Gwallek Kedar visitors. Given that about 7,900 visitors enter the Patal Bhuwaneshwar cave temple each year paying a nominal entry fee, the total welfare gain for these visitors is approximately INR 108.4 million (or NPR 173.4 million/USD 1.7 million) per year. For the three watersheds, the annual estimated use value of the religious sites is NPR 126.7 million (or INR 79.2 million/USD 1.22 million). Therefore, the combined average annual estimated cultural value of all three sample sites is NPR 300 million (or INR 187.6 million/USD 2.9 million).

Extrapolating the results from the sample estimates, the estimated use value of the religious sites for the entire KSL area to the local residents comes close to NPR 2.35 billion (or INR 1.47 billion/USD 22.6 million) per year. This estimate is derived based on the 200,000 households with a family size of 5.5 living in the KSL area assuming that at least 3 members from approximately 50%[7] of these households visit the local cultural sites at least four times per year (sample average). Our estimates for the value of the cultural services of the KSL area reported in this study are at the lower-bound as the method that we use considers only the use value (i.e., consumer surplus) of these services to the local households and do not capture the producer surplus of hotels and other service providers.

Nonetheless, this research fills an important gap in the valuation of cultural services, especially religious services, since most of the extant literature on the valuation of cultural services disproportionately focuses on the recreational services provided by nature (Caulkins and Bishop, 1986; Willis and Garrod, 1991; Weiqi et al., 2004; Fleming and Cook, 2008). In contrast, only a handful of studies have focused on cultural services with studies on religious values almost non-existent (Alberini and Longo, 2006; Tuan and Navrud, 2007). However, understanding and capturing the religious values of the landscape are important in the context of the Himalayas, where communities living in the region nurture a rich history that contains myths and stories of gods and goddesses and place great value on the religious sites and the natural landscapes.

The Himalayas provide several examples for ecosystems invested with religious value, which in return contribute to protecting the natural ecosystem. The Forest Act of Nepal has identified religious forest as one of six forest management regimes in the country (Forest Act, 1993). According to the Act, religious forest is a part of the national forest that is managed by any religious body, group or community near a religious site. Similarly, in the Kumaon region of India, the community belief that *Golu Devta*, a famous deity of the region, resides in the forests ensures that trees inside these forests is prohibited (Dhaila-Adhikari and Adhikari, 2007). In Uttarakhand, India, according to Negi (2010), the villagers offer[6] their forest to the deity for a particular period, when faced with difficulties in conserving the forest due to encroachment and uncontrolled extraction of forest resources. There is evidence to suggest that, in these sacred forests/landscapes, certain socio-cultural and management guidelines decided upon the communities are operational ensuring conservation (Pandey and Negi, 2004). The examples go to show that people in the Himalayas confer on ecosystems a religious value and that landscape management by researchers and decision-makers will be aided by a proper understanding and account of these services of ecosystems to local residents.

In the absence of an accurate assessment of the cultural and religious values of ecosystem services, decision-making relating to landscape management in the Himalayas may not only be incomplete but also lead to conflict. The valuation of ecosystem services is considered as an essential tool for promoting good ecosystem governance because such valuation gives information on the values, incentives and options in ecosystem management (King, 2007). However, estimating the economic value of spiritual and religious services is not straightforward as these

[6] NPR refers to Nepali currency while INR refers to Indian currency. We use 1 USD = NPR 104 and INR 65 as per the April 2016 exchange rate.

[7] This estimate is based on information collected from the sample survey, where the average household size is 5.5. We note that the visitation rate of local residents differs from site to site. In our sample, it ranges from 25% to 75%.

services are mostly intangible and carry a subjective dimension (De Groot, 2006). This has meant a dearth of literature on the valuation of spiritual and religious services (Daniel et al., 2012). Our study attempts to fill this gap. Though the travel cost method captures only the use value of the cultural or religious services of the ecosystem, the use value of the cultural services of the ecosystem reported in this study provides much-needed information on the value that local residents and visitors place on religious sites. Such values would be of use to policy makers in landscape management and decision-making. The study also provides the basis for future research on the valuation of the religious/cultural services of other such landscapes.

2.2 Methodology

2.2.1 Basic theory

This study uses the individual travel cost method (Hotelling, 1947; Brown and Nawas, 1973; Brown et al., 1983; McConnell, 1985; Rosenthal, 1987; Parsons and Wilson, 1997) for estimating the trip generating function and consumer surplus, an economic measure of welfare, for travellers who travel to the Patal Bhuwaneshwar cave, Hat-Kalika temple, and Gwallek Kedar. The Travel Cost Method (TCM) has been used extensively for valuation of recreational sites as well as the valuation of the use value of cultural heritage sites (Poor and Smith, 2004; Alberini and Longo, 2006). The main idea behind this method is that the expenditure of visitors to the site is the demand price of the service provided by the site or the value visitors place on the site. In other words, the expenditure incurred by a visitor during the course of the journey to any one of these sites is equal to the use value of the spiritual and religious sites for him/her. We hypothesize that the higher the cost to visit these sites, lower the visitation rates. We estimate a trip generating function for estimating the use value of the spiritual and religious services generated by these sites.

We assume that an individual derives utility from consuming a bundle of goods and services (X) and visiting a cultural site with a given quality (q). The individual spends the total available time for work (t_1) traveling to the site (t_2) and for spending time at the destination site (t_3) and earns non-labor (Y_1) and labor income ($w.t_1$). We formalize a representative consumer's problem as:

$$MaxU\ (X,r,q) \tag{2.1}$$

Subject to:

$$Y_1+w.t_1 = X+c.r, \text{ and} \tag{2.2}$$

$$t=t_1+r(t_2+t_3), \tag{2.3}$$

where r is the number of trips to a given site within a certain period, c is the cost of round trip travel to the cultural site that accounts for the cost of transportation, food and lodging, and w is the wage rate. Without loss of generality, we normalize the price of composite goods (X) to 1. Here, equation (2.2) and (2.3) are the income and time constraint, respectively. Substituting t_1 from equation (2.3) to equation (2.2), we get the joint constraint as,

$$Y_1+w.[t-r.(t_2+t_3)] = X+c.r \tag{2.4}$$

The time spent in cultural activities (travel time plus time spent on the site) can be used in other activities. Therefore, the total cost of the trip (TC) is the sum of the travel cost, time costs and entrance fee. Maximizing (2.1) subject to (2.4) gives the trip generating function or the travel demand function for a religious site as:

$$r=r(TC,\ M,q) \tag{2.5}$$

where, M is the total income (both labor and non-labor) and TC is the total travel cost for the trip including the entrance fee and the time cost for the i^{th} visitor. Since the travel demand function for a religious site depends on the cost of visiting a substitute site (if any) and the socio-economic and demographic characteristics of the visitor (i), the modified travel demand function to a religious site is:

$$r_i=r(TC_i,\ TC_i^s,\ M_i,\ Z_i,\ q) \tag{2.6}$$

where, TC_i^s is the travel cost to the substitute site and Z_i is a vector of the characteristics of the visitor i.

2.2.2 Econometric issues

As the dependent variable in equation (2.6) is a non-negative integer, it violates the major assumptions of the classical linear model. Hence, the use of the Ordinary Least Squared (OLS) estimator is inappropriate. For the non-negative integer (count data), we can use either the Poisson or Negative Binomial estimator. The Poisson distribution assumes equality between the mean and the variance of the number of trips (*r*). If equality between the mean and the variance of the dependent variable does not hold, then the Negative Binomial estimator is more appropriate (Nepal, Bohara, and Berrens, 2007). For empirical purposes, we estimate both Poisson and Negative Binomial models using the following log-linear demand function for religious travel:

$$E(r_i) \mid TC, X) = exp(\beta_0 + \beta_1 TC_i + \beta_2 TC_i^s + \beta_3 M_i + \beta_4 Z_i + \beta_5 q \qquad (2.7)$$

where, *X* refers to all covariates except *TC*. The use value of cultural services is given by the consumer surplus that is an area under the demand curve (Equation 2.7) after subtracting the travel costs. For the log-linear demand function, it can be shown that the Consumer Surplus (CS_i) is a measure of visitor i's welfare gain per trip, which is given by the following expression (Creel and Loomis, 1990; Willis, 1991):

$$CS_i = -\frac{1}{\hat{\beta}_1} \qquad (2.8)$$

Since our goal is to estimate the cultural use value of the entire KSL landscape, not just that of one particular site, we include visitors who were on multi-destination trips as well as single-destination visitors on day trips in our sample. Hence, roughly 44% of the Patal Bhuwaneshwar cave visitors had visited several sites before coming to the cave temple. Therefore, we estimate the travel demand function using the full sample of Patal Bhuwaneshwar visitors as well as the sub-sample of day visitors who come from surrounding areas to visit the site. For the Hat-Kalika temple, we surveyed households in the two watersheds in KSL India (Hat-Kalika and Chandak-Aunla Ghat) while, for Gwallek Kedar, we surveyed households of the Gwallek watershed in KSL Nepal. Hence, there are no outside visitors in the Hat-Kalika and Gwallek Kedar samples because the 2 sites are mostly visited by locals in the vicinity or residents from the area. We, therefore, interpret the estimated value of these cultural sites to be at the lower bound since the TCM considers the use value of the cultural sites or landscapes to the visitors. The use value includes neither the value to the hotel owners and other service providers (producer surplus) nor the existence and non-use values of the cultural sites. We use the following equation to estimate the aggregate use value of the cultural services to the local households living in the KSL area.

$$Aggregate = -\frac{1}{\hat{\beta}_1} {}^{*} \# \text{ of HHs} {}^{*} \# \text{ of trip} \mid year {}^{*} \text{ group size} {}^{*} \% \text{ of HHs visiting local cultural sites}$$

2.3 Study Area and Data

The study area for valuation of cultural services, as described in Chapter 1, are Patal Bhubaneswar, Hat-Kalika and Gwallek Kedar temples. The research team visited all the sites during the month of September 2015, and held discussions with local communities in order to gather ground-level information on the different aspects of these sites and the visitor characteristics. Chapter 1 also describes in detail the Focus Group discussions, the development and finalization of the questionnaire consequent to these discussions, and the visitor and household surveys for the collection of data.

For the Patal Bhuwaneshwar cave, we use visitor intercept surveys for 12 days (between the 3rd and 14th of April 2016) covering all days including weekends, where the enumerators requested visitors who were intercepted at the cave temple site to participate in the survey and selected one visitor from each group as a respondent. The questionnaire is divided into two broad sections. The first section gathers general information on the respondents. The second section seeks information related to the visit to the site and other alternative locations that include information related to costs of traveling, accommodation costs, food and other expenses, travel time from their home to the site, site quality and purpose of the visit.

In all, we surveyed 954 households in the three watersheds, Hat-Kalika, Chandak-Aunla Ghat and Gwallek, using the systematic random sampling method, where we selected the first households randomly while the selection of the rest of the households was done at systematic intervals. The interval between sampled households was based on the number of households in the watersheds and a pre-determined sample size.[8] The survey questionnaire covers the household's socio-economic characteristics and whether the households had visited the Hat-Kalika or the Gwallek Kedar temple in the past five years. Other information gathered related to agricultural practices, drinking water provision, etc. If the respondent or other household member(s) had visited these local cultural sites during the past five years, we sought information on how often as well as the different components of the travel-related costs for the most recent trip. The travel-related costs included transportation costs, expenses on food, offerings to the temple, costs for performing the religious ceremony, if any, and the time costs of the household member who visited the site. If more than one household member were in the group, we recorded the travel and time costs of only one member of the household. In order to estimate the time-cost of the visit, we used the reported average daily earning/income of the person who travelled to the site and the time spent on the round-trip.

2.4 Results and Discussion

2.4.1 Visitor characteristics

Of the total respondents surveyed at the Patal Bhuwaneshwar cave, more than one third (35%) were female indicating that women are deeply involved in cultural travel in the region (Table 2.1). The Table further indicates that most of the visitors are educated urban residents. In addition, a majority of them (88%) are pilgrims or religious tourists who were traveling in groups with the average group size at more than six.

More than half of the respondents (58%) who visited Patal Bhuwaneshwar are residents of Uttarakhand, followed by Uttar Pradesh (28%) and West Bengal (5%). The remaining respondents (8%) were from other parts of India. Of the respondents from Uttarakhand, 97% were day visitors. This is not surprising as a majority of the pilgrims were visitors from nearby towns and villages. In our sample, roughly 44% of the respondents said that they stayed overnight at the site as they were multi-destination pilgrims from different parts of India.

Table 2.1: **Descriptive statistics (Patal Bhuwaneshwar visitors)**

Variables	Variable definition	Mean	SD	Min	Max
Total trips	No. of trips in 5 years	2.09	1.45	1	8
Travel cost	Total travel costs for current trip	8,789	9,733	370	43,950
Alternative site TC	Travel costs to alternative site	2,811	8,813	0	104,925
HH income >300k	1 if annual HH income > INR 300k	0.48	0.50	0	1
Male	1 if respondent is male	0.65	0.48	0	1
Respondent's age	Respondent's age in years	38	8	21	62
Urban	1 if visitor is from urban area	0.73	0.44	0	1
Group size	No. of people visiting together	6.5	3.3	2	30
Recreational purpose	1 if the visitor is traveling for recreation	0.12	0.33	0	1
Agriculture	1 if visitor's occupation is agriculture	0.13	0.34	0	1
Business	1 if visitor's occupation is business	0.14	0.35	0	1
Government employee	1 if visitor is a government employee	0.23	0.42	0	1
NGO/private	1 if visitor works for NGO/private	0.21	0.41	0	1
Housewife	1 if visitor is a housewife	0.20	0.40	0	1
Other	1 if visitor's occupation is 'other'	0.08	0.27	0	1
Less than 12th grade	1 if visitor has < 12 years of schooling	0.36	0.48	0	1
Bachelor's	1 if visitor has Bachelor's degree	0.35	0.48	0	1
MA/PhD	1 if visitor has MA/PhD degree	0.29	0.45	0	1
Site quality – average	1 if site quality is average	0.04	0.20	0	1
Site quality – good	1 if site quality is good	0.36	0.48	0	1
Site quality – very good	1 if site quality is very good	0.60	0.49	0	1

Notes: Sample size came down from 202 to 187 after adjusting for missing and incomplete information.
Source: Field Survey, 2016

8 There are 1,750 households in Hat-Kalika, 1,774 households in Chandak-Aunla Ghat, and 5,393 households in the Gwallek watershed.

In the case of Patal Bhuwaneshwar, we found that, on average, each individual visitor had travelled to the site twice in the last five years (Table 2.1) with the number of trips made by respondents ranging from 1 to 8. We also found that day visitors spend between 1.5 and 12 hours on the visit with the average time spent by a day visitor being 4.3 hours. Similarly, taxis were a popular mode of transportation (42%), followed by private cars (21%), public buses (16%), tourist buses (14%), and motorcycles (7%).

About 24% of the sampled households from the Chandak-Aunla Ghat watershed had visited the Hat-Kalika temple within the past 5 years. However, this figure was over 75% for the sample households from the Hat-Kalika watershed due to proximity where, on average, household members had visited the Hat-Kalika temple more than 15 times in the past 5 years and had spent less than INR 300 per person for the most recent trip (Table 2.2). Women with lower education levels were the majority of the respondents (at 70%) while the monthly income of the majority of the respondents' households was less than INR 50,000. In the sample, about 40% of respondents were Dalit, a socially disadvantaged lower caste/ethnic group, who are sometimes barred from entering temples and holy places.

Table 2.3 shows descriptive statistics of the variables for the visitors to Gwallek Kedar. Out of 350 sample households, about 40% of households reported that one household member or more had visited the Gwallek Kedar at least once in the past five years with such visitors, on average, visiting the site more than 21 times, thus incurring an average individual travel cost of NPR 354. About 17% of the respondent households belonged to the lower caste Dalit group. The average family size in the sample comprises seven members while the percentage of respondents who had had more than six years of education was less than 30.

Table 2.2: **Descriptive statistics and variable definition (sampled households who visited Hat-Kalika Temple)**

Variables	Definition	Mean	SD	Min	Max
Total trips	No. of trips in 5 years	15.15	17.41	1	100
Travel cost	Travel costs for the last trip (INR)	284	499	2	3,080
Alternative site TC	Travel costs to alternative site (INR)	163	291	0	1,947
HH income >50k	1 if monthly household income > INR 50k	0.25	0.43	0	1
Male	1 if respondent is male	0.30	0.46	0	1
Respondent's age	Respondent's age in years	45	15	17	98
Household size	No of members in household	5.36	2.16	1	16
Dalit	1 if respondent is classified as lower caste	0.39	0.48	0	1
Education more than grade 6	1 if respondent has information education	0.48	0.50	0	1

Notes: Sample size with complete information for this site is 305 after excluding households who did not travel to the Hat-Kalika temple at least once in the past five years.
Source: Field Survey, 2016

Table 2.3: **Descriptive statistics and variable definition (sampled households who visited Gwallek Kedar Temple)**

Variables	Definition	Mean	SD	Min	Max
Total trips	No. of trips in 5 years	21.88	24.23	1	100
Travel cost	Travel costs for the last trip	354	221	0	1,680
Alternative site TC	Travel costs to alternative site	786	437	0	1,920
HH income > 50k	1 if monthly HH income > NPR 50k	0.74	0.44	0	1
Male	1 if respondent is male	0.60	0.49	0	1
Respondent's age	Respondent's age in years	45	14	20	80
Family size	No. of household members	7.0	3.3	1	22
Dalit	1 if respondent is classified as lower caste	0.17	0.38	0	1
Education more than grade 6	1 if respondent has > 6 years of education	0.29	0.46	0	1

Notes: Sample size with complete information for this site is 139.
Source: Field Survey, 2016

It is to be noted that unlike visitors to Patal Bhuwaneshwar, 88% of whom visit the site for recreational purposes, local residents visit these cultural sites purely for religious purposes. Women make up a significant fraction of these visitors to the local cultural sites. Our survey showed that, on average, about 3 household members together visit the site with women comprising 50% of the group. The local people do not stay overnight at these cultural sites either because they are from nearby areas or due to lack of facilities for overnight stay. In our sample, about 16% of the respondents, who had already visited at least one of the three named religious sites on previous occasions, indicated that they would stay overnight provided there were overnight-stay facilities at the sites. The villagers mostly travelled on foot (53%) or used public transport (46%) to get to these sites.

In our sample, only 4 respondents (out of 954) had visited Mt. Kailash, the ultimate destination for religious visitors in the KSL area, in the past five years. An additional 13 respondents indicated that they would visit Mt. Kailash in the coming years. The journey to Mt. Kailash, however, takes 16 days from the pilot sites and the average expected costs come to NPR 120,000 (or INR 75,000/ USD 1,140) per trip per person that is more than the average annual per capita income of households in the study sites. Thus, households in our sample were more likely to visit nearby cultural sites than Mt. Kailash because the Mt. Kailash journey is organized by certified travel agents requires obtaining visas from the Chinese government, and incurs high expenditure in addition to the more than two weeks' travel time that the journey demands.

2.4.2 Empirical results

We had two different sets of respondents in our survey. The first set of respondents were the visitors to the Patal Bhuwaneshwar cave temple who come from Uttrakhand and other states of India. We intercepted these visitors on site for the survey. The second set of respondents were the households from the three watersheds (Hat-Kalika, Chandak-Aunla Ghat and Gwallek). We surveyed these households by visiting their homes. Our sample comprises households who had visited one of these sites (Hat-Kalika temple and Gwallek Kedar) at least once in the past five years. Households who did not visit any of the three sites in the past five years did not provide travel-related information to these sites. This means that out of the 954 households that we surveyed from the three watersheds, the usable sample with complete information comprised 443 observations (which was 46% of the total) for estimating cultural services. We used the Patal Bhuwaneshwar visitor data and household data separately in our analysis since these two groups of respondents could be considered as two different sets of people – one group surveyed on site and the other group surveyed in their homes.

2.4.3 Patal Bhuwaneshwar: full sample

The dependent variable, which is the number of trips that the surveyed visitors to Patal Bhuwaneshwar had made in the past five years, is a non-negative integer. Therefore, we use the count data modeling technique for estimating the trip generating function (equation 2.7). As the visitors were surveyed on site, we also faced the problem of truncation (at least each visitor has one visit) and endogenous stratification (the survey captured frequent visitors thus excluding a more representative general population who had not visited the site during the survey period but could have visited the site at some other time). Therefore, we use the truncated negative binomial regression that addresses the issues of endogenous stratification and truncation (Table 2.4). For completeness and comparison, we also estimate the same models using truncated Poisson regressions, which assume equality between the mean and variance of the dependent variable. Table 2A.1 (Appendix) presents the results from truncated Poisson regressions.

Table 2.4 presents the first set of results where we estimate three different models that account for endogenous stratification and truncation. The first model (M1) is the basic model with travel cost as the main variable of concern, with costs to visit an alternative site and visitors' characteristics as covariates. In the second model (M2), we add the visitor's education and occupation as preference shifters while in the last model (M3), we add site quality to examine the robustness of our findings. Since all models give comparable results in terms of the sign and size of the estimated coefficients of the Travel Cost, we use M2 for further discussion since the coefficients of site quality indicators in M3 are not statistically significant.

Our results indicate that the coefficient of *Travel Cost* is negative and significant, suggesting that, after controlling for visitor and site characteristics and costs to visit the alternative site, visitors, on average, come to the site less

Table 2.4: **Truncated negative binomial estimates with endogenous stratification (Patal Bhuwaneshwar)**

	Zero truncated negative binomial estimates					
Variables	M1		M2		M3	
Travel cost (TC)	-6.73e-05***	(1.87e-05)	-7.29e-05***	(1.91e-05)	-7.07e-05***	(1.90e-05)
Alternative site TC	-2.20e-05	(1.71e-05)	-1.32e-05	(2.51e-05)	-1.62e-05	(2.50e-05)
HH income (*base <50k*)	-0.218	(0.246)	-0.429	(0.267)	-0.474*	(0.265)
Male	0.290	(0.207)	0.225	(0.329)	0.143	(0.328)
Age of respondent	0.00909	(0.0122)	0.0112	(0.0129)	0.0132	(0.0129)
Urban	-0.348	(0.219)	-0.613**	(0.251)	-0.525**	(0.246)
Group size	-0.0240	(0.0347)	0.000671	(0.0351)	0.00867	(0.0347)
Recreational purpose	-0.343	(0.364)	-0.456	(0.377)	-0.470	(0.374)
Site quality (*base: average*)						
Good					14.41	(574.6)
Very good					14.43	(574.6)
Respondent education (*base: below 12th grade*)						
Bachelor's			0.374	(0.277)	0.420	(0.279)
Master's and above			0.834**	(0.359)	0.790**	(0.356)
			(0.450)		(0.447)	
Constant	-0.295	(0.662)	-0.490	(0.728)	-14.89	(574.6)
Ln(alpha)	0.0665	(0.841)	-0.280	(0.813)	-0.479	(0.796)
Observations	188		185		185	

Notes: In M2 and M3, we controlled for occupational categories of the respondents but these coefficients are not included here for reasons of space. Results are available upon request. Standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

frequently if the travel cost is high. However, the coefficient of the *Travel Cost* to the alternative site is not statistically significant. This indicates that the Patal Bhuwaneshwar cave temple has no close substitute for those visitors whose primary reason for visiting the site is religious. The perceived site quality or the purpose of the visit (recreation vs. religious) does not seem to affect the number of trips that the visitors make. Our results also suggest that educated visitors visit the site more often than less educated visitors do. However, wealthier and urban visitors seem to visit the site less frequently. This result is counterintuitive at first glance when we compare our results with similar studies on recreational travel to particular sites. This may be attributable to the fact that the primary reason for visiting the site, among the sampled visitors, is religious which in turn would explain the predominance of less wealthy visitors.

2.4.4 Patal Bhuwaneshwar: day visitors

Since the visitors in our sample include both day visitors who visit only the Patal Bhuwaneshwar cave temple and those who visit multiple sites before coming to Patal Bhuwaneshwar, we estimate another set of models using only the sub-sample of day visitors in order to segregate the value that single site visitors attribute to the landscape compared to those who visit multiple sites. We present these results in Table 2.5 and Table 2A.2 (see Appendix).

In both cases, the results are similar to what we have presented in Table 2.4 and Table 2A.1 (see Appendix). Hence, when the travel cost increases, visitors travel to the site less frequently, indicating the internal consistency of the results. In Table 2.5, we report results from two models (M1 and M2) as Model M3 does not converge when we add site quality in M2. As the site quality is not significant in any of the previous models, dropping M3 from Table 2.5 does not affect the main results.

2.4.5 Chandak-Aunla Ghat and Hat-Kalika

In Table 2.6 and Table 2A.3 (Appendix), we present results for the sample of households who had visited the local Hat-Kalika Temple at least once in the past five years. Unlike the sample of visitors from the Patal Bhuwaneshwar cave temple who were surveyed on site, the sampled households did not face the problem of endogenous stratification, as the survey was not conducted on site. Since the sample of villagers were more homogenous and were all living in a rural area with most of them engaged in subsistence agriculture, we used a smaller number of covariates, such as travel cost, cost to alternative site, and household income as well as a few more variables as preference shifters such as the respondent's gender, age, education, ethnicity and household size, for estimating the travel cost models. The results were mostly consistent with the ones presented in Tables 2.4 and 2.5, suggesting that our results are internally consistent. As before, the coefficient of income is negative as in the case of Patal Bhuwaneshwar though not significant.

Table 2.5: **Truncated negative binomial estimates (Patal Bhuwaneshwar day visitors)**

	Zero truncated negative binomial estimates			
Variables	M1		M2	
Travel cost	-0.000225***	(7.07e-05)	-0.000238***	(7.48e-05)
Alternative site TC	-2.59e-05	(1.91e-05)	-1.80e-05	(2.78e-05)
HH income (*base <50k*)	-0.197	(0.257)	-0.553**	(0.277)
Male	0.403*	(0.211)	0.368	(0.340)
Age of respondent	0.00383	(0.0117)	0.0102	(0.0119)
Urban	-0.0637	(0.200)	-0.447*	(0.236)
Group size	0.0229	(0.0360)	0.0629*	(0.0351)
Recreational purpose	-0.447	(0.500)	-0.687	(0.509)
Respondent education (*base: below 12^{th} grade*)				
Bachelor's			0.470*	(0.250)
Master's and Above			1.296***	(0.356)
Constant	0.269	(0.524)	-0.420	(0.683)
Ln (alpha)	-1.444	(0.921)	-2.247	(1.388)
Observations	108		105	

Notes: In M2, we controlled for occupational categories of the respondents but these coefficients are not included here just to save space. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

2.4.6 Gwallek Kedar

On the Nepal side of the KSL, of the 350 households sampled, 138 reported that some household members had visited Gwallek Kedar at least once in the past five years. Here, too, we estimated the same model used in the case of the Chandak-Aunla Ghat-Hat-Kalika sample. Table 2.7 reports the results from zero truncated Poisson estimates.[9]

Our results again indicate that visits of households to the local religious site decline with the travel cost. The coefficient of the *Alternative Site TC* is positive and significant, indicating that households visit Gwallek Kedar more frequently if the cost to the alternative site is higher, and that in turn suggests that there are alternative sites to Gwallek Kedar. For this sub-sample, the coefficient of household income is positive and significant, which is the opposite of what we have for Patal Bhuwaneshwar, suggesting that the effect of income on religious travel is not conclusive in our sample.

2.4.7 Pooled sample

Finally, we pool the Chandak-Aunla Ghat and Hat-Kalika sample with the Gwallek sample and estimate the same models reported in Tables 2.6 and 2.7. The pooled sample has 443 observations after dropping observations with incomplete responses and missing values. Table 2.8 reports the results from the pooled sample where we estimate zero truncated negative binomial models. In the appendix (see Table 2A.4), we present the results from the zero truncated Poisson models. Results

Table 2.6: **Zero truncated negative binomial estimates (Chandak-Aunla Ghat and Hat-Kalika)**

	Zero truncated negative binomial estimates			
Variables	M1		M2	
Travel cost	-0.000851***	(0.000120)	-0.000897***	(0.000123)
Alternative site TC	0.000274	(0.000213)	0.000304	(0.000214)
HH income (*base <50k*)	-0.176	(0.177)	-0.206	(0.177)
Male	0.0738	(0.147)	-0.0477	(0.166)
Age	0.0174***	(0.00509)	0.0215***	(0.00571)
Family size	-0.00744	(0.0365)	-0.0159	(0.0369)
Dalit	-0.290*	(0.153)	-0.215	(0.160)
Education (*base: up to grade 6*)			0.256	(0.162)
More than Grade 6	2.150***		1.906***	
Constant	(0.292)		(0.331)	
Pseudo R^2	0.025		0.026	
Observations	305		305	

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

[9] The zero truncated negative binomial models do not converge for Gwallek sample.

from the pooled sample are consistent with the ones reported in earlier tables indicating that the results reported in the different tables are robust and reliable.

2.5 Cultural/Religious Value of the Landscape

2.5.1 Per visitor per year value

Using the estimated coefficients of the travel cost models, we derive the welfare gain by the visitors and households who had visited the religious sites (Patal Bhuwaneshwar cave Temple, Hat-Kalika Temple, and Gwallek Kedar) at least once in the past five years. Table 2.9 reports the average consumer surplus per visit per person, a measure of social welfare or the use value of cultural services that the Kailash Scared Landscape provides to visitors' households living in the three watersheds within the KSL area. Our results indicate that the per visit per capita average value of the cultural services to the Patal Bhuwaneshwar visitors ranges between NPR 21,947 and 23,774 (or between INR 13,717 and 14,859), which is roughly USD 210–230. For the day visitors, per visit per capita average value of the cultural services is between NPR 6,723 and 7,110 (or INR 4,202–4,444/USD 65–68).

Table 2.7: **Zero truncated poisson estimates (Gwallek)**

	Zero truncated poisson estimates			
Variables	M1		M2	
Travel cost	-0.000303***	(8.97e-05)	-0.000293***	(8.89e-05)
Alternative site TC	0.00108***	(5.02e-05)	0.00117***	(5.05e-05)
HH income (*base <50k*)	0.127**	(0.0522)	0.199***	(0.0529)
Male	-0.0902**	(0.0410)	-0.333***	(0.0462)
Age	0.00786***	(0.00139)	0.00224	(0.00150)
Family size	-0.0527***	(0.00696)	-0.0516***	(0.00700)
Dalit	-0.238***	(0.0556)	-0.352***	(0.0567)
Education (*base: up to grade 6*)			-0.551***	(0.0512)
More than Grade 6	2.504***		2.952***	
Constant	(0.0924)		(0.0992)	
Pseudo R^2	0.22		0.25	
Observations	138		138	
Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1				

Table 2.8: **Zero truncated negative binomial estimates (pooled sample)**

	Zero truncated negative binomial estimates			
Variables	M1		M2	
Travel cost	-0.000789***	(0.000117)	-0.000816***	(0.000122)
Alternative site TC	0.000944***	(0.000160)	0.000966***	(0.000164)
HH income (*base <50k*)	-0.0869	(0.136)	-0.0769	(0.137)
Male	0.0490	(0.117)	0.0370	(0.118)
Age	0.0147***	(0.00417)	0.0156***	(0.00432)
Family size	-0.0301	(0.0235)	-0.0309	(0.0235)
Dalit	-0.315**	(0.133)	-0.292**	(0.136)
Education (*base: up to grade 6*)			0.1000	(0.122)
More than Grade 6	2.258***		2.172***	
Constant	(0.229)		(0.252)	
Pseudo R^2	0.021		0.022	
Observations	443		443	
Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1				

For the households living in the Chandak-Aunla Ghat and Hat-Kalika watersheds who visited the religious site of the Hat-Kalika Temple at least once in the past five years, the average per visit per capita use value of the cultural services is between NPR 1,784 and 1,880 (or INR 1,115–1,175/USD 17-18). For the households living in the Gwallek watershed, the use value of cultural services ranges from NPR 3,300 to 3,413 (or INR 2,063–2,133/USD 32-33). For the pooled sample of all three watersheds, the average cultural value of the sampled landscape is between NPR 1,980 and 2,027 (or INR 1,225 – 1,357/USD 19-21) per person per visit.

2.5.2 Annual use value of cultural services to the KSL residents

In order to estimate the aggregate use value of cultural services that visitors and households derive from the KSL area, we collect information on the number of visitors to the Patal Bhuwaneshwar cave for the past five years. However, as there is an entry fee of INR 20 per visitor, the record keeping is done for only those visitors who actually enter the cave temple premises by paying the entrance fee. On the other hand, though local people from the surrounding villages also travel to the site frequently, they generally do not pay the entrance fee to enter the temple premises. Therefore, these frequent visitors are not recorded as visitors in the official records. The record shows that in the past five year, about 39,380 people visited the cave temple, with an annual average of 7,900 visitors.

Conversations with local priests, however, gave a rough estimate of around 12,000 visitors each year, which includes local visitors who do not enter the cave temple. Using a per visitor per year welfare gain of NPR 22,400 (or INR 14,000/USD 215), and an official estimate of 7,900 visitors each year, the estimated annual use value of cultural services to the visitors coming to the Patal Bhuwaneshwar cave is NPR 180 million (or INR 112 million/USD 1.7 million). This number changes depending on which figure we use for the number of visitors.

Table 2.9: **Per person per trip use value of cultural services at KSL area in NPR (USD)**

Patal Bhuwaneshwar	M1	M2	M3
Full sample (Table 2.4)	23,774 (229)	21,947 (211)	22,630 (218)
Day visitors (Table 2.5)	7,110 (68)	6.723 (65)	– –
Hat- Kalika visitors (Table 2.6)	1,880 (18)	1,784 (17)	– –
Gwallek Kedar visitors (Table 2.7)	3,300 (32)	3,413 (33)	– –
Pooled sample (local residents of sites 2 and 3) (Table 2.8)	2,027 (20)	1,980 (19)	– –
KSL area	–	–	–
• Total cultural (use) value for three sites	–	300 million (2.9 million)	–
• Total cultural (use) value of KSL area (for local residents only)	–	2.35 billion (22.6 million)	–

Note: In the Chandak-Aunla Ghat-Hat-Kalika sample, the site quality related information is missing and M3 is not estimated. In the day visitors' case, M3 does not converge. For the Gwallek watershed sample, the zero-truncated negative binomial model does not converge. The pooled sample includes a sample from Chandak-Aunla Ghat-Hat-Kalika and Gwallek watersheds. The cultural value of the KSL area to local residents is estimated using the use value of NPR 1,980 per person/trip/year (Model M2) for 200,000 households, in which 50% were more likely to visit the sites in question more than 4 times each year in a group of three members.

In the three watersheds, Hat-Kalika, Chandak-Aunla Ghat and Gwallek, there are 1,750, 1,774 and 5,393 households, respectively. From these watersheds, roughly 77%, 25% and 40%, respectively, of the sampled households visited one of the three sites at least once in the past five years. The average number of visits by the residents is 15 to the Hat-Kalika temple and 22 to the Gwallek Kedar in the past five years. On average, about 3 people per household visited the sites of which roughly 50% were female. Therefore, the average annual estimated use value of cultural services to the local households from the Hat-Kalika and Gwallek Kedar sites is NPR 38.4 million (or INR 24 million/USD 368,770) and NPR 88.3 million (or INR 55.2 million/USD 850,000), respectively. The combined annual use value of cultural services from these three sites to the households is NPR 305.92 million (or INR 191.2 million/USD 2.9 million).

About 1.1 million people live in the KSL area (Pandey, Kotru andand Pradhan, 2016). With an average family size of 5.5, this translates into over 200,000 households in the KSL area. Assuming that 3 members of each household from 50% of households visit the local cultural sites in the KSL area 4 times annually, on average (which is the sample average of these three watersheds), the estimated use value of the annual cultural service provided by the KSL landscape to the local residents is NPR 2.35 billion (or INR 1.47 billion/USD 22.6 million). This estimate does not include the value to visitors from elsewhere who visit the different sites of the KSL area as we do not have data on the number of travellers to these sites except for Patal Bhuwaneshwar. This estimate also depends on the number of visits that households make to the local sites. These results, based on the sample information from the three watersheds, thus take into consideration the heterogeneity of the households, not simply in terms of socio-economic characteristics but also in terms of proximity to the site under consideration since our sample includes households from the surrounding villages as well as from neighboring villages (for e.g., visitors to the Hat-Kalika temple from the Chandak-Aunla Ghat watershed) giving a basis for generalization of the results to the entire KSL area.

2.6 Conclusion

The literature on the valuation of the cultural services of religious sites and landscapes is very thin (Alberini and Longo, 2006). This research thus fills a gap in the existing literature by valuing the cultural services of particular religious sites. In this research, two different types of survey data were used for the valuation of the cultural (religious) services of the Kailash Sacred Landscape. The first survey included visitors from a cultural site, the Patal Bhuwaneshwar cave temple situated in Uttarakhand, India, while the second survey included households from three watersheds in India and Nepal (Hat-Kalika and Chandak-Aunla Ghat Watersheds in Uttrakhand, India, and Gwallek watershed from Baitadi, Nepal). All these sites are located within the Kailash Sacred Landscape, an area that spans three countries, China, India, and Nepal, covering some 31,252 km^2. The KSL area is famous for Mt.

Kailash, which is worshipped by more than one religious community, among them Hindus and Buddhists. Within the KSL area, there are several pilgrimage sites, which are visited by several thousand visitors each year from these countries. Households living in the KSL area also visit these religious sites. Our study includes three of these sites for estimating the use value of the cultural services that the visitors and households living in these watersheds derive by visiting the cultural sites. We used the travel cost method for this purpose.

The results indicate that the per visit average use value of the cultural services to the visitors who visit the Patal Bhuwaneshwar temple was NPR 21,947 (or INR 13,717/USD 211) in 2016. For the residents of the three watersheds, the per visit value of cultural services to the nearby religious site ranges from NPR 1,784 (or INR 1,100/ USD17) to NPR 3,413 (or INR 2,100/USD 33), depending on the location of the religious site. The annual cultural value provided by these three sites to the visitors and households who had visited one of these sites in the past five years is NPR 300 million (or INR 187.5 million/USD 2.9 million). For the entire KSL area, where 200,000 households are in residence, the use value of cultural services to the local residents (excluding outside visitors) is close to NPR 2.35 billion (or INR 1.47 billion/USD 22.6 million).

Since we survey households in three different watersheds, we also try to understand the contribution of the visitors to the local economy. In our sample, only 17% of the visitors purchase local products from the sites while none of the visitors stays overnight at these sites, indicating that the contribution to the local economy from such visits is minimal. This may be because of the lack of local products available at these sites for sale and the non-availability of overnight-stay facilities. The sampled respondents indicated that they were willing to stay overnight incurring an expenditure of NPR 88 (excluding the food cost) if over-night stay facilities were available. Though this rate may seem very low compared to the per night cost at local hotels for travellers who travelled to the Patal Bhuwaneshwar cave temple from outside, it is comparable with what a home-stay tourist would pay per night (NPR 100 per person) for staying in some tourist destinations in Nepal. This information suggests that making overnight home-stay facilities available around these sites may help improve the local economy that would be a byproduct of cultural tourism in the KSL area. Further, such arrangement may also offer scope for marketing local handicrafts/value-added items, which would in turn generate employment to local artisans.

3 Forest Composition and Water Availability: Valuation of Water Provisioning Services of Forests in Kailash Sacred Landscape

3.1 Introduction

Forests are considered the main contributors to hydrological services because of their ecological role in promoting infiltration that increases soil moisture content and groundwater recharge which contribute to the gradual release of water (Bruijnzeel, 2004; Calder, 2002). Forested watersheds are thus considered to be exceptionally stable hydrological systems (FAO, 2003) while the bio-physical process of forest-water interaction has been clearly established by researchers (see Bonell and Bruijnzeel, 2005).They also reduce surface runoff and maintain soil stability, thus improving water quality in terms of sediment loading (Ilstedt et al., 2007; Lele, 2009). A review of scientific studies of the hydrology of the Indian Himalayan region shows forested land to lose smaller quantities of both soil and water compared to other land uses such as jhum cultivation, grassland, etc. (Negi, 2002) and for forest cover to have a perceptible positive effect on water yield, especially in the micro-scale (Bruijnzeel and Bremmer, 1989). However, the biophysical condition of the area works as a strong modifier in the water provisioning services of forests (Calder, 2002; Negi and Joshi, 2004). This complex forest-water relationship has been studied and summarized by many hydrologists (Negi, 2002; Bruijnzeel, 2004; Calder, 2005, 2007; Van Dijk and Keenan, 2007) albeit with diverse results.

Although there is consensus regarding some outcomes such as the important role that the upstream forest cover can play in ensuring the delivery of high-quality water (Vincent et al., 2016), there is less agreement regarding other observations such as the positive effect that upstream forest cover can have on downstream annual and seasonal flows, especially in arid and semi-arid ecosystems (Malagnoux et al., 2007; Ilstedt et al., 2016; Tobella et al., 2014). Similarly, the role of forest in controlling seasonal downstream floods in large river basins has been found to be exaggerated (FAO and CIFOR, 2005). Carvalho-Santos et al., (2014) have summarized the extensive literature on the forest-water nexus and provides a synthesis that supports the 'water supply enhancer role' that forests play. However, with regard to the effects of reforestation on stream flow, the views of policy-makers, the public at large and the scientific community do not cohere so that more work is needed in order to arrive at any conclusive opinion (Tobella et al., 2014; Zingari and Achouri, 2007).

There are many studies establishing a link between forest quality and water provisioning. But less attention has been paid to the nexus between species composition of forest and water availability though there is general consensus that the relationship between the two could work both ways, i.e., each acting as both cause and effect in relation to the other (Espinosa and Cabrera, 2011; Sarvade et al., 2016). This report studies the link between species composition of forest and water in three remote watersheds of the Kailash Sacred Landscape (KSL) in the upper Himalayan region. During focus group discussions, the local stakeholders in the KSL area said that the provision of water is the most important ecosystem service from the forest while they also said that deforestation, forest degradation and changes in species composition have resulted in reduced water flow causing water stress in the surrounding areas. There are also reports of declining discharge from water sources in the Himalayan region due to climatic, anthropogenic or developmental factors in recent years (Negi and Joshi, 2002 and 2004; Vashisht and Sharma, 2007; Rawat et al., 2011). Considering the multiple drivers involved, determining which components of water stress can be attributed to forest or forest composition is not easy. Our study investigates the link between the species composition of forests and water availability using societal coping cost as a principal determiner as described below.

The study measures the coping cost of households and values the water provisioning service of forest species using the household production function, which are special cases of utility maximization (Freeman, 1993; McConnell and Rosado, 2000). Water stress is reflected in different types of coping behavior on the part of the people: they may spend more time on collecting water or more money on purchasing water from the market; they may simply cut down on or give up activities that they would undertake in times of plenty or even go for distress sales such as selling off livestock if obtaining the required amount of water is beyond their means. Several studies have assessed the demand for improved water services by studying households' use of substitutable market commodities for water (Pattanayak et al., 2005; Smith et al., 1986; Larson and Gnedenko, 1999; Wu and Huang, 2001; Um et al., 2002; Jalan et al., 2003; V´asquez, 2012). However, in areas with limited or no market access, water stress can be studied through time allocation of households to various household activities. In the upper Himalayan region, there have been reports of people standing in long queues at water points and women and children carrying water from increasingly distant sources or collecting unclean water, thereby inviting water-borne diseases, due to water stress (Negi and Joshi, 2002, 2004). This study attempts to determine the types of coping strategies of people in times of water stress and whether the coping costs of households is related to the type or quality of forest near the village.

We developed the research method after multiple Focus Group Discussions (FGDs) in the study area. The FGDs were followed by a detailed questionnaire survey of the households in which we collected information related to their demographic and socio-economic profiles, water requirement and availability, type of water-related stress and coping activities, observations on the flow of ecosystem services from the forest over time, etc., which were analyzed using statistical software. The results show households facing severe water stress in some of the areas in the summer, the major coping strategy for which has been spending long hours on water collection. We found the dry season water collection time per day to be twice the time spent on water collection in other seasons while households in villages surrounded by Chir Pine forests were found to spend more time on water collection compared to those surrounded by either Broadleaf, Deodar or Mixed Forest. Thus, our study contributes to previous studies by highlighting the important role of forest type in the provision of hydrological services.

This chapter follows the following schema - section 2 provides a theoretical background of coping behavior, which is followed by a description of the data, the empirical model, the estimated results, the coping costs and conclusions.

3.2 Coping Cost of Water

The demand for water has been studied using both the stated and revealed preference methods, both approaches having their own limitations. Stated preference studies, such as contingent valuation and conjoint method studies, directly measure households' willingness to pay for contingent or hypothetical improvements in water and are more comprehensive though they are vulnerable to validity threats and usually overestimate the true economic benefits (Kolstad, 2000; Champ et al., 2003). Revealed preference studies, such as avoided or coping cost studies, on the other hand, measure the economic benefits by examining the actual preventive behavior of people when faced with water stress (Kolstad, 2000). Such studies measure either the prevention costs incurred by households in order to cope with poor water or the savings in prevention costs resulting from improvements in water availability. However, as argued by Pattanayak et al. (2010), these measures usually underestimate the true economic benefits of a given intervention because they do not capture the economic value of a lowered risk of death or reduced pain and suffering. This argument is reinforced by empirical analysis of enhanced water provisioning which has shown coping costs to be lower than the willingness to pay for improvements in water supply in most cases (Whittington et al., 1990; Pattanayak et al,. 2005; Cook et al., 2015). The present study adopts the revealed preference method in order to examine the coping behavior of people when faced with water stress.

Coping costs refer to the expenditure of households on different types of averting, mitigating and defensive activities in order to cope with water stress in order to come to terms with the limited resource (Pereira et al., 2009; Cook et al., 2015; Ahile et al., 2015; Majuru et al., 2016). Globally, people are seen to be engaged in a variety of water-stress-related coping behaviors, which can be clubbed into five major strategies (Whittington et al., 1990; Mishra, 2006; Alam and Pattanayak, 2009; Pattanayak et al., 2005; Cook et al., 2015):

- Collection: Households collect water from sources other than their in-house and other usual water connections. Households may also reschedule their activities to spend extra time on water collection.
- Pumping: Households use groundwater through hand pumps or tube wells;
- Storing: Households buy storage utensils to store municipal water provided through their in-house connections or water collected from other sources;

- **Treating:** Households recycle or filter water through boiling or use of chemicals;
- **Purchasing:** Households purchase water from vendors or neighborhoods.

Avoided illness costs can also be included as a coping cost because medical spending can lead to the prevention of severe diarrhea and mortality. Although hidden, these are the real costs of a water supply system that delivers low volumes of poor-quality water on an irregular basis (Pattanayak et al., 2005). However, the coping costs vary across regions with the type of stress faced by households and, even within regions, due to the different socio-economic profiles of households constituting a given region. For instance, whereas averting monthly expenditure to cope with scarcity of clean water varied between USD 153 and 483 for households in Pennsylvania (Harrington et al., 1989), it was estimated to range between USD 16 and USD 35 per households for the same region to cope with an episode of surface water contamination (Laughland et al., 1993). In the case of developing and emerging economies, the monthly coping cost for similar scarcity-related stress has been estimated to be just USD 3 in Nepal (Pattanayak et al., 2005), between USD 4 and 5 in India (Mishra, 2006), USD 9.5 in Taiwan (Wu and Huang, 2001) and between USD 20 and 39 in Kenya (Cook et al., 2016).

In developing countries, the highest coping cost has been found to be the collection cost whereas in developed countries, it has been the purchase price. Researchers (Larson and Gnedenko, 1999; Mirajul et al., 2008; McConnell and Rosado, 2000) have found different factors, among them, income, perception of water quality, location of residence, education, number of small children, job type, gender etc., to influence the choice of coping activity, i.e., whether to boil and/or filter collected water or purchase bottled water. However, few studies to date have measured the coping cost in remote mountainous regions of developing countries, which is what this study attempts, where market penetration is limited and people are fully dependent on natural water sources.

3.2.1 Theoretical model

To better understand households' behavioral decisions with regard to coping with water scarcity, we begin with a household production function approach, drawn from Pattanayak et al. (2005), Pattanayak, and Pfaff (2009). Utility maximization under the household production function framework provides a complete understanding of this concept (Pattanayak et al., 2005; McConnell and Rosado, 2000).

A utility maximizing household allocates his/her time and income to leisure (T_l), health (*H*), some primary production (*P*) at home (livestock, vegetable farming) and consumption of a composite commodity (*Z*) from market. The household also undertakes coping activity (*C*) if faced with water stress. The quantity and quality of water enters into the utility function through health, as health is dependent on water and on primary production at home. In the context of our study area, we make some specific assumptions, viz., water availability in any season depends on only forest type[10]; government policies are unchanged in the short run; and time allocation to activities depends on water availability. Next, we assume *input M* for coping activity (say, storage items) to depend on water and the input requirement for primary production, *input I* (say, fodder for livestock), to depend only on the forest type nearby. The objective of the household is to maximize utility subject to time, health and income constraint. From utility maximization and the utility maximizing minimum expenditure function, it can be shown that the change in minimum expenditure due to a change in forest will consist of the following[11] :

$$\frac{\partial \Omega}{\partial F} = \frac{\partial W}{\partial F}\left[w\left(\frac{\partial T_i}{\partial W} + \frac{\partial H}{\partial W}\right) + p_1\frac{\partial M}{\partial W} + - \lambda\left\{\left(\frac{\partial U}{\partial T_i}\frac{\partial T_i}{\partial W}\right) + \left(\frac{\partial U}{\partial H}\frac{\partial H}{\partial W}\right)\right\}\right] + \left[w\left\{\frac{\partial H}{\partial P}\frac{\partial P}{\partial I}\frac{\partial I}{\partial F}\right\} + p_2\ \frac{\partial I}{\partial F} - \lambda\frac{\partial U}{\partial H}\frac{\partial H}{\partial P}\frac{\partial P}{\partial I}\frac{\partial I}{\partial F}\right] \quad (3.1)$$

In equation 1, the left hand side gives the change in minimum expenditure of the household (to keep utility constant) due to a change in forest cover in the watershed, as the household is completely dependent on the forest ecosystem. This should be his/her equivalent willingness to pay (WTP) to bring in improvements in forest type or quality. This consists of two components, the first part of which is WTP for water stress (the terms within the big bracket [ ]) and the second component being WTP due to the direct dependency on forest for input requirements like fodder,

[10] To be more specific, we can assume water availability to depend on forest type and aspect. Of course, rainfall is the major source of aquifer recharge and the water yield of springs. Land use and land cover mediate the partitioning of precipitation into various hydrological components within the watersheds (Negi and Joshi, 2002). As we study watersheds, which are close by, we, expect the rainfall pattern to be similar across these watersheds and we use various household level features to control for land use (as described later). Thus, for the cross-sectional data used in the analysis, the assumption of forest type determining water availability in the neighborhood can be justified.

[11] Detailed derivation can be shared if requested.

fuel wood, etc. Each of these components consists of three items: (i) lost wage income due to time reallocation for longer distances travelled or for waiting longer to collect water as well as illnesses emanating from the water problem, (ii) extra expenditure on coping or primary inputs, and (iii) pain and suffering due to loss of leisure or ill-health (the terms multiplied with $-\lambda$).

Since the cost of illness and utility lost due to pain and suffering are positive, we can expect that the coping cost of deforestation in general or water in particular represents a lower bound for the theoretically correct measure of WTP for comprehensive improvements in forest or water supply as witnessed in other studies (V´asquez, et al., 2009). However, empirical studies have shown that this relation may not always hold true. Coping costs will also diverge from "true" WTP if coping behaviors are suboptimal, inefficient, or incomplete for reasons such as information costs, uncertainty, or limited property rights to raw water sources, etc. (Pattanayak et al., 2005). In spite of the limitations, the coping cost has been a tool to reflect on natural resource stress and to formulate policies to best manage the resource (Cook et al., 2015; Zerab, 2002; Katuwal and Bohra, 2011; Kremer et al., 2011; V´asquez, 2012).

The present study measures the coping cost due to water stress and then measures the value of water provisioning services after linking it to forest type. Thus, Equation 2 will be estimated as

$$C_{ijwc} = \beta_0 + \beta_1 X_{ijwc} + \beta_2 F_{ijwc} + \beta_3 T_{jwc} + \beta_4 \theta_w + \beta_5 \vartheta_c + \xi_{ijwc} \tag{3.2}$$

where C is the coping cost for water stress, i is household, j village and w watershed, c country, X household features, F forest features which can be linked to household, T tree/vegetation type in the j^{th} village of the watershed, θ and ϑ watershed and country dummies respectively, and ξ is error.

3.3 Study Area and Data

The study areas for this chapter, as mentioned in Chapter 1, are the three watersheds, Hat-Kalika and Chandak-Aunla Ghat in India and Gwallek in Nepal. The data collection followed a structured approach: focus group discussions, consultations, questionnaire development, training of enumerators, pretesting of questionnaire, and household survey. See Chapter 1 for a description of the FGDs and the household surveys. The discussions with watershed communities were mainly focused on the status and change in the local ecosystem, the benefits received from the forest, and the existing management practices in relation to forest whereas consultations with others were to identify the state of forest management, issues raised by local communities, and perspectives on forest management in the future. We used the inputs from FGDs to develop the questionnaire, based on the piloting, the draft questionnaires were revised, and the survey conducted. Figure 1.1 shows the study area. We measure the coping costs for the sampled households of all three watersheds.

We interviewed a total of 604 households in the Hat-Kalika and Chandak-Aunla Ghat Watersheds and 350 households in the Gwallek watershed. The selected sample size is 17% and 14% of the total watershed households in India and Nepal respectively. At the Indian site, all habitat villages having more than 10 households were selected in both the watersheds. Since both watersheds have a nearly equal number of households-1,750 in Hat-Kalika and 1,774 in Chandak-Aunla Ghat-303 and 301 households were interviewed respectively. We then selected a number of sample households proportionately based on the total households of a village. We followed a similar procedure in the Gwallek Watershed of Nepal. In all, a total of 954 households were studied from the 3 watersheds.

3.4 Results

The survey data were analyzed to find out the type of water and forest product related stress in the villages and to econometrically estimate the impact of forest type on the availability of water. We considered the types of forests surrounding the villages in order to understand their potential for water provisioning. We conducted both univariate and multivariate analyses to generate the results. First, we describe the general features of the watersheds with respect to socio-economic aspects and forest services available and then describe the econometric results.

3.4.1 Socio-economic and forest features of study area

General caste and Dalits constitute the two major caste categories in the sample[12], with 85 percent of households in Gwallek, 52 percent in Chandak-Aunlaghat and 59 percent in Hat-Kalika belonging to general caste (see Table 3.1). People in general were less educated (class 6th to 12th) while agriculture was the main occupation, the income from which constituted the primary source of income for most households, especially in the two watersheds in India. In Gwallek, on the other hand, remittances constitute an important source of income. We found both Chandak-Aunlaghat and Hat-Kalika to have more concrete houses than Gwallek and most households in all the watersheds to have better (*pucki*)[13] toilets, which are connected to septic tanks. However, the sewage connection to wastewater was nearly missing in all the watersheds, which meant that more than 95 percent of the households simply threw their wastewater out into the open. Thus, the socio-economic features show the sample households in India and Nepal to be similar with respect to their occupations and life-styles.

Table 3.1: **Socio-economic features of the sample households (percentage of households)**

Name of watershed	Caste		Education				Household occupation			Sources of income			House type		Toilet type		Toilet connected to septic tank	Household waste management	
	General	Dalits	Illiterate	Primary	Class 6-12	Bachelor's and above	Agriculture	Govt	Others	Main occupation	Remittances	Other	Traditional	Concrete	Pucci	Kachi		Sewage	Open
Gwallek	85.19	14.81	0.28	4.84	82.05	12.82	67.24	10.54	22.22	55.56	30.77	13.68	49.86	50.14	93.4	0.6	97.4	2.6	97.4
Chandak-Aunla Ghat	51.5	48.5	1	1.33	84.05	13.62	91.03	2.33	6.64	69.77	13.95	16.28	28.57	71.43	78.9	3.9	100	5.1	94.9
Hat-Kalika	59.41	40.59	1.32	5.28	90.43	2.97	78.55	8.91	12.54	76.24	11.55	12.21	43.23	56.77	68.5	10.6	100	3.9	96.1

Source: Field Survey, 2016

Table 3.2 gives the type of forest surrounding the sample villages and the percentage of sample households close to those forest types, which shows the forest cover to be different in the different watersheds. Whereas it is either Broadleaf or Broadleaf-Pine Mixed in Gwallek, the main forest type surrounding the villages in Chandak-Aunla Ghat, is bush vegetation. On the other hand, Broadleaf and Pine Mixed Forest dominates the Hat-Kalika watershed followed by Pine Forest. Deodar and Deodar Mixed Pine are however quite sparse and found only in Gwallek and Hat-Kalika as reflected in the sample. We have exploited this divergence in forest cover to measure the effect of forest type on water provisioning in the study.

Table 3.2: **Type of forest surrounding the villages of sample households (percentage of households)**

Name of watersheds	Forest types					
	Pine	Deodar	Broadleaf	Bush	Mixed (broadleaf and pine)	Conifer mix (deodar and pine)
Gwallek	2.56	0.57	29.34	12.25	53.56	1.71
Chandak-Aunla Ghat	10.3	0	9.63	78.74	1.33	0
Hat-Kalika	24.75	0	15.51	0	59.08	0.66

Source: Field Survey, 2016

With respect to the flow of ecosystem services, the dominant opinion in the communities spoke of a general deterioration in forest benefits. Most households reported flows of services like availability of water, fuel wood, fodder, leaf litter, etc. to have declined in the past 10 years though opinions with regard to water quality were somewhat mixed (Table 3.3).

Table 3.3: **Perceptions of households about trends in ecosystem services over years (% of households reporting decrease in the ecosystem services over the past 10 years)**

Watershed	Ecosystem services						
	Water quality	Water quantity	Other NTFP	Fuel wood availability	Fodder availability	Leaf litter availability	Cultivated area
Gwallek	29.43	79.14	53.85	84.77	86.29	76.66	84.03
Chandak-Aunla Ghat	60.13	88.37	86.3	96.95	93.64	71.37	71.55
Hat-Kalika	37.95	68.98	80.83	75.25	70.86	55.52	82.37

Source: Field survey, 2016

[12] In the entire sample, Dalits constituted 32 percent and general caste 67 percent while other castes made up the rest. However, since other castes were only found in one watershed, i.e., Chandak, we merge other castes with general caste to create two categories, Dalit and general.

[13] Made of concrete and of permanent structure.

3.4.2 Usage of water sources and coping activities for water stress

Table 3.4 shows the supply-demand gap of water, the usage of water sources by different households, and investment in water stress related coping activities in the last five years. This shows the daily water requirement to be the highest in Gwallek (at 268 ltr) followed by Chandak-Aunlaghat (at 189 ltr) and Hat-Kalika (at 144 ltr). This could be due to family size too as Gwallek has the largest family size (at 7 members) whereas the family size is 4.7 and 5.5 respectively in the other two watershed areas. While the amount collected in both the summer and the other seasons is the same in Gwallek, this is not the case in Hat-Kalika and Chandak where the dry season demand-supply gap is, for Chandak, around 21 liters per day and, for Hat-Kalika, 27 liters per day. With regard to water sources, the public tap is the most widely used source followed by the public well in Gwallek whereas, on the Indian side, it is the public well (*Naula*) followed by public tap or private tap. However, private tap is available only to a limited number of households except in the case of Chandak-Aunlaghat where 36 percent of households in summer and 45 percent of households in other seasons collect water from private taps. Both water filters and water purifiers are more in use in Hat-Kalika and Chandak than in Gwallek where people seem to be investing more in water storage items. On the other hand, nearly 69 percent of households in Gwallek and 55 percent in Chandak participate in watershed management whereas only 27 percent do so in Hat-Kalika.

Table 3.4: **Percentage of households using different water sources or buying water storage or purifier items**

Watershed	Water requirement (in liters)			Water sources: Percentage of households using in dry season[a]			Coping activities: Purchased the following in last 5 years			Participating in different watershed management activity
	Total require-ment	Collec-tion in dry season	Collec-tion in other season	Private tap	Public tap	Public well	Water filter	Water purifiers	Water tank or buckets	
Gwallek	226.8	254.1	253.5	15.95 (15.66)	71.79 (71.79)	50.71 (29.91)	0.00	5.1	76.22	69.06
Chandak-Aunla Ghat	189.4	168.5	190.3	35.90 (44.51)	31.91 (38.21)	47.01 (54.81)	23.0	9.38	26.57	55.48
Hat-Kalika	144.3	117.2	139.6	18.52 (22.11)	51.85 (61.72)	54.42 (63.04)	50.0	32.37	26.08	26.73

Note: [a]Figures in parenthesis are percentage of households using these sources in other seasons.
Use of pump as a water source was very low. Of the 951 households surveyed, only six households reported to have used water from pump both during dry and other seasons.
Source: Field Survey, 2016

3.4.3 Water collection time

Table 3.5 shows the average water collection time per day and the opportunity cost of time so spent.

Table 3.5: **Season-wise average water collection time (in minutes) per day and per liter of water and opportunity cost (in NPR) of time spent per day**

Name of water sheds and season	Gwallek		Chandak-Aunla Ghat		Hat-Kalika	
	Dry	Other	Dry	Other	Dry	Other
Total water collection time (in minutes) per day	72.52	27.32	102.06	67.20	73.84	30.33
Collection time per day (in minutes) per liter of water (simple average)	0.33	0.15	0.80	0.51	0.79	0.28
Collection time per day (in minutes) per liter of water (weighted average)	0.49	0.18	1.38	0.89	1.42	0.23
Opportunity cost of labor time spent per day to collect water	INR 14.16 (NPR 22.66)	INR 3.73 (NPR 5.96)	INR 22.56 (NPR 42.49)	INR 12.2 (NPR 19.52)	INR 18.98 (NPR 30.37)	INR 5.55 (NPR 8.7)

Source: Field Survey, 2016

The time spent to collect water is the highest in Chandak-Aunlaghat followed by Hat-Kalika and Gwallek, both in the dry and other seasons. For daily collection, households in Chandak-Aunlaghat spent 102 minutes (or one hour and forty-two minutes) in the dry season while they spent 74 minutes in Hat-Kalika and 72.5 minutes in Gwallek. On the other hand, in the other seasons, the amount of time spent on water collection is 67 minutes in Chandak, 30 minutes in Hat-Kalika and 27 minutes in Gwalek. This shows that the dry season collection time is more than double that of other seasons in these watersheds. Although Gwallek ranks number one in terms of the total amount of water collected, also the watershed area records the lowest collection time per liter of water in both the dry and other seasons.

We measure both a simple and a weighted average of time taken per liter of water collected by using the inverse of water collected from a source per day as the weights. This shows the weighted average of time required per liter of water to be much higher than the simple average, and the time taken to be nearly one and a half to two times higher during the dry season in all the watersheds. This means that people have to walk long distances and/or wait much longer in summer to collect small amounts of water to fulfill their daily requirements. In terms of the opportunity cost of time or foregone income daily, it is INR 23 (or NPR 43) in Chandak, INR 19 (or NPR 30) in Hat-Kalika and INR 14 (or NPR 23) in Gwalek in the dry season while it is INR 12.2 (or NPR 20), INR 5.6 (or NPR 9) and INR 3.7 (or NPR 6) respectively in other seasons. This suggests that households face a lot of hardship to collect water in the dry season in these areas though Gwalek and Chandak-Aunlaghat seem to be the least and most water stressed regions, respectively, of the 3 study sites. In the next section, we therefore try to estimate econometrically the link between forest types and water stress in terms of collection time and other coping activities.

3.5 Econometric Results

We examine the link between forest type and water availability based on the hypothesis that more the availability of water, less the collection time and less the expenditure on storage. Thus, collection time is the main identified strategy of water stressed communities in a situation where market integration is limited so that, in the absence of the availability of packaged water, fetching water from a far-off forest source is the only option available to communities. To establish this link, we estimate equation 2 using the survey data. The specific equation estimated is the following:

$$t_{ij} = \alpha_0 w_j + \alpha_1 l_{ij} + \alpha_2 r_{ij} + \alpha_3 oc_{ij} + \alpha_4 ed_{ij} + \alpha_5 caste_{ij} + \alpha_6 land_{ij} + \alpha_7 income_{ij} + \alpha_8 livestock_{ij} + \alpha_9 f_{ij}^{*} dir_{ij} + \varepsilon_{ij} \quad (3)$$

In equation 3, *t* is coping activity (either time spent to collect water or both time spent and expenditure made for storage and cleaning), i is ith household and *j* is *jth* watershed. *w* is watershed dummy, *l* is distance of household from road, r is the respondent's biographical features (viz., gender, age, etc.), *oc* is the type of occupation of household, *ed* is the highest education level in the household, caste is the *caste* of the household, *land* is the size and type of landholding of the household, *income* is the annual income category of household, *livestock* is the total livestock holding of the household in tropical livestock units, *f* is the forest type (whether Pine, Broadleaf, Deodar, etc.) in the vicinity of the village where the household is located, *dir* is the direction of the mountain where the forest is located and ε is the error term. The forest type and forest direction are interacted to test an existing belief in the watershed communities that pine forest comes up in south-facing directions, which are usually dry, and short of water (an opinion voiced in the FGDs). The Bush and Broadleaf Forest types, on the other hand, were highly correlated and, in many cases, Bush Forests were degraded broadleaf forests. We therefore add them together to generate the category 'Native Broadleaf' forest as these two categories share similar soil types and features.

We use different measures of water collection time and different specifications for equation 3 to derive robust results. The pooled data of all three watersheds is used to estimate equation 3. Table 6 explains the variables used in estimating equation 3 along with the summary statistics of these variables. This Table shows the different measures of time required to collect water or the equivalent monetary income lost, according to which the simple average collection time across all three watersheds for one liter of water is 0.61 minutes in the dry season and 0.29 minutes in other seasons while these time requirements increase to 1.09 and 0.40 minutes if the weighted average of collection time is calculated taking the inverse of water collected from sources as weights.[14] The maximum time taken to collect one liter of water is 9 minutes in the dry season and 6.5 minutes in the other seasons. However,

[14] Table 5 explains these averages for different watersheds in more detail.

Table 3.6: **Summary statistics of variables (number of observations: 954)**

Name of variables	Units	Mean	Std.dev	Minimum	Maximum
Collection time (simple, /ltr dry sea.)	Minutes	0.61	0.68	0.00	9.05
Collection time (simple, /ltr oth. sea.)	Minutes	0.29	0.49	0.00	6.47
Collection time (weighted, /ltr dry sea.)	Minutes	1.05	1.58	0.00	28.13
Collection time (weighted, /ltr oth. sea.)	Minutes	0.40	0.88	0.00	8.93
Cost of collection (/day in dry season)	NPR	31.36	34.24	0.00	343.75
Cost of collection (per day other season)	NPR	11.10	12.38	0.00	112.92
Cost (coll. and storage per day dry season)	NPR	37.36	37.54	0.00	410.42
Hat-Kalika	Dummy variable	0.317	0.466	0	1
Chandak-Aunla Ghat	Dummy variable	0.315	0.465	0	1
Water collection (/day dry season)	Liters	183.692	126.075	0	1200
Water collection (/day other season)	Liters	197.452	119.540	0	1200
Road distance	Kilometers	36.307	46.111	0	240
Gender	Dummy	0.406	0.491	0	1
Age	Years	45.069	14.893	17	98
HH-occupation = govt. job	Dummy variable	0.074	0.262	0	1
HH-occupation =other than agriculture and govt.	Dummy variable	0.142	0.350	0	1
Female (percentage in family)	Dummy variable	0.485	0.165	0	1
Family highedu = Primary	Dummy variable	0.853	0.354	0	1
Family highedu=Secondary	Dummy variable	0.008	0.091	0	1
Familyhighedu =Graduate	Dummy variable	0.039	0.193	0	1
Dalits (compared to general caste)	Dummy variable	0.336	0.473	0	1
House type (traditional vs. others)	Dummy variable	0.410	.492	0	1
Toilet (pukki)	Dummy variable	0.773	0.419	0	1
Irrigated land area	Hectares	.0084	0.0311	0	0.5
Total land area	Hectares	9.468	9.553	0	100
Income (50k – 1 lakh)	Dummy variable	0.239	0.427	0	1
Income (1 lakh-3 lakhs)	Dummy variable	0.164	0.370	0	1
Income (3 lakhs – 5 lakhs)	Dummy variable	0.040	0.196	0	1
Income (more than 5 lakhs)	Dummy variable	0.004	0.065	0	1
Livestock	Livestock unit	4.670	3.409	0	32
Deodar in North east	Dummy variable	0.000	0.000	0	0
Deodar in West	Dummy variable	0.000	0.000	0	0
Deodar in South east	Dummy variable	0.002	0.046	0	1
Deodar in South west	Dummy variable	0.000	0.000	0	0
Native Broadleaf in North east	Dummy variable	0.141	0.349	0	1
Native Broadleaf in West	Dummy variable	0.062	0.241	0	1
Native Broadleaf in South east	Dummy variable	0.187	0.390	0	1
Native Broadleaf in South west	Dummy variable	0.090	0.286	0	1
Mix in North east	Dummy variable	0.016	0.124	0	1
Mix in West	Dummy variable	0.047	0.212	0	1
Mix in South east	Dummy variable	0.282	0.450	0	1
Mix in South west	Dummy variable	0.044	0.205	0	1
Conifer-mix in North east	Dummy variable	0.002	0.046	0	1
Conifer-mix in West	Dummy variable	0.001	0.032	0	1
Conifer mix in South east	Dummy variable	0.004	0.065	0	1
Conifer-mix in South west	Dummy variable	0.001	0.032	0	1

Source: Field Survey, 2016

if we take into account the water sources as well as water collected from these sources explicitly in measuring the time required to collect a liter of water, the time required increases to a maximum of 28 minutes and 9 minutes respectively. In terms of wage income lost, the loss is NPR 31 (or INR 19.4) per day in the dry season and NPR 11 (or INR 6.9) per day in other seasons on average whereas in terms of maximum loss, it is NPR 344 (or INR 215) in the dry season and NPR 113 (or INR7.6) in other seasons. The dry season maximum cost increases to NPR 410 (or INR 256) if we take into account the money spent on water storage.

Most of the explanatory variables used in these estimations are dummy variables. We use the Chir Pine forests as the comparison forest category for other forest types and illiterate as the comparison education category for other education categories in the estimation. Except for Deodar, which was observed only in the Southeast aspect, we found other forests facing all directions, Northeast, North-west, Southeast and South-west.

Table 7 shows the estimated coefficients of variables explaining the time needed to collect one liter of water per day in the different seasons. We estimate both linear and log linear models and use both the simple and weighted average of time to collect one liter of water per day as dependent variables. We used the robust standard errors. The results show the time needed to be significantly higher in the Indian watersheds compared to Gwalek and especially so in the case of Chandak-Aunlaghat in both the seasons. In Hat-Kalika, the water collection time is not very different from that in Gwalek during other seasons though it is significantly higher in the dry season. The results also show people in high-income groups to take more time to collect water compared to people in the less-than 50,000-income slab.

With regard to results on forest types, the coefficients show the difference in collection time of a liter of water between the forest area under consideration and that for Chir Pine forest area, which was the comparison category for estimation purposes. All the coefficients for all the forest types facing different directions were negative for both the dry and other seasons and significantly so in most cases which means that the collection time is less in villages having Deodar, Native Broadleaf, Mixed or Needle Mix Forests compared to villages having only Chir Pine Forests. This result is robust and visible during both the dry and other seasons irrespective of the model or definition of average time per liter of water collected. The absolute value of the coefficients, which are the differences in collection time between Pine and other forest types, is larger in the dry season compared to other seasons which means that during the dry season, people having Pine forests in the vicinity of their villages spend more time collecting water compared to villagers with other types of forest surrounding their villages. This facilitating role of other forests compared to Pine in the provisioning of water is visible irrespective of the direction: i.e., other forest types facing northeast provide better water provisioning compared to Chir Pine facing the Northeast and other forests facing North-west provide better water provisioning than Chir Pine facing the North-west. This role of other forests is also visible in those facing the Southeast and South-west directions. Although it has been argued[15] that Chir Pines come up facing a southerly direction as these are water-scarce and dry regions, the results prove that even in these regions other forests provide better water provisioning services than Chir Pines.

We next examine the effect of forest types on total water collection time per day, wage income and sum of wages foregone, and storage cost by re-estimating Equation 3 using these as dependent variables. Investment in storage by households is primarily a coping strategy when faced with water scarcity. Investment in a water purifier could be a strategy to cope with poor water quality, especially in the rainy season. Since expenditure on watershed management could be endogenous to water supply, we have not added it to the collection cost. Table 3A.1 in the Appendix gives these regression results, which are similar to the ones shown in Table 3.7. As the Table shows, villagers whose villages are surrounded by Broadleaf or Deodar or Mixed Forests save time and income compared to villagers whose villagers are surrounded by Chir Pine forest. However, these results are not used for the valuation of water provisioning services as the storage and water filtration cost could not be annualized due to lack of information on the longevity of these items[16] while the total water collected in any given day would be influenced by other factors such as family size, livestock size, etc. Hence, we use the results from Table 7, which gives the time savings in other forest areas when it comes to collecting one liter of water per day in comparison with that for the Chir Pine areas in order to derive the water provisioning value of the forests.

[15] Some FGD participants were of this view.

[16] Such information could not be collected during the survey, as most of the interviewees did not know the answer.

Table 3.7: **Estimated coefficients showing the effect of forest type on average water collection time (per liter) in different seasons**

Explanatory variables	Dry season							
	Linear and log linear of simple average collection time				Linear and log linear of weighted average collection time			
	Dep. Var. = TSD		Dep. var. = ln (TSD)		Dep. var. = TWD		Dep. var. = ln (TWD)	
Deodar in South east	-0.471	(4.26)**	-0.311	(6.63)**	-0.97	(3.31)**	-0.438	(6.05)**
Native Broadleaf in North east	-0.15	(1.48)	-0.074	(1.71)	-0.633	(2.37)*	-0.204	(2.83)**
Native Broadleaf in West	-0.476	(4.47)**	-0.241	(5.01)**	-1.456	(5.37)**	-0.518	(6.76)**
Native Broadleaf in South east	-0.234	(1.95)	-0.156	(3.47)**	-0.713	(2.25)*	-0.323	(4.72)**
Native Broadleaf in South west	-0.598	(5.83)**	-0.332	(7.36)**	-1.33	(4.83)**	-0.499	(6.48)**
Mix in North east	-0.299	(2.83)**	-0.14	(2.44)*	-0.772	(2.89)**	-0.212	(2.17)*
Mix in West	-0.258	(2.06)*	-0.136	(2.22)*	-0.728	(2.65)**	-0.238	(2.66)**
Mix in South east	-0.421	(5.59)**	-0.233	(6.41)**	-0.93	(4.49)**	-0.357	(5.81)**
Mix in South west	-0.354	(3.89)**	-0.181	(3.70)**	-0.787	(3.19)**	-0.296	(3.50)**
Needle-mix in North east	-0.823	(5.69)**	-0.486	(4.48)**	-1.928	(9.44)**	-0.91	(14.54)**
Needle-mix in West	-0.551	(5.29)**	-0.302	(5.93)**	-1.296	(4.96)**	-0.56	(6.94)**
Needle-mix in South east	-0.535	(4.24)**	-0.326	(4.26)**	-1.184	(4.52)**	-0.558	(6.07)**
Needle-mix in South west	-0.291	(3.15)**	-0.119	(2.66)**	-0.587	(2.68)**	-0.107	(1.51)
Constant	0.722	(4.64)**	0.482	(6.26)**	1.594	(4.34)**	0.745	(6.53)**
Observations	948		948		950		950	
R^2	0.23		0.32		0.15		0.27	
	Other season							
Deodar in South east	-0.298	(3.53)**	-0.192	(5.16)**	-0.423	(2.66)**	-0.13	(2.04)*
Native Broadleaf in North east	-0.274	(3.22)**	-0.153	(3.96)**	-0.429	(2.35)*	-0.146	(2.28)*
Native Broadleaf in West	-0.472	(5.36)**	-0.255	(6.17)**	-0.982	(5.40)**	-0.363	(5.40)**
Native Broadleaf in South east	-0.242	(2.85)**	-0.148	(4.22)**	-0.492	(3.73)**	-0.173	(3.57)**
Native Broadleaf in South west	-0.479	(5.47)**	-0.282	(7.21)**	-0.82	(4.67)**	-0.315	(4.88)**
Mix in North east	-0.105	(0.96)	-0.048	(0.74)	-0.132	(0.41)	-0.064	(0.64)
Mix in West	-0.109	(1.73)	-0.04	(1.09)	-0.311	(3.07)**	-0.106	(2.39)*
Mix in South east	-0.275	(4.42)**	-0.176	(6.16)**	-0.323	(2.53)*	-0.133	(2.89)**
Mix in South west	-0.299	(4.45)**	-0.17	(5.03)**	-0.44	(3.82)**	-0.192	(4.16)**
Needle-mix in North east	-0.019	(0.11)	0.028	(0.23)	0.65	(1.05)	0.415	(1.24)
Needle-mix in West	-0.358	(4.29)**	-0.196	(4.57)**	-0.483	(3.08)**	-0.152	(2.52)*
Needle-mix in South east	-0.234	(2.27)*	-0.142	(2.44)*	-0.404	(2.53)*	-0.136	(1.97)*
Needle-mix in South west	-0.299	(4.68)**	-0.172	(5.30)**	-0.478	(3.09)**	-0.18	(3.30)**
Constant	0.352	(3.38)**	0.234	(4.22)**	0.032	(0.16)	0.07	(0.88)
Observations	938		938		950		950	
R^2	0.24		0.33		0.26		0.32	

Absolute values of robust t statistics are in parentheses;
* significant at 5%; ** significant at 1%
Note 1: T_{SD} = per liter collection time in Dry Season (simple average), T_{WD} = per liter collection time in Dry Season (weighted average), T_{SO} = per liter collection time in Other (simple average), T_{WO} = per liter collection time in Other (weighted average).
Note 2: Other variables used in each model are watershed dummies, distance to road, gender and age of respondent, occupation, education and income category dummies, caste, house type, landholding, area under irrigation and livestock holding of households.

3.6 Value of Water Provisioning Services of Forest Types to KSL Residents

We multiply the coefficients of forest types from Table 3.7 with total average water requirement per household per day to measure the total time saving per day for the forest type when compared to Chir Pine forest. We next calculate the total saving per month and convert it to work days saved multiplying it then by the nominal wage rate for unskilled labor in order to calculate the saving in monthly wage income in the dry and other seasons.[17] The monthly savings are then converted to seasonal savings by factoring in the number of months per season which are then added up to measure the savings per year to a representative household in the KSL area. Table 3.8 shows the annual savings in wage income for different types of forests in comparison with Chir Pine under different specifications of the coping cost model. These are the annual water provisioning values of forest type compared

[17] For the semi-log model, the coefficients are first multiplied by the exponential of the predicted y values after which the time- and income-savings are measured.

Table 3.8: **Water provisioning value of deodar and broadleaf forests over Chir Pine forests**

Forest type in different direction	Annual Water Provisioning Value of Forest Types Compared to Chir Pine in the Same Direction (in USD)							
	INDIA				NEPAL			
	Simple average models		Weighted average models		Simple average models		Weighted average models	
	Linear	Log-linear	Linear	Log-linear	Linear	Log-linear	Linear	Log-linear
Deodar in North east	NA	NA	NA	NA	NA	NA	NA	NA
Deodar in West	NA	NA	NA	NA	NA	NA	NA	NA
Deodar in South east	99.7	90.4	175.3	113.5	74.7	67.8	131.4	85.1
Deodar in South west	NA	NA	NA	NA	NA	NA	NA	NA
Native Broadleaf in North east	59.9	42.5	138.4	70.0	44.9	31.9	103.8	52.5
Native Broadleaf in West	127.5	90.8	317.6	176.2	95.6	68.1	238.1	132.1
Native Broadleaf in South east	64.3	55.4	157.3	99.2	48.2	41.6	117.9	74.4
Native Broadleaf in South west	142.3	111.5	278.0	162.8	106.7	83.6	208.4	122.0
Mix in North east	50.0	33.2	107.4	55.2	37.5	24.9	80.5	41.4
Mix in West	46.1	30.9	130.5	68.8	34.5	23.2	97.9	51.6
Mix in South east	90.4	74.0	155.1	97.9	67.8	55.5	116.3	73.4
Mix in South west	86.7	64.0	157.4	97.6	65.0	48.0	118.0	73.2
Conifer mix in North east	95.3	77.1	114.2	98.6	71.5	57.8	85.6	73.9
Conifer mix in West	118.1	89.6	221.3	142.3	88.5	67.2	165.9	106.7
Conifer mix in South east	96.8	83.1	196.3	138.7	72.6	62.3	147.2	104.0
Conifer mix in South west	79.6	53.9	140.9	57.4	59.7	40.4	105.7	43.1

with Chir Pine to a household of the KSL region. The results show every other forest type to provide a higher water provisioning service compared to Chir Pine. These values are measured separately for India and Nepal using the prevailing wage rates and exchange rates in the two countries.[18]

The water provisioning value of the Deodar forest facing a Southeast direction varies between USD 90 and 175 per year to a household in India and between USD 68 and 131 per year to a household in Nepal in comparison with Chir Pine facing the same direction. The values of other forests facing different directions can be interpreted similarly. Depending on the forest type, the direction and models, these values vary between USD 30.9 and 318 in India and between USD 23 and 238 in Nepal. Broadly, it is possible to say that Native Broadleaf facing a westerly and south-westerly direction provide very high water provisioning or income savings while Mixed Forest facing west yield the lowest savings to households.

3.7 Conclusion

The provision and sustainable management of safe water to all by 2030 constitutes goal 6 of the Sustainable Development Agenda of the United Nations. In the plains, this could be met by investments in water storage or water purification strategies but, in remote mountainous regions, it has to be dealt with differently. Our study focuses on the forest-water link in the remote KSL areas of the Himalayas and finds a clear link between the forest type and water collection cost which is expressed in the number of minutes it takes to walk to the water source and the collection time. It also finds people whose villages are surrounded by Chir Pine forest to be more water stressed and to spend more time on collecting water and more money on storage and other devices compared to those whose villages are surrounded by Broadleaf, Deodar or Broadleaf Deodar Mixed Pine Forests. The water provisioning value of these forests varies between USD 30.9 and 318 in India and between USD 23 and 238 in Nepal per year per household when compared with Chir Pine. Research shows Conifer Forest to have higher evapotranspiration than Broadleaved Forest and for planted stands to have higher evapotranspiration than natural stands (Cui et al., 2012; Hisada et al., 2012). This could explain the results of the present study, which find Chir Pine areas to be

[18] The wage rates are INR 125 per day (8 hours) in India and NPR 150 per day in Nepal. The exchange rates used are 1USD = INR 67.7 and 1USD= NPR 108.

more water stressed than other forest areas. Anecdotal evidence in the Himalayan regions has it that Chir Pine forests in the longer run dry up the springs (Negi, 2004). Our findings are thus in line with the outcomes of previous ecological studies. The results underscore the need for a different approach to solve the water scarcity and crisis in the mountain regions, for example, the preservation and promotion of different species of forest such as Broadleaf or the adoption of mixed species plantations in Chir Pine areas.

Among the limitations of a study like ours are the limited number of households from three watersheds on which it is based; the one-time cross-section survey from which the data is derived; and reliance on recall for many responses. These could be sources of bias in the results derived. Nevertheless, the results are firm on one thing: Chir Pine areas are more water stressed than other Broadleaf Forest areas.

4 Ensuring Water Availability to Water Users through Incentive Payment for Ecosystem Services Scheme in a Small Hilly Town of Nepal

4.1 Introduction

Many hilly towns of Nepal have inadequate water in terms of coverage, quantity and quality (ADB, 2011). The Government of Nepal (GoN) has initiated the Small Towns[19] Water Supply and Sanitation Project with the support of the Asian Development Bank (ADB) from 2001 to enhance the water and sanitation services in these small towns. The project has so far supported 50 small towns between 2001 and 2015 and has planned a third phase of the project to support an additional 26 small towns. The project aims to provide inclusive and sustainable water and sanitation service delivery of medium/high standards and strengthen sector policy and institutional capacity (ADB, 2011). The project is designed in such a way as to operate on a cost-sharing basis between the participating water users, the central government, and the local government (Government of Nepal, 2015). However, it ignores the important role that the community living close to the water sources can play in maintaining the quality and quantity of the available drinking water. In addition, the Initial Environmental Examination (IEE) report of the project, which is supposed to recommend mitigation measures for damages caused by the project, focuses mainly on the safety measures in place for workers and capacity-building of water users (Department of Water Supply and Sewerage, 2014), thus overlooking the watershed communities of the areas from which the town would receive its supply of water. However, as the water quality depends on the activities of the members of the watershed communities, such indifference towards them may lead to conflicts between the community and those in charge of the project threatening in turn the sustainability of the drinking water project.

Indubitably, the participation of the communities living close to water sources is crucial to maintaining the watershed condition. The success of community-based forestry in improving forest resources while ensuring the welfare of local communities is the best example of local community involvement in resource management in Nepal (Niraula et al., 2013; Rai, Shyamsundar, Bhatta, and Nepal, 2016). However, motivating communities living close to the resource in question to implement activities that would provide benefits to other communities is not simple as it may entail costs to the former. These costs may be in terms of a reduction in their reliance on the resource and/or a change in their livelihood activities. Thus, involvement of the local community is only possible if incentives can be provided to resource managers to manage their resource in such a way as to provide specific ecosystem services. This policy instrument is called payment for ecosystem services (PES), which can supplement the existing resource management strategies to address environmental issues (Engel, Pagiola and Wunder, 2008). Wunder's seminal definition of PES describes it as a voluntary transaction, where at least one buyer buys a defined ecosystem service or services from at least one servicer provider, if and only if the provider ensures the flow of the traded ecosystem service(s) (Wunder, 2005).

In many developing countries including Nepal, natural resources are managed and controlled by local communities. Therefore, any payment for maintaining those services should be made to the communities. However, most existing PES schemes are based on payment made to individuals while most of them are input based (Asquith, Vargas, and Wunder, 2008; Echavarria et al., 2004; To et al., 2012) . Schemes in which payments are made to individuals are simple. Designing a scheme where consumers of ecosystem services make payment to the communities who manage the resource would undoubtedly be more complex.

[19] Small towns are defined as towns that have (i) a population of 5,000 to 40,000, and (ii) perennial access to roads, grid power, telecommunications, etc., i.e., potential for growth.

Developing a volunteer market, particularly for freely available services, without external pressure is almost not possible. This has meant that while there are very few PES schemes following the Coasean concepts of market, most of them are paid for by either the state or public projects (Schomers and Matzdorf, 2013). Considering this, we use the term Incentive Payment for Ecosystem Services (IPES) instead of PES in this study. In addressing these complexities, our study aims at enriching the existing literature on PES, particularly on payments made to communities and payments made by users, by discussing the appropriate basis for payment and the appropriate institutional framework for implementation.

4.1.1 Baitadi Drinking Water Project

The study was based on the Drinking water and Sanitation Project of the Dasharath Chand Municipality of Baitadi, Nepal (see Figure 1.1). Ghattigadh/Madhkhola is the source of the proposed drinking water project, which is 5 km from the project area. Madhkhola lies in the Gwallek forest area, which covers eight Village Development Committees (VDCs). For the drinking water project, the water from Madhkhola will first be collected in the storage reservoir by gravity flow, a part of which would then be pumped to the service reservoir of the two sub-schemes at a higher elevation and the rest supplied through gravity to a lower elevation.

Currently, municipal households face acute water scarcity. In the year 2010, the water supply in the town was 155m^3/day against a demand of 692m^3/day (Department of Water Supply and Sewerage, 2014). The focus group discussions with municipal residents revealed that they are now able to collect water from public taps, each such tap shared by 8-10 households. Not only is the existing water supply not regular, it mostly comes only once a day and sometimes even once in two days without a properly instituted schedule to water users to inform them when water would be available, with the water quantity per household not exceeding 100 liters of water. The user committee keeps the water clean by treating the service reservoir during the rainy season while some households use either filters or tablets to purify water that they personally use. During the dry season, most households fetch water from old water sources which can be reached within one hour of walking (one way) while some buy water from a tanker during the dry season which costs up to NPR 2.5/liter.

The proposed PES scheme is to encourage the watershed community to protect the water source so that the current level of water quantity and quality will be maintained and to discourage them against protesting about water diversion in future. Although the project has plans to install a purification system, the proposed IPES scheme may not only contribute to reduce the cost of purification but would also enhance the relationship between water users and the watershed community.

4.2 Methods

This study adopts the following steps for the purpose of designing the PES scheme (Sattler and Matzdorf, 2013): (i) Identification of issues, (ii) Survey implementation, (iii) Data analysis, and (iv) Development of institution.

FGDs identified the issues related to drinking water and the watershed area. Survey data from 150 households in the Gwallek VDC, which is 26% of the total households living close to the water source, were used to understand the issues relating to the watershed community. In addition, 262 water users were interviewed from Baitadi town to elicit their preferences regarding the drinking water project. Chapter 1 gives the details.

Discrete choice experiment

A discrete choice experiment (DCE) was carried out to determine the preferences of the municipal drinking water users of the Dasharath Chand Municipality considering that water users may want more from the drinking water project than simply having sufficient quantities of water. The DCE helps estimate the marginal value of each attribute included in the experiment while also allowing a trade-off among them (Hanley, Wright, and Adamowicz, 1998; Rai and Scarborough, 2013). DCE is based on the neoclassical economic theory that consumers maximize utility selecting the best alternative from the set of alternatives presented to them. Therefore, in a DCE survey, respondents are given multiple-choice sets with different alternatives. A DCE assumes that respondents select the alternative based on the levels of attributes rather than the alternative *per se* (Lancaster, 1966). In other word, utility is the function of attributes included in the DCE survey.

Conceptually, household *i* obtains utility (U_{ij}) by choosing an alternative *j*, based on the attributes of the good under consideration. We examine the determinants of this choice by first recognizing that utility can be decomposed into observable (α) and random (ε) components:

$$U_{ij} = \alpha_{ij} + \varepsilon_{ij} \tag{4.1}$$

In this study, the important attributes of the drinking water supply are the quantity, quality and water distribution system. The final attribute is water source management fee (Table 4.1). We identified these attributes based on focus group discussions with local communities, which were verified in discussions with local experts.

After identifying the attributes, we identified their status and feasible changes with focus group participants (Table 4.1). These were again verified in discussions with local experts working in the fields of watershed, forestry, drinking water and agriculture and by means of secondary information (Rai et al., 2015; Rai and Scarborough, 2013).

After selecting the attributes and their level, the next step is to create scenarios. We used a D-efficient design to create 16 choice scenarios, which were divided into four blocks (Scarpa and Rose, 2008). We choose the D-efficient designs because choice responses are analyzed using logistic specifications which reduce the cost of the experiment by reducing the size of the experiment (Bliemer, Rose, and Hensher, 2009; Kerr and Sharp, 2010; Scarpa and Rose, 2008). Accordingly, each respondent received four scenarios with each scenario offering three alternatives— status quo, alternative 1, and alternative 2. The two alternatives in question are policy outcomes after the implementation of the watershed management program. The choice sets were visualized using pictures and bar diagrams so that the respondents could understand the choice task easily (Rai and Scarborough, 2013).

Table 4.1: **Selected attributes and their levels**

Attributes	Description	Levels
Water quantity	This is defined as availability of water during the dry season on private tap since, after the implementation of the new project, every household will be connected to the pipe-borne water supply system. Currently, there are no private taps and households get water from the public tap that is shared by 8-10 households.	• 25 liter/person/day* • 50 liter/person/day • 75 liter/person/day • 100 liter/person/day
Water quality	The quality of drinking water from the new source. The water is currently drinkable but only after a normal treatment such as boil and filter or treated using tablet. The new drinking water project may supply better quality of water after treatment in the treatment plant but the maintenance of the water quality requires eco-friendly activities upstream.	• Drinkable after either filter or using tablet* • Drinkable from the tap
Water distribution system	The schedule of water distribution to household. Currently, it is irregular.	• Irregular* • Once a day • Twice a day
Water source management fee	A new fee for water source management, which is additional to the monthly water fee. This is expressed as the monthly charge for water source protection and management#.	• NPR. 0/month* • NPR. 10/month • NPR. 25/month • NPR. 50/month • NPR. 75/month

Note: * denotes levels used in status quo/current situation.

4.3 Data Analysis

We analyze the data from the upstream survey using simple statistical tools while the choice responses of municipal water users are analyzed using the random parameter logit (RPL) model. This is mainly due to the fact that RPL relaxes the constraints of an assumption that alternatives are independent and irrelevant, which is the strong assumption of the multinomial logit (MNL) model that is usually deployed (Train, 1998). The RPL model can be expressed as;

$$V_{ij} = ASC + \beta x_{ij} + \eta x_i + \gamma s_i + \epsilon_i \tag{4.2}$$

where, V_{ij} is the indirect utility obtained by the i^{th} household from the jth alternative, *x* is a vector of attributes; β is a vector of coefficients of attributes, and η is a vector of individual deviations of random attributes. We

The water user committee has not finalized the monthly water tariff. During focus group discussion they said that it might be between NPR 500 and 1,000 per month based on the water volume used.

introduce a vector of socio-economic variables (s_i) to control heterogeneity. The coefficient (γ) reflects these effects. An alternative specific constant (ASC) explains the systematic variation between the status-quo and proposed alternatives that cannot be captured by the attributes. These constants are coded as *1* for policy alternatives and *0* for the status-quo.

We estimate the implicit price (IP) or marginal WTP of each attribute using the following equation;

$$IP_k = -\beta_k/(\beta_c + \sigma_c \times \varphi_c) \tag{4.3}$$

where, β_k and β_c are coefficients of attribute *k* and cost respectively, σ_c is the estimated standard error of the cost attribute, and φ_c is a draw from the triangular distribution of the cost attribute (Hensher, Rose, and Greene, 2005).

The next step is to estimate the average household WTP for the improved situation. The change in household welfare from implementing the improved drinking water supply program can be estimated using the following formula:

$$WTP_{hh} = \frac{1}{\bar{\beta}_c} [\ln (\Sigma_{j\in R} \exp (V_0)) - \ln \Sigma_{j\in R} \exp (V_1))] \tag{4.4}$$

where, WTP_{hh} is the household willingness to pay for the change in utility moving from the current situation to a new scenario. V_0 is utility in the current situation (levels of attributes are listed in Table 4.1) and V_1 is utility in the new situation. Total WTP is the aggregation of WTP for the beneficiary households, which is the total fund available locally for the given water source protection program. This can be estimated as follows:

$$Total\ WTP = WTP_{hh} \times population \times p \tag{4.5}$$

where, *p* is the proportion of respondents with a positive WTP.

4.4 Development of Institution

An institution is required for the effective and efficient implementation of the PES scheme (Fauzi and Anna, 2013). A stakeholder analysis would complement the existing approaches to developing local institutions for natural resource management (Grimble and Chan, 1995). Thus, we organized a half-day interaction workshop after analyzing data from the household survey. Thirty-six people participated in the workshop representing the watershed community, the municipal water users, the District Federation of Nepalese Chamber of Commerce and Industries (DFNCCI), the NGOs, the media, and officials of local bodies and government agencies. The objective of this workshop was to share the results from the household survey with the participants in order to elicit feedback, to develop a local institution to implement IPES, and to develop the fund mobilization mechanism. We asked the participants to identify stakeholders for the proposed IPES mechanism, to categorize stakeholders using power-interest quadrants, and to identify the institutional framework required for both implementation of IPES and fund flow mechanism.

An institution is necessary for several reasons. First, by definition, there will be a regular flow of ecosystem services, which would require funds for maintenance (Wunder, 2005). This fund is assumed to be invested in activities that would contribute to the maintenance of the watershed for ensuring watershed services. This also requires monitoring whether the money is spent on the identified activities and whether payments for output are based on an assessment of the services performed under the scheme and also if services and benefits are on inclusive basis. Secondly, although PES is considered a voluntary scheme, there is need for an agreement between the service providers and users to ensure that the scheme is implemented effectively and equitably.

4.5 Results

4.5.1 Sample characteristics

Table 4.2 reports the sample characteristics of both the watershed community and the Dasharath Chand Municipality. Female respondents comprise 56% of the sample in the watershed community and 50% of the sample in the Dasharath Chand Municipality. The average household size in the two areas, which is 6.29 and 6.28 in the watershed community and the Municipality respectively, is larger than the average size of the household of the district population, which is 5.55 (Central Bureau of Statistics, 2014). The distance to road indicates the access to road for households within the Municipality. The standard deviation of landholding size suggests the gap between smallholder farmers and large farm-holders. The ratio of irrigated land to rain-fed land indicates water availability in the two areas.

In the watershed community, educational attainments are not very high. Roughly one third (32%) of respondents are illiterate while 12% have an informal education; only 4% have attended university. Agriculture is the main occupation of the area with over three-fourth (77%) of respondents identifying agriculture as the main occupation of their household. The rest work for the government (8%) or a non-government organization (5%) while 5% are engaged in traditional occupations.

Table 4.2: **Sample characteristics (standard deviation in parentheses not followed by %)**

Variable	Watershed community	Dasharath Chand Municipality
Age (Years)	46.18 (14.66)	42.71 (14.38)
Female	84 (56%)	131 (50%)
Family size	6.90 (3.15)	6.28 (2.91)
Distance to road (minutes)	13.35 (10.44)	7.88 (11.43)
Irrigated land (sq meter)	148 (412)	5.82 (94.33)
Rainfed land (sq meter)	2,525 (1,696)	2,833 (5,599)
Other land (sq meter)	3.41 (3.66)	390 (286)
Sample size	150	262

Source: Field Survey, 2016

While educational attainments are better in the municipal area than in the watershed area, 11% of the respondents are still illiterate and 17% claim an informal education while only 7% have attended university. Agriculture is the major occupation of 40% of the municipal households followed by business (24%), government service (24%), and wage labor (10%). It is clear from the above that, with urbanization, occupations of households are shifting from farm-based to off-farm activities.

4.5.2 Watershed community

Mixed forest is the dominant forest type in the watershed, followed by broadleaved forest and mixed conifer forest. Sanitation conditions in the area seem satisfactory since 94% of households have a toilet linked with a septic tank while the rest (6%) have pit toilets. However, as brought to light during focus group discussions, traditions associated with menstruation prohibit the use by women of toilets used by other members of the family, which compel them to use open areas for defecation while sanitary pads are disposed in water bodies.

The results reveal that two-third (62%) of households practice the agro-forestry system as evident from the trees found on their agricultural land. Paddy, Maize, Millet, Wheat, and Lentil are the most common agriculture crops (see Table 4.3). As evident from Table 4.3, most of the farmers practice organic farming with very few using chemical fertilizer. The use of pesticides is seen only in paddy fields. However, discussions with focus group participants point to a growing trend in the use of chemical fertilizer.

Table 4.3: **No of farmers cultivating crops and using chemical fertilizer and pesticides**

Crops	No of farmers	Chemical fertilizer	Pesticides
Paddy	20	6 (30%)	1 (5%)
Maize	123	4 (3%)	0
Wheat	124	4 (3%)	0
Lentil	116	1 (1%)	0

Source: Field Survey, 2016

Cattle, coat and buffalo constitute the major livestock in the area with 96% (144) of the sample households owning livestock. The average household livestock holding is 3.4 livestock units. According to the results, 90% of households have both cattle and goat while 6% have only cattle. The forest is the area of choice for grazing of cattle and goat with a household, on average, grazing cattle for 32 days/year and goats for 103 days/year. For the rest of the year, the animals are stall-fed. The average annual expense for fodder and other feed is NPR 6,387/household for cattle and NPR 481/household for goat. Assuming that this is the cost of stall-feeding when animals are not taken to the nearby forest, per household additional annual stall feeding cost would be NPR 136/household for goat and NPR 560/household for cattle. This cost would impose an additional cost of NPR 365,640 per year on the watershed community if that cost were to be borne by the community in the event grazing is curtailed or restricted under the proposed drinking water supply scheme for the municipal water users. Nevertheless, the management of grazing may reverse the observable trend of forest degradation, which would ultimately contribute to the purification of water (Vincent et al., 2015).

The survey information indicates that the watershed condition is degrading due to the decreasing availability of watershed services in the past five years for the watershed community (see Table 4.4). In the watershed, most of the respondents were of the opinion that the quantity of water is decreasing though they were not sure about the change in the quality of the drinking water.

The survey information reveals that watershed households mostly collect water either from a public tap or public well (see Table 4.5). The average distance to the *Naula* (public well) is 17.34 minutes with 73 (or 27%) of the sample households collecting water from the *Naula*. The average distance to the public tap, on the other hand, is 4.02 minutes. In the dry season, 105 (or 70%) households collect water from the public tap while the number is 102 (or 68%) in the other season. Furthermore, households collect more water from the *Naula* in the dry season indicating that the *Naula* is the alternative source to fulfill their requirements in case of water shortage. The results from the household survey indicate that the average daily household demand for water is 312 liters per day.

Focus group participants clearly stated that they would need support to maintain and improve the existing conditions of the watershed. Among such activities would be the construction of public toilets with waste disposal facilities; management of drinking water distribution; promotion of off-season vegetable farming; collection of non-timber forest products; and management of grazing. The promotion of off-seasonal vegetables based on organic farming may reduce the risk of chemical fertilizer and pesticide use while improving household incomes of the watershed community.

Table 4.4: **Trends in ecosystem services compared to last 5 years**

Services	Response	Decreasing (↓)	No change (↔)	Increasing (↑)
Drinking water (quantity)	150	111 (74%)	12 (8)	27 (18%)
Drinking water (quality)	150	14 (9%)	134 (90%)	2 (1%)
Irrigation water	50	46 (92%)	4 (8%)	-
Firewood availability	147	110 (75%)	8 (5%)	29 (20%)
Fodder availability	150	112 (75%)	9 (6%)	29 (19%)
Leaf litter availability	149	107 (72%)	12 (8%)	30 (20%)
Timber availability	95	64 (67%)	5 (5%)	26 (27%)
NTFP availability	14	3 (21%)	11 (79%)	-
Forest condition	138	16 (11%)	118 (86%)	4 (3%)
Paddy productivity	25	25 (100%)	-	-
Maize productivity	148	143 (97%)	5 (3%)	-
Millet productivity	6	6 (100%)	-	-
Wheat productivity	149	144 (97%)	5 (3%)	
Livestock holding	148	129 (87%)	16 (11%)	3 (2%)
Forest cover (Conifer)	134	94 (70%)	9 (7%)	31 (23%)
Forest cover (Broadleaved)	148	101 (68%)	14 (9%)	33 (22%)
Cultivated area	139	95 (68%)	43 (31%)	1 (1%)
Barren area	136	15 (11%)	39 (29%)	82 (60%)

Source: Field Survey, 2016

Table 4.5: **Water availability and collection time of water for household water use (standard deviation in parentheses)**

Description	Dry season	Other season
Number of households collecting water from public tap	105	102
Collection time (excluding time taken for walking) in minutes per trip at public tap	19.25 (16.62)	11.82 (11.00)
Number of households collecting water from public well (*Naula*)	85	28
Collection time (excluding time taken for walking) in minutes per trip at *Naula*	14.94 (17.12)	8.66 (8.15)

Source: Field Survey, 2016

4.5.3 Municipal water users

The results of the household survey show that 60% (156) of the municipal households have access to pipe-borne water while 28% (or 72) collect water from the *Naula* and 12% (or 32) from a public tap. With regard to ownership of the water source, only 8% (or 21) households have access to a private water source. The sampled households unanimously indicated that there is an acute shortage of water in the municipal area to cope with which 60% (or 156) of the households use an alternative water source and 8% (or 22) of the households buy water from the market while the rest adjust their needs in line with water availability. The survey results also show that 42% (or 110) of the total households treat the water before drinking with the majority (at 33%) boiling the water, 8% using a filter, and about 1% using tablets to purify the water. 96% (or 252) of the respondents are in favor of the idea of supporting the watershed community in order to protect the water source and are willing to contribute towards that purpose.

We analyze the choice responses with the Multinomial Logit Model (MNL) and the RPL model (see Table 4.6) which show both models to produce similar results though RPL shows slight improvement in terms of the pseudo R2. This study therefore discusses the results of RPL because MNL requires a restrictive assumption of identically and independently distributed error terms (McFadden, 1974). The results of the RPL model reported is in 1,000 replications for simulated probabilities with Halton sequences used for simulations. The model is statistically significant with Chi-squared statistics of 1,227.41 where watershed management fee is the random parameter

Table 4.6: **Results of MNL and RPL**

Variables	MNL	RPL
Attributes		
Quantity	4.17e-2 (1.98e-2)**	4.09e-2 (1.94e-2)**
Distribution 1	4.46 (2.68)*	4.51(2.67)*
Distribution 2	4.00 (2.61)	4.03 (2.61)
Quality	0.876 (0.315)***	0.880 (0.319)***
Fee	-2.28e-2 (8.02e-3)***	-2.25e-2 (7.94e-3)***
Interaction of attributes and socio-economic variables		
Male × quality	-5.98e-2 (0.179)	-5.98e-3 (0.18)
Male × distribution 1	0.351 (0.194)*	0.353 0.195)
Male × fee	8.43e-3 (3.40e-3)**	8.49e-3 (3.47e-3)**
Family size × quantity	-1.47e-3 (1.56e-3)	-1.48e-3 (1.58e-3)
Family size × quality	-1.58e-2 (3.14e-2)	-1.61e-2 (3.17e-2)
Family size × fee	3.34e-4 (6.25e-4)	3.28e-4 (6.31e-4)
Income × quantity	-1.51e-2 (7.23e-3)**	-1.49e-2 (7.22e-3)**
Incomex quality	4.76e-2 (5.16e-2)	4.86e-2 (5.19e-2)
Income × fee	8.47e-3 (2.93e-3)***	8.39e-3 (2.91e-3)***
Income × distribution 1	0.927 (1.22)	0.922 (1.23)
Income × distribution 2	0.686 (1.20)	0.685 (1.20)
Urban residence × quantity	-1.08e-2 (7.74e-3)	-1.09e-2 (7.82e-3)
Urban location × quality	0.158 (0.178)	0.161 (0.180)
ASC	-0.422 (9.22e-2)***	-0.425 (9.24e-2)***
Standard deviation of random parameter		
Fee (T)	-	1.12e-2 (3.97e-3)***
Log likelihood	-537.57	-537.63
Pseudo R^2	0.263	0.264

Note: *, ** and *** refer to significance at 10%, 5% and 1% level respectively. T is the triangular distribution of random attribute (fee).

having a triangular distribution and other attributes are the non-random parameter. The use of the triangular distribution of the cost attribute (i.e., watershed management fee) is mainly to ensure the finite moments for the distribution of WTP (Daly, Hess, and Train, 2012). The model also includes selected socio-economic variables interacted with the attributes, the selection of which variables mainly dependent on their relationship with drinking water use and watershed management (Rai et al., 2016).

As expected, the results of the RPL model indicate that water quantity and water quality are significant with a positive sign while the watershed management fee (fee) is significant with a negative attribute. Drinking water distribution system, Distribution 1 and Distribution 2 are coded as dummy for once a day and twice a day levels respectively. This shows Distribution 1 to be significant at the 10% level of significance only while Distribution 2 is insignificant. This may be because households, who face water scarcity, concentrate more on water quantity and quality than the distribution system.

The significant and negative sign of ASC indicates that other attributes, which are not included in the experiment, have a significant impact on the selection of alternatives against the current situation. The interaction between the selected socio-economic variables and attributes indicates that male respondents are more likely to select alternatives carrying a higher watershed management fee compared to their female counterparts. This result is in line with literature that show men to have higher WTP compared to women (Dong et al., 2003).

The results also indicate that households having a higher income show less preference for drinking water quantity instead selecting alternatives with a high fee. This may be because households belonging to a higher income bracket have private water sources, thus revealing less interest in water quality compared to their neighbours falling into lower household income brackets. This aspect however needs further investigation in order to see whether there is a correlation between the availability of private water source and household income or not. Similarly, households belonging to a higher income bracket frequently prefer alternatives with high watershed management fee compared to households coming under lower income categories. Again, existing literature confirms the positive association between household income and WTP for environmental services (Rai et al., 2015). However, the interaction term of household income and water quality is not significant.

4.6 Estimating WTP of Municipal Water Users

We estimate the implicit price of each attribute using equation 4.3. The estimated value indicates that water users would like to pay an additional NPR 1.90/month for an increase in the supply of one liter of water per person per day (see Table 4.7). This means that they are willing to pay NPR 1.90 for 188 liters of water (based on an average family size of 6.3). This is far less than the price that municipal water users, who buy tanker water during the dry season, currently pay for tanker water which comes to NPR 2.5/liter. Our results indicate that households would like to pay a water source management fee of NPR 40.88 per month if the available tap water is drinkable. This amount is reasonable compared to what they are paying currently for tanker water.

Table 4.7: **Implicit price and confidence intervals of attributes (NPR/month)**

Attributes	Implicit price (confident interval)
Water quantity	1.90 (1.22-3.57)
Water quality	40.88 (26.27-76.86)

We estimate the average household WTP for the two hypothetical improved scenarios using equations 2 and 4. The first scenario is to double the water availability from the current situation, i.e., increase from 25 liter/person/day to 50 liter/person/day while improving the water quality so that the tap water becomes drinkable without treatment. The second scenario is to simply double water availability without improving water quality. The household level estimated WTPhh for the first scenario is NPR 69/month while it is NPR 28/month for the second scenario. The total monthly WTP (equation 5) of the total water users (at 1,473 households) is NPR 97,980 and NPR 40,173 for the first and second scenarios, respectively.

4.7 Stakeholders Mapping

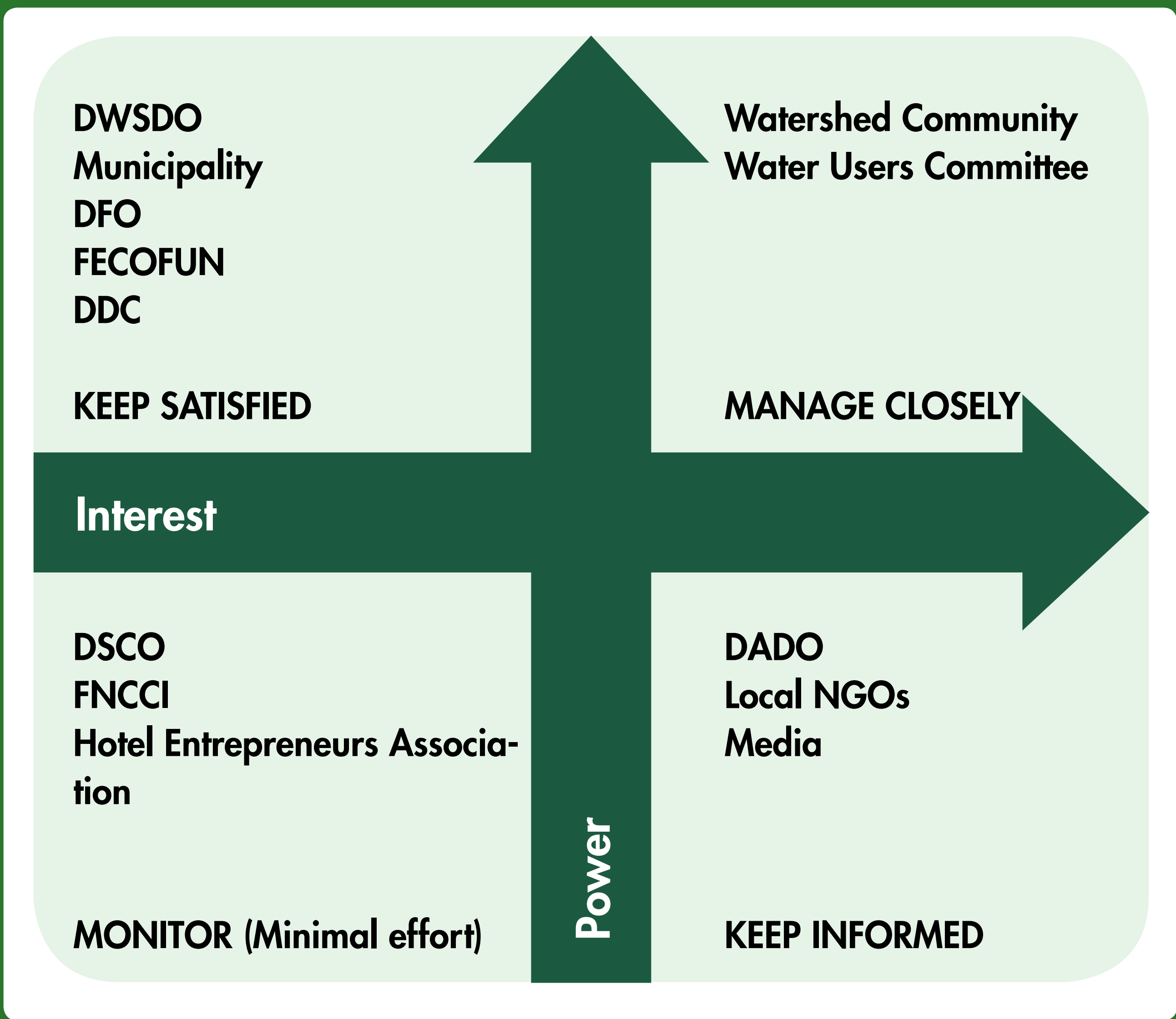
We identified a total of 13 stakeholders which included the watershed community (Gwallek), water users' committee, District Development Committee (DDC), Dasharath Chand Municipality, Hotel Entrepreneurs Association, Federation of Nepalese Chambers of Commerce and Industry (FNCCI), District Forest Office, District Soil Conservation Office

(DSCO), District Agriculture and Development Office (DADO), Drinking Water and Sanitation Division Office (DWSDO), NGOs, Federation of Community Forest User Groups Nepal (FECOFUN), political parties and the media. The water users' committee is responsible for financing the IPES scheme since they are responsible for the supply of safe drinking water.

We categorize the stakeholders using a matrix that takes into consideration the stakeholders' power with regard to and interest in the IPES scheme (Brugha and Varvasovszky, 2000). The participants at the workshop were tasked with allocating stakeholders to appropriate quadrants based on the latter's power and interest and it is important to note that the decisions regarding allocations were unanimous. Figure 4.1 reports the list of stakeholders in each quadrant based on the power-interest matrix. The ecosystem service providers and users are in the first quadrant. These stakeholders need close interactions and regular dialogue since they are the major actors in the IPES scheme. On the other hand, the stakeholders in the second quadrant have high power but low interest in the scheme. Government offices, local bodies and the federation of forest user groups are in this quadrant because they are powerful with regard to regulating natural and financial resources. Thus, during the implementation of the IPES scheme, these stakeholders would have to be consulted regularly and treated as a group that can be relied on to implement the scheme.

The third quadrant includes stakeholders who have little interest and power, such as DSCO and FNCCI. However, these stakeholders could play a crucial role if a conflict were to arise over the sharing of the resource. Hence, they

Figure 4.1: **List of stakeholders in the power-interest quadrant**



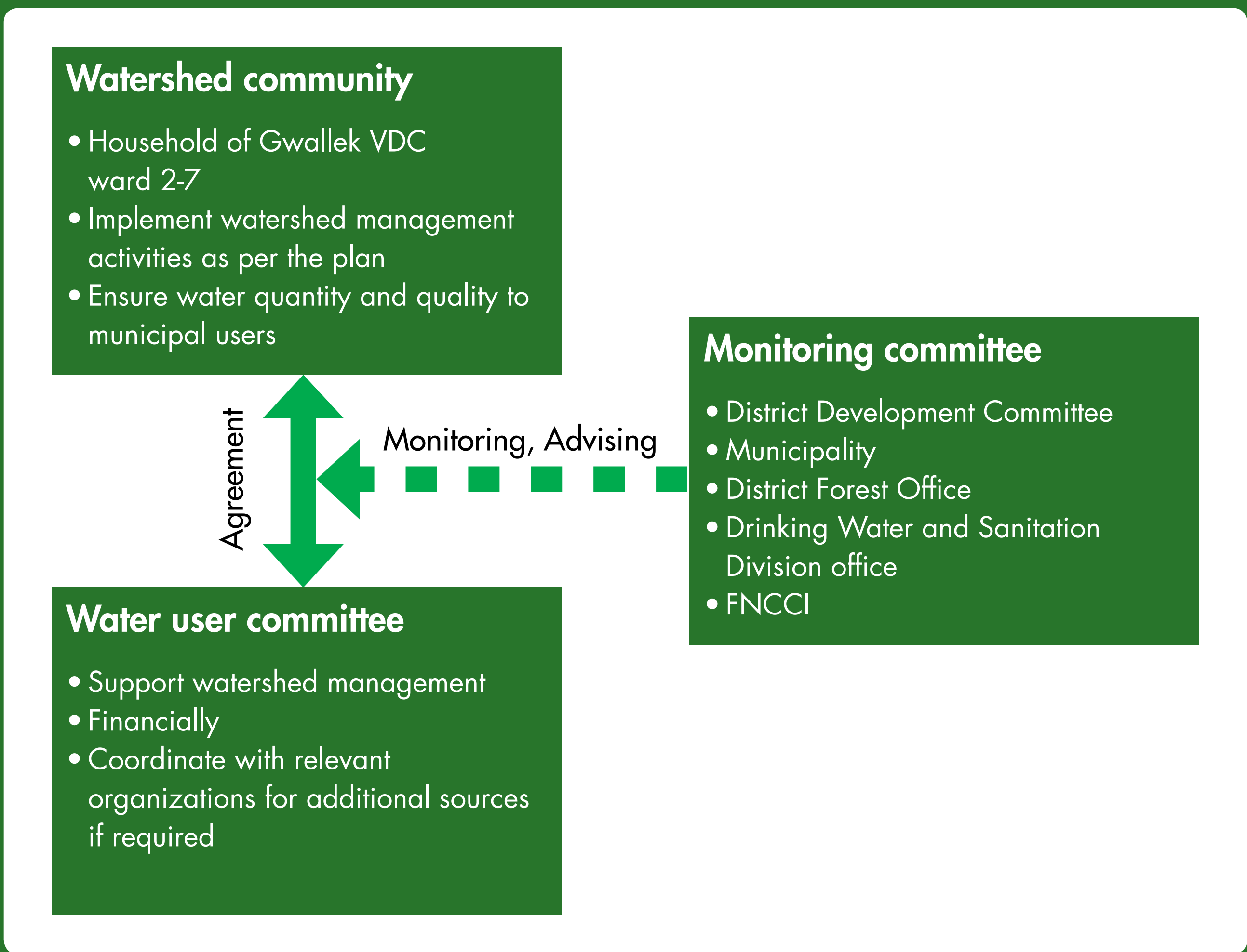
too need to be monitored. In the fourth quadrant were grouped DADO, media and local NGOs who may profess more interest in the scheme but have less power. However, they too can play a crucial role in conflict management and can play a crucial role when it comes to speeding up the program, as they would have to be kept informed about and updated on the implementation of IPES scheme.

4.8 Institution for Implementing IPES

Establishment of a new institution for the implementation of IPES may increase the cost of the scheme as this not only requires successful coordination among stakeholders but entails monitoring and verification costs (Brner and Wunder, 2008). In order to reduce such administrative costs, an attempt has been made to establish a new set-up in coordination with existing institutions (Figure 4.2). For instance, service providers, who are the implementers of activities in the watershed to ensure the flow of targeted ecosystem services, are represented by their respective community forest user groups or farmer groups. Use of such existing institutions would enable the community avoid the additional administrative cost of registering a new organization, opening a bank account, separate auditing, and in organizing a village assembly. Similarly, service consumers, who provide funds for implementing watershed management activities, are represented by the existing Water User Committee. This committee is responsible for the construction and management of the drinking water project.

Similarly, a monitoring committee can be set up involving those institutions already involved in the drinking water project and watershed management activities. This approach helps to save the monitoring and verification costs of IPES activities. Although linking up with an existing institution may require modification in the regular plan of the institution or body in question, it would be less costly than setting up a new institution.

Figure 4.2: **Proposed institutional set-up for implementing IPES scheme**



Another issue discussed during the stakeholders' workshop was developing a procedure for implementing an IPES mechanism. This involves an agreement between the service providers and consumers on how to transfer funds and monitor the activities that help maintain and improve water quality. The watershed community, for instance, would require a registered body to receive and transfer funds. At the discussion, a suggestion was made that they would be represented by either the community forest user group or the farmer group registered in the DADO office. The upstream community will prepare an annual plan, which will be submitted to the Water User Committee of the Municipality. The user committee will release funds based on the annual plan while the monitoring committee will have oversight over activities undertaken under the approved plan. The water user committee will, in turn, add an agreed-upon watershed management fee by the water users to the annual fund as well as the monthly tariff for drinking water.

An important point that was discussed during the stakeholder meeting was the basis for incentive payment to the watershed community considering the ambiguous relationship between land use practices and ecosystem services. Nevertheless, water users agreed to pay for the identified activities regardless of the quality and quantity of water available to them. This is mainly because the water user committee was confident that providing monetary support to the watershed community would incentivize them to protect the water sources and discourage villagers from acting against water diversion from the watershed to the Municipality. However, the stakeholder meeting also proposed that the watershed community should strictly follow the implementation of the identified activities and not perform any activities that would be detrimental to the water supply.

4.9 Discussion

The results of our study indicate that funds for managing the watershed for maintaining the supply of drinking water can be raised locally. The estimated annual fund flow from water users to the watershed community is between NPR 482,076 and NPR 1,175,760. The estimated funds required for the activities that would help maintain and improve water quality in the watershed is NPR 1,175,640[20]. Out of the identified activities, some activities like grazing management and water distribution to upstream households require annual input, but other activities such as construction of toilets and off-season vegetable farming may need only a one-time payment. Given the proximity to the urban center, the upstream villagers can earn extra income from off-season vegetable farming once they get the start-up inputs and resources and sustain the activity without further support thereafter. This suggests that the IPES is financially and socially feasible in the study area and that, with additional support from the regular development activities of the district development committees and other government offices that are linked to the drinking water project, the efficacy of the IPES scheme will be ensured and enhanced. Such a scheme may adopt both the Coasean and Pigouvian concepts of IPES in order to address the inadequacy of funds in developing economies (Schomers and Matzdorf, 2013).

Water users have preferences with regard to the quantity and quality of water from the ongoing drinking water project. Similar preferences with regard to watershed services have been observed in other parts of Nepal (Rai et al., 2015; Rai et al., 2016). This underscores the important role that the watershed community can play in maintaining the flow and quantity of water. However, the relationship between land use and water availability remains inconclusive (Mátyás and Sun, 2014). Inadequate understanding of the quantity of ecosystem service flow due to specific activities may lower the efficacy of the IPES scheme since WTP is determined by the quantity of ecosystem services. Moreover, the watershed community (service providers) has to modify their activities in order to maintain the watershed for the purpose of ensuring the flow of selected services (Rawlins and Westby, 2013). In this drinking water project, however, the watershed community shares excess water with the municipal water users and the intention of the proposed IPES is to maintain the ecosystem rather than its improvement.

In addition, it is also true that output-based schemes impose a higher risk on the watershed community (service provider) because the provision of services may be influenced by external factors such as climate (Norgaard, 2010). In order to avoid such risk, it was agreed that regardless of the quantity of water available to water users, the watershed community would be paid based on the activities identified by the stakeholders. These activities are related to sanitation and agricultural practices (public toilet construction, management of dead animals,

[20] Toilet construction NPR 200,000 (5 toilets @NPR 40,000), grazing management 365,640.00, water distribution (personnel) NPR 60,000 (NPR 5,000/month), off-season vegetable farming NPR 500,000, and NTFP management training NPR 50,000. These estimates are based on existing local practices as discussed during the interaction workshop.

and organic farming), and forest management (grazing regularization and the management of non-timber forest products). In general, determining the best land use practices for the sustainable flow of targeted ecosystem services based on traditional knowledge may help to build trust between the ecosystem service providers and the consumers (Raymond et al., 2010).

4.10 Conclusions

IPES may contribute to building up the confidence of water users in the sustainable management of the drinking water project in collaboration with the watershed community. In the study area, the implementation of an IPES mechanism in the still-under-construction drinking water project is socially acceptable and financially feasible. However, it requires a substantial start-up fund in addition to a rigorous process to design an appropriate IPES scheme. Therefore, our study proposes the integration of an IPES design process into the project design phase of drinking water supply projects. In the case of the Baitadi Drinking Water Project, although the proponent has carried out an Initial Environmental Examination, it mainly concentrates on project-level environmental assessment, disregarding the watershed management aspect. Improving the existing Initial Environmental Examination process by integrating into it an IPES scheme will bring down the cost while also reducing the risk of conflict between the water users and the upstream community during the implementation phase of the drinking water project.

This study also suggests that output-based incentive payments may put service providers, who are comparatively low-income and resource dependent, at a greater risk because of the uncertainty in relationship between land-use practices and production of ecosystem services. In order to reduce the risk to service providers and to make service consumers more confident regarding the service in question, it would be better to define the inputs or activities, to be carried out in the watershed, with the participation of all stakeholders. In addition, the activities can be revised annually, based on experience, in collaboration with all participating stakeholders. For this, we suggest a tripartite institution in which government agencies, local bodies and civil society organizations will come together to perform the function of a monitoring team in order to facilitate the IPES scheme.

5 Conclusion

The Kailash Sacred Landscape (KSL), a cultural landscape that spreads across an area of 31,000 km^2 and shared by three countries (China, India, and Nepal), provides multiple on-site and off-site services which are enjoyed by local, regional and national as well as global consumers. The KSL area is predominantly rural and both the lives and livelihoods of people in the area are strongly tied up with the surrounding ecosystems. The ecosystems provide the context, setting and boundaries for their daily lives and activities while their health, culture, religion/belief systems, and livelihoods are influenced by the ecosystem services they receive. Some ecosystem services, like cultural/religious services, also occur off-site and are enjoyed by people living nearby as well as in faraway places, both within and beyond the national boundaries.

Ecosystem valuation in mountain contexts, where a majority of the people live below or close to the poverty line and where non-monetized subsistence economies are dominant, is, however, not a straightforward task. It requires specific strategies to cope with the low level of income and education of mountain communities when collecting data, which underscores the point that both ecosystem services and their valuation are context specific. Hence, the study team in the present instance had to travel to the study sites for understanding the complexities of the context and life-styles of the people living in the KSL area before developing a methodology for valuing the ecosystem services attributable to this specific ecosystem.

The valuation of ecosystem services in rural contexts is further complicated by the fact that these services are not bought and sold in the markets and some such services, such as cultural services, anyway carry a subjective dimension. Thus, this study adopts a behavioral economic approach for the non-market valuation of ecosystem services while using statistical approaches to estimate the use (economic) value of the KSL ecosystem services. Pandey et al. (2016b) provide a framework for a non-economic approach for understanding the non-monetary value of cultural ecosystem services in the KSL area, which complements the economic approach to non-market valuation adopted in this study.

This study is an attempt to estimate the use value of the ecosystem services that people living in the area and visitors from outside the region derive. In this study, we consider three issues: valuation of cultural services, valuation of the water provisioning services of the forest ecosystem, and designing an Incentive Payment for Ecosystem Services (IPES) mechanism in one of the watersheds in KSL area, which is a pilot study to understand if such IPES mechanisms are desirable and feasible in some of the other watersheds.

Given the large area covered by KSL, which spreads across three countries, this study focused on three pilot sites in two countries for estimating the value of ecosystem services provided by them – Patal Bhuwaneshwar cave temple and Hat-Kalika temple in Uttrakhand (two watersheds – Hat-Kalika and Chandak-Aunla Ghat), India, and Gwallek (the Gwallek watershed and the Dasharath Chand Municipality) in Baitadi, Nepal. In the Patal Bhuwaneshwar cave temple, 202 visitors were surveyed for the purpose of obtaining visitor profiles, visitation frequency, costs for each visit, travel time and site quality. In the two watersheds – Hat-Kalika and Chandak-Aunla Ghat– 604 households were surveyed in order to understand the issues relating to drinking water, the state and types of forests in and around the villages, household characteristics, frequency of visits of local people to the nearby Hat-Kalika temple, and the monetary and time costs of such visits. In the Gwallek watershed, 350 households were surveyed to obtain complementary information from Nepal for purposes of a cross-country comparison of the value of the ecosystem services to the local residents in India and Nepal. In order to understand how desirable and feasible an IPES mechanism would be within a specific local context, 250 water user households were surveyed from the Dasharath Chand Municipality of Baitadi, Nepal.

We analyzed both qualitative as well as quantitative information in order to estimate the use value of ecosystem services in these pilot sites. We collected the qualitative information from 10 focus group discussions with service users from the pilot sites and from several key informant interviews with local NGO representatives, government officials, and researchers. The main findings of the study are summarized below.

5.1 Cultural Services

In order to estimate the use value of intangible cultural services, we use the travel cost method, which is one of the revealed preference approaches that has been widely used in the valuation of non-market environmental goods and services. We use the visitors' survey from Patal Bhuwaneshwar and rural household surveys from both countries. The sample of rural households includes households from the Gwallek watershed of Nepal and the Chandak-Aunla Ghat and Hat-Kalika watersheds of India who reported that at least one member had visited either the Hat-Kalika temple or Gwallek Kedar during the past five years.

Our estimates show that visitors come to the Patal Bhuwaneshwar cave temple from Uttarakhanda as well as from outside, mostly for religious purposes, at least twice every five years on average, spending around INR 9,000 (or USD 140) per trip. The use value (or consumer surplus in economic terms) of the cultural services that the visitor derive from each trip is close to INR 13,750 (or USD 210). For the rural households, the use value of cultural services that they derive from traveling to Hat-Kalika temple is INR 1,115 (or USD 17) and for traveling to Gwallek Kedar is NPR 3,413 (or USD 33). When aggregated, the value of the cultural services offered by the three sample sites comes close to NPR 300 million (or INR 187.5 million/USD 2.9 million) to the 7,900 annual visitors who come to the Patal Bhuwaneshwar cave temple each year and for the 9,000 households from the three watersheds for whom there is a 50% probability of visiting one of the three sites at least four times per year.

Since we do not have information on the total number of visitors to the major cultural sites of the KSL area, we do not attempt to estimate the use value of cultural services to all the visitors to the KSL cultural sites. Instead, we estimate the use value of cultural services to the local residents who visit the local cultural sites more frequently extrapolating from the sample information from pilot sites. Based on the sample information, our estimate suggests that the use value of the cultural services from the KSL area to the 200,000 households comes to around NPR 2.35 billion (or INR 1.47 billion/USD 22.6 million).

5.2 Water Provisioning Services of Forests

We studied the forest-water link in these remote areas of KSL having limited or no market for packaged water and found a clear link between the forest type and the water collection cost expressed in terms of minutes of walk and collection time. It shows that though people manage to collect nearly the same amount of water that they require in the dry months, they have to walk further and spend more time on water collection compared to the other months. We also find people who have pine forests near their villages to be more water stressed and to spend more time on collecting water as well as more money on storage and other devices than villagers who have broadleaf, deodar or broadleaf deodar or mixed pine forests near their villages. In quantitative terms, the villagers whose villages had these other forests nearby were saving both time and money which varies between 27 minutes to 90 minutes per day per household depending on the type of forest which translates to an income saving of USD 31 to USD 318 in India and USD 23 to USD 238 in Nepal per household per year. These are the values of the water provisioning services of other forests compared to Chir Pine to an average household in a given year in the KSL region.

Results from the study suggest that, taking into consideration the remoteness of the area, the conservation of native broadleaf forests and the gradual conversion of Chir Pine monocultures into mixed forest are essential for ensuring water availability to the villagers in future.

5.3 Incentive Payment for Ecosystem Services

Incentive payment for ecosystem services (IPES) may contribute to instilling confidence in water users on contributing to the sustainable management of the Drinking Water Project by linking them up with the watershed community. Although the implementation of an IPES for the drinking water project is socially acceptable and financially feasible in the study area, the rigorous process entailed in designing and capacity building for the IPES scheme demands substantial funds. Therefore, our study recommends the integration of the PES design process into the project design phase. In the present instance, for example, while the proponents of the Baitadi Drinking Water Project has carried out an Initial Environmental Examination, it mainly concentrates on project-level environmental assessment. On the other hand, improving the existing Initial Environmental Examination process by integrating the PES mechanism into it may bring down the cost while also reducing the risk of conflict at the implementation phase. The possibility exists that an output based payment scheme could put service providers at risk given the uncertainty in relationship between land-use practices and the production of ecosystem services and the comparatively low-income and resource-dependent nature of the providers. In order to reduce the risk and to make service consumers more confident, it would be better to define the activities to be carried out in the watershed with the participation of all stakeholders who would also oversee its proper implementation. In addition, the activities must be revised annually with inputs from all participating stakeholders. In order to implement the IPES scheme, we therefore propose a tripartite institution with the participation of government agencies, local bodies and civil society organizations who would function as a monitoring team in order to facilitate the scheme.

There are numerous cultural sites in Hindu-Kush Himalayan region, a broader area that comprises KSL. With this study design and findings, we believe that valuation of ecosystem services in the larger Hindu-Kush Himalaya, including China, would bring promising and practical perspectives for designing evidence based policies that would help brining benefits to the mountain communities while conserving cultural sites and natural landscapes.

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Annex A: **Main findings of focus group discussions in KSL sites Pithoragarh District, India**

Sites included are the *Hat-Kalika* watershed in Gangolihat and *Chandak-Aunla Ghat* watershed in Chandak of Pithoragarh district. The field visit started with a meeting with Indian partners of KSL project at GB Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora on 28th Sept 2015 where the KSL project along with the work done by Indian partners was discussed and shared. There are many attempts to collect information on ecosystem services from forests, especially provision services, and to value them by some partners. Though partners agreed to share the data, there were issues like the different objectives of different surveys, non-representative sampling (which do not capture the diversities), non-response, ambiguous questions, limited survey pertaining to only Hat-Kalika, not *Chandak-Aunla Ghat*, and hard to reconcile indicators collected using different surveys that limits the use of such data for the proposed study. Hence, an appropriate sampling design and survey instruments had to be developed afresh to collect data for valuation.

Several FGDs were conducted to understand the ground reality of the watershed lifestyles. The details of the FGDs are the following:

Focus group discussion in Pithoragarh District, India

Date	Venue	Type of participants	Number of participants
29/9/15	Himalayan Gram Vikas Samiti (HGVS), Gangolihat	Villagers, area NGOs, Gram Panchayat and Ban Panchayat representatives, women workers, researchers, representatives of KSL partners	50
30/9/15	Gangolihat Town	Representatives of different urban bodies	9
30/9/15	Himalayan Seva Samiti (HSS), Chandak, Pithoragarh	Chief functionary of HSS and some women workers/ researchers	5
1/10/15	Forest Department, Pithoragarh district, Pithoragarh	Deputy Director, Uttarakhand Biodiversity Board and two members of Pithoragarh forest department	4
1/10/15	Nekina village, Chandak-Aunla Ghat	Village members, mostly women who manage forest, village pradhan and some local NGOs	25-30
1/10/15	Chhanapande Village, Chandak-Aunla Ghat	Few villagers including village pradhan and local NGO	15-16

All FGDs made it clear that lifestyle and well-being of people in these watersheds is completely dependent on and intertwined with forests ecosystem and that they have a strong belief that Chir Pine stands have negative impacts on their livelihoods by drying up water sources and not providing the daily needed forest products including grass and fodder. The benefits derived from forest ecosystems are put into three categories

i) Direct use goods and services (provisioning services)

- Water for domestic and agricultural use
- Fodder ((Green and dry grass, broad leaves (especially of *Banjha* trees) and branches))
- Leaf-litter for animal bed
- Pasture for livestock, mainly cows and goats
- Fuel wood for cooking and heating
- Building materials (poles, roof material)
- Fruits
- Herbs and medicinal plants
- Fresh air, good health, no disease such as TB, etc.

ii) Indirect uses (regulating and supporting services)

- Hydrological services of forests (water recharge and moisture maintenance)
- Supply of nutrients, especially leaf litter, to agriculture

iii) Cultural and spiritual services

- Regular visit to temples in close proximity
- Large number of visitors (both locals and outsiders) during festival (*Navratri*, *Shiv ratri*, and *Shravan* month) to main temples (Patal Bhubaneswar and Hat-Kalika temple) of the area where no facilities are available.
- High dedication to local deities in every aspect of life.
- Offerings to local deities in different forms (bells of different sizes, gold and silver, money, resources especially village forest)

(iv) Main Issues (the following issues and beliefs came out during the FGDs)

- Forest type (Chir Pine vs. broad leave forest): Participants of the FGDs mention that Chir Pine consumes more nutrients and does not let other species grow nearby. It does not help in water recharge as it has shallow roots and rainwater is simply drained out. The natural drains dry up causing water stress in nearby areas. Thus, Chir Pine may provide fewer hydrological services and nutrients as well compared to other forest types. These services are available in plenty by broad leave forests like Banjha. Chir Pines also provide no provisional services, e.g., the timber/poles are weak in quality, get infected by pests within a few years, tilted, etc., they aggravate forest fire as fallen dry leaves, lax from these trees easily catch fire.
- Chir Pine is one of the fast growing species in certain locations, mostly dry areas. In order to allow the growth of other broadleaf trees, proper management of Chir Pine is needed.
- Forest department, on the other hand, wants Chir Pine to be there as such species grow in rocky and dry areas where no other trees will grow. It provides good timber and lax which is expensive. Villagers who collect lax have become rich as per forest department. However, lax can be sold to government and villagers need training to learn about the lax collection process.
- Van Panchayat management is probably the most important institutional issue affecting the village forest quality and well-being of the village. Villages with good Van Panchayats are better off. In some cases, when forest quality deteriorates and it is difficult to manage forest, the Van Panchayat leader (Sarpanch) consults with the villagers about offering the forest to God for a fixed tenure, i.e., 5-10 years. This is the last resort that villagers use to protect their forest. In that case, people cannot enter the forest, do not extract anything, either exploit government forest if possible or buy from outside or grow fodder instead of crops in their field and suffer. There are debates on this such as forests offered to God become dense in the course of time and improve services like water. Therefore, the issue facing villagers is forest offered to deities vs. livelihood vs. water recharge.
- Open sewerage vs. clean water (absence of proper drainage system in Gangolihat town except night soil facility to some extent). In 2012, one of the night soil pits got damaged causing serious water pollution in some area that led to a diarrhea outbreak and death of some people. There is no provision of sewage treatment. It is open and hence ultimately being mixed up with water. With a rise in population, this will be a serious public health hazard in near future, though it is not a big issue now.
- Willingness to contribute labor (at least one full day per month) in villages to maintain watershed, but there was no willingness to pay money
- High dependency on government for money and assistance in everything
- Van Panchayats want financial help
- Fertilizer and chemicals used in agriculture is limited, water quality is believed to be good and households use water without treatment.
- Mostly rain fed agriculture, not irrigation based
- People use piped water, supplied 4 hours/day, but less during dry season and they depend on natural springs, walking a long distance to get water.
- Urban households pay INR75/per month, but rural households get it free.

Main Findings of Focus Group Discussion (FGD) in KSL sites, Gwallek watershed area, Baitadi, Nepal

Eight FGDs were conducted in this area, two with villagers and the rest, with different representative groups of the Dasharath Chand Municipality of Baitadi town who are the main consumers of water resources of the area.

Focus Group Discussion in Baitadi District, Nepal

Date	Venue	Type of participants	Number of participants
1/10/15	Gothalapani, Baitadi	Travelled from Pithoragarh to Baitadi, and had discussions with District Forest Office, Dasharath Chand Municipality and District Development Committee, Baitadi	16
2/10/15	Gwallek watershed	Forest users of two community forest user groups of Gwallek watershed area	35
3/10/15	Baitadi Municipality	Members of Baitadi water user committee, Baitadi Chambers of Commerce, and Sanitation and Drinking Water Division	19
4/10/15	Baitadi Municipality	Water users of Shahilek area of Baitadi Municipality	6

i) Features of the Municipality water supply

The sources of the water supplied in Dasharath Chand Municipality of Baitadi lies in the Gwallek watershed. The proposed drinking water project is for about 1,000 municipal households out of whom one-third households are in rural settings. There is no private tap and households receive water from public tap. They pay NRs. 250/month/tap (8-10 households), which are divided among the households. However, water supplied through these taps is not sufficient. They get water twice a day and for 1-1.5 hours each time. However, during the dry season, the water is supplied once every three days. In order to the improve water supply situation, the Government of Nepal has designed the new drinking water supply project and the source is in the Gwallek Watershed area while the estimated cost is 150 million NRs.

ii) Watershed area

- 7 village development committees,
- The forest on the top of the hills is under government management,
- Community forest in the middle and bottom of the hills,
- Sacred site –around 100,000 pilgrims per year during the rainy season and Shivaratri,
- No entrance fee and facility of night stay,
- Private tap in households though distribution is not systematic. Pay NRs. 10/month. This money goes to the person who handles the distribution system,
- Drinking Water and Sanitation Division has implemented a new scheme for 25-30 households near the water sources for the drinking water supply and awareness program in order to use the water source for the Dasharath Chand Municipality,

iii) Issues in watershed area

- Open grazing
- Haphazard collection of forest products (fuelwood and fodder)
- Use of chemical fertilizer which is an increasing trend,
- Issue with drinking water distribution management,
- Water supply is a problem during the dry season when they have to travel 10 min to 1 hour to get it from old sources,
- Throwing dead animals and sanitary pads in water bodies,
- Women can’t share toilets and water source with men during their menstruation cycle,
- Open defecation is free but since no water is supplied in toilet, Dalit people (untouchable caste) have to use open spaces.

iv) Issues with water users of Municipality

- Water quality is not a problem at all. Very few households use filters and tablets,
- Existing water supply –
  - Public tap (8-10 households/tap)
  - 2 times/day and 1 hour/day (around 100 liters /household)
  - Treat reservoir during rainy season
  - During dry season – either old sources (up to 1 hour walk) or buy @Rs. 2.5/liter,
- New drinking water project
  - Design for 15 years – 100 liter/person/day during dry season
  - Formation of water user committee, who will manage water supply after construction,
  - Project fund source – ADB (50%), Municipality (6%), users (5%), district development committee (4%), TDF loan (35%),
  - Individual tap and plan to distribute common tap in those areas where household can't pay monthly water tariff,
  - Considering minimum monthly water tariff – NRs. 250/hh in rural area, NRs. 500-700/hh in urban area, NRs. 1,000/government office, NRs. 1,200-1,500/hotel
  - Can spend 10 Rs/hh/month or 10% of the total income for upstream water source protection
  - Expect upstream people to spend 25%-60% in conservation and 40%-75% in income generating activities
  - Awareness raising program in upstream community focusing on women and youth
  - Toilet construction across bridges in upstream area
  - Expected annual expenses of user committee – NRs. 150,000 for electricity, and 5-7 staff

v) For Gwallek area tourism promotion

- A dharmashala with water, utensils, bedding and firewood facility can charge NRs. 500/group
- Visitors information center
- Black topped road

Annex B: **South Asian Network for Development and Environmental Economics (SANDEE), in collaboration with ICIMOD (Nepal) tourist/pilgrim questionnaire - Patal Bhubaneswar**

Introduction of the survey

Kailash landscape is called 'Devbhumi or land of Gods' and the day-to-day life of residents in this area is closely integrated with the religious places of the region. These religious places are integral to the local culture/festivals and development of these places can stimulate the development of the region. Patal Bhubaneswar is sacred as well as a spot of natural beauty and people from far and wide visit this area throughout the year. We would like to request you to be a part of the survey and provide some information about your travel experience. The survey will not take more than 20 minutes of your time. In this survey, we would like to get detailed information regarding your travel to this place, the facilities available here, what facilities you expect, etc. so that suggestions on those can be submitted to local government for further improvement of this place. We are collecting such information through a questionnaire survey. We will take handwritten notes on your responses and would like to assure you that your response will be completely anonymous and your name or identity will not be revealed to anyone. If you do not agree, you may refuse to take part.

Thank you very much
SANDEE team

Would you like to participate in the survey? [ ] Yes = 1, No = 0 (>> if no find another visitor)

Interview Schedule

Code. .... Date: .... /.......... /2016

Note: please make sure to interview at least one-third female visitors

A: General Information about the Visitor

	Response (See Code)	Code	
1. Gender of the respondent: (need to interview 40-50% female visitors)	....	Male = 1 Female = 0	
2. Age of the respondent	.... Years		
3. Household size (No. of family members, whether traveling with you or not).	....		
4. Highest level of education (years)	....	None = 1 ≤ 5years = 2 6 – 8 years = 3 9 – 12 years= 4	Bachelor's = 5, Masters and above = 6, Informal = 7
5. House location	....	Urban dweller = 1	Living in rural areas = 0
6. House address State	Country:		
7. What is your profession?	....	Agriculture = 1 Wage labor = 2 Traditional prof. = 3 Business = 4 Govt. job = 5 NGO/Pvt. job = 6	Employed abroad = 7 Student = 8 Housewife = 9 Unemployed = 10 Other .... = 11

8. Which income group better describes your household's average monthly income? INR/month) [ ] (use one code)

1 = Less than 5,000 2 = 5,000-10,000 3 = 10,000-20,000 4 = 20,000-30,000

5 = 30,000-50,000 6 = 50,000-1, 00,000 7 = More than 1, 00,000

9. What is your personal monthly income (INR/month) ………………………..…

10. Approximately how much income do you spend every year on travel/recreation? INR…………………

11. How many are people accompanying you during this visit? [ ]

Family members: [ ] Friends: [ ] Female member: [ ]

B. Visitor's Behavior

12. For Day-trippers: Approximate time spent for this trip: ……..... hours (round trip travel time plus time spent onsite) (Go to 14)

13. For holiday makers with multi destination trip: Expected number of days making up full journey: …... days

13.1. Name three main sites visited chronologically before coming to Patal Bhubaneswar
1. ……………………..
2. ……………………..
3. ……………………..

13.2. What is the name of the place you plan to visit next to Patal-Bhubaneswar before going home?
1. ……………………

14. What is the main purpose of your visit in Patal-Bhubaneswar? [ ]

Religious = 1 Recreational = 2 Business = 3 Other (specify ………) = 4

15. Is this your first visit to this place? [ ] Yes = 1 No = 0

16. If no, how many times have you visited this place in the past five years? ………………………………..

17. How did you come here? [ ]

Tourist Bus = 1 Mini bus = 2 Taxi = 3 Private car = 4

Motorcycle = 5 Public bus = 6 Walking = 7

18. Who arranged your trip? [ ]

Travel agency = 1 Family member/friend = 2 Myself = 3

19. How much did you spend (per person) on your total trip from home to this place?

1. Transportation:	Plane ticket/Train ticket	Approx. INR …………………
	Bus ticket	Approx. INR ………………….
	Taxi	Approx. INR…………………
	Any other (say, porter)	Approx. INR …………………
2. Fuel cost (If private/own vehicle)		Approx. INR…………………
3. Food per day (approximate)		Approx. INR…………………
4. Accommodation per day (approximate)		Approx. INR …………………
5. Bheti/Donation		Approx. INR …………………
6. Toll Tax One way		Approx. INR …………………
7. Entry Fee to Patal Bhubaneswar cave		Approx. INR …………………
8. Guide fee		Approx. INR …………………
9. Other expenses ………………………………..		Approx. INR …………………
Total expenses per person for round trip (if available)		Approx. INR …………………

20. If you were not on this trip today, what would you be most likely be doing? [ ]

Working = 1, Watching TV = 2, Housework/Shopping = 3

Visiting nearby temples = 4 Spending time with family = 5 Other (Specify ……….) = 6

21. If you could have worked at this time (during recreational hours), how much would you be earning per day? INR. ………

22. Rate the quality of the site: [ ]

Very poor = 1 Poor = 2 Fair = 3 Good = 4 Very good = 5

23. Do you think the facility around the temple needs improvement? [ ] Yes = 1 No = 0

24. If yes, what is the most desired improvement? [Circle one for each to rank; 1 means the most desired improvement and 5 means the least desired]

Upgrade and refurbish accommodation	[1]	[2]	[3]	[4]	[5]
Lavatory	[1]	[2]	[3]	[4]	[5]
Waste disposal	[1]	[2]	[3]	[4]	[5]
Eating place	[1]	[2]	[3]	[4]	[5]
Road and transportation	[1]	[2]	[3]	[4]	[5]
Security service	[1]	[2]	[3]	[4]	[5]
Any other …………………	[1]	[2]	[3]	[4]	[5]

25. Will you come again to this site if these improvements are made? [ ] Yes = 1 No = 0

26. Most valuable attribute of the site. [ ]

Unspoiled nature/scenery =1 Sacred places = 2 Other ……………. = 3

27. Do you know any other site that you would like to visit instead of Patal Bhubaneswar? [ ] Yes = 1 No = 0

28. If yes, which other single site do you want to visit? ……………………….

29. What would be your total cost to visit that place? INR. …………………….

30. How long does it take to get there (one-way)? ……………… hours

31. Currently, visitors are paying Rs 20 as entrance fee for Patal Bhubaneshwar. This site requires more resources to provide better services for visitors, such as improved cleanliness, better road/infrastructure, greater public safety and resting area. How much will you be willing to pay on top of the existing entrance fee of INR20 that can be used to improve site quality? INR……………….

C. Visitor's View on Kailash Journey

32. Have you ever been on the Kailash journey? [ ] Yes = 1 No = 0 [go to 39.]

33. If yes, when was your last trip on Kailash Yatra? 20____/____/____

34. No. days making up the full journey that time: ………………

35. No. of people in your group that time …………………….

36. Who arranged this Kailash trip? [ ]

Travel agent = 1 Friend/Family member = 2 I = 3

37. Total spending per person (INR) ………………….

38. Did you come to Patal Bhubaneswar during that Kailash Yatra? [ ] Yes = 1 No = 0

39. If no to 32, do you have a plan to visit Kailash Maansarovar in the coming years? [ ] Yes = 1 No = 0

40. If yes, which route would you use for Kailash Yatra?

Lipulekh (Dharchula) = 1 Nathula Pass = 2 Kathmandu Nepal = 3 O ther ……. = 4

Thank you!!!

Annex C: **Questionnaire for household survey on valuation of watershed services in *Hat-Kalika* and *Chandak-Aunlaghat* watersheds, Pithoragarh, India and Gwallek Kedar watershed, Baitadi, Nepal under Kailash Sacred Landscape Project**

Introduction of the survey

Namaste! We are conducting a research project on the valuation of ecosystem services. You are invited to take part in this research project. Please note that your participation is entirely voluntary and deciding not to participate will not affect your relationship to the researchers or associated organizations. However, your participation will provide valuable information for managing ecosystem services in your area. Once you agree to participate, you will be interviewed using a questionnaire. It will take approximately half an hour and you may of course decide to stop the interview at any point. You have been selected as a resident of the watershed area. The purpose of this research is to value the contribution as well as the effect of any changes in the quality of the watershed on your livelihood. This research aims to raise awareness about the issues associated with watershed management and the value of ecosystem services that the village is getting from the nearby forests. Your response to the survey will be a basis for valuable information to policy-makers to manage the watershed in a sustainable way. We are interested in your opinion and there are no correct or incorrect answers to these questions. We will take handwritten notes on your responses on a questionnaire sheet. We would like to assure you that your response will be completely anonymous and only aggregated results of the questionnaires will be published.

Thank you very much
SANDEE team

Do you agree to take part in the survey? Yes [ ] No [ ]>>> find another house

Name of the watershed: ……………… HH GPS Code …………

Distance from motor road: ……………. minutes of walk

Household code:	………….	VDC /Block Name:
Ward No. :	……………	Tole/ Village: …………………………
Aspect of the forest	…………….	North-east =1, North-west = 2, South-east = 3, South-west = 4
Major forest type surrounding the village		Chir Pine = 1 Deodar = 2 Broadleaved = 3 Shrubs = 4 Mixed (Broadleaved + conifers) = 5 Mixed conifers (Chir Pine + Deodar) = 6
		Date of interview: 2016/____/____

Part I: General Information

Section 1. Individual's Information (please make sure to interview 30 – 50% women)

	Response (See code)	Code	
1.1. Gender of the respondent:	....	Male= 0 Female = 1	
1.2. Are you household head?	....	Yes = 1 No = 0	
1.3. Your age	...... (Years)		
1.4. Your education	....	Illiterate = 1 Literate without schooling = 2 Grade 1-5 = 3	Grade 6-10 = 4 +2 Graduate = 5 Bachelor and above = 6
1.5. Highest education of the person living with you in your household (See code in 1.4.)	....		
1.6. Name of the community forest user group (CFUG)/Van Panchayat (VP)	....		
1. 7. Designation in CFUG/VP :	....	General user =1 Committee member = 2	
1.8. Ethnicity:	....	Dalit (SC/ST) = 1 Indigenous = 2	Bramhin /Chhetri= 3 Others .... = 4
1.9. Your profession	....	Agriculture = 1 wage labour = 2 Traditional = 3 Business = 4	Govt service = 5 NGO service = 6 Other (.........) = 7
1.10. Main income source of your household	....	Main occupation as reported in 1.9 = 1 Pension = 2 Money transfer from outside = 3 Any other (specify...........) = 4	
1.11. Household annual income (Rs.)	....	Less than 50,000 =1 50,000 to 100,000 =2 100,000 to 300,000 =3	300,000 to 500,000 =4 more than 500,000 =5

1.12. Family size .... Male = ... Female = ...

Section 2: Living conditions and Consumption

2.1. Living conditions and sanitation

SN	Facility	Response (see code)	Code
2.1.1	House type		Traditional =1 Concrete with pillar =2 Concrete without pillar =3 Others (specify) ...... =4
2.1.2	What kind of toilet facility does your household usually use?		Pucci =1 Kachchi (Pit toilet) =2 Open toilet =3
2.1.3	If Pucci, flush is connected to what?		Septic tank =1 Other (specify) =2
2.1.4	Waste water outlet connection		Connected to drainage =1 No drainage =2

Section 3: Agriculture

3.1. Land Holding and Crop Cultivation (Last 12 months)

Land Type	Area Unit Ropani =1 Naali = 2	Total land area	Area of land outside your village	Crop cultivated during last year		
				Rainy	Winter	Dry
Irrigated						
Rain fed						
Grass land						

3.1.1 Are the types of forest surrounding your village the same as that surrounding much of your agricultural land? [ ] Yes = 1 No = 0

3.1.2 Is your agricultural land below or above the forest? [ ] Below=1 Above = 0

3.1.3 Do you have trees on your farmland? [ ] Yes=1 No=0

3.2 Agricultural production and income (Last 12 months)

Crops	Gross area cultivated	Share of irrigated land	Chemical fertilizer use Yes =1 No =0	Pesticide use Yes = 1 No = 0	Total produc-tion (kg)	Units consumed	Units sold	Unit price sold NRs/ INR)	Approximate loss due to wild animal attack (kg)
Paddy									
Millet									
Maize									
Wheat									
Lentil									
Mustard									
……									
……									

3.3 Livestock holding in the last 12 Months

Livestock type	How many do you own?	Do you buy fodder any time of year? Yes=1 No=0	Amount spent if you bought fodder any time of year (Rs.)	How many days a week do you take them out for open grazing?	How many months a year do you take them for open grazing?	Other yearly expenses on maintenance of these types of animals (Rs)
Cows/ox						
Buffalo- Female/ Male						
Goats/sheep						

Part II: Water use and Watershed

State of the watershed area (Show watershed map)

A watershed has four basic components - popularly known as water, land, forest, and wildlife. A watershed-based management approach therefore takes into account everything that occurs within a watershed, including both naturally occurring activities and human activities.We are interested in only your household's use of the forest and water, not use by other households.

1. Status of ecosystem services and production (compared to the last 5 years, since 2010)

Category	Items		Trend (see code) Decreasing =1 No change =2 Increasing =3
Water	Water for household use (quantity)		
	Water for household use (quality)		
	Irrigation water		
Forest	Fuel wood		
	Fodder		
	Leaf litter		
	Timber		
	Other………		
	Forest condition/size		
Agriculture	Paddy (production per unit area)		
	Maize (production per unit area)		
	Millet (production per unit area)		
	Wheat (production per unit area)		
	Livestock holding		
Other	Forest area under tree species	Tree species 1 (Conifer)	
		Tree species 2 (Broadleaves)	
		Agriculture land	
		Barren Land	

2. Water for household use

Unit Gagri =1 Litre=2	How many units do you require per day?	
	For drinking	For other uses

2.1 Household water use

Water source	Collection amount in Gagri/Litre		One-way distance between house and source …. min walk	Per trip collection time (except walking time)		Perception over water quality Drinkable =1 Drinkable after either boil or filter = 2 Need both boil and filter =3
	In dry season	In other season		In dry season	In other Season	
Private Tap						
Public Tap						
Public well/ stream						
Hand pump						

2.2 Drinking (household use) water

SN	Information	Response (use code)		Code
		In dry season	In other season	
2.2.1	Number of HH sharing the water source	.... House	..... House	
2.2.2	Forest type in drinking water source			Chir Pine ...1 Deodar...2 Broadleaved ...3 Shrubs....4 Mixed (Broadleaved + conifer)...5 Mixed conifer (Chir Pine + Deodar)......6
2.2.3	Who goes to collect water?			Mother = 1 Son = 3 Daughter/-in-law = 2 father = 4

2.2.4 Activities foregone because of more time needed to collect water [ ]

School attendance	= 1	Child and house care	= 2
Attending meetings	= 3	Rest time	= 4
Ignore garden/horticulture crop	= 5	All of the above	= 6

2.2.5 Suggestions to improve drinking water availability? [ ]

Conservation/storage pond	=1	Regularizing water distribution	=2
Conversion of pine to broadleaved	=3	Other (specify)	=4

2.2.6 Do you pay a water fee? [ ] Yes = 1 No = 0

2.2.10.1 If yes, how much? ....Rs/Month

2.2.7 Do you undertake any activities to manage/protect water source? [ ] Yes = 1 No = 0

2.2.7.1 If yes, what are they? [ ]

Money Contribution = 1 Labour contribution = 2 Both = 3

2.2.7.2 Estimated expenses in water source management/protection Rs. .... /Year

2.2.7.3 Estimated labour contribution to water source management/protection. .... Days/year

2.2.8 Did you purchase or invest in the followings during the last 5 years?

Items	Code (Yes =1, No=0)	Initial cost (Rs)	Total life of the item
Water filter			
Water purifier (Kent, Arrow, etc.)			
Additional water tanks or buckets			
Rain water storage tank			

2.3 Irrigation water

2.3.1 One-way distance between starting point of irrigation canal and farmland .... min walk

2.3.2 Number of irrigation canals above your irrigation canal along the river .... canals

2.3.3 Number of households sharing the irrigation canal that you are using ....House

2.3.4 Forest type in your irrigation water source [ ]

Chir Pine ...1 Deodar...2 Broadleaved ...3 Shrubs....4

Mixed (Broadleaved + conifers)...5 Mixed conifer (Chir Pine + Deodar)......6

2.3.5 Irrigation water Shortage and availability (Last 12 months)

Seasons	Rainy season	Winter season	Dry season
Water shortage (Yes=1 No=0)			
Availability compared to demand (%)			

2.3.6 How do you manage shortage in irrigation water demand? [ ]

Rain water harvest =1 Drip irrigation =2 Leaving farmland barren =3

Crops requiring less water =4 Others (specify) ………. =5

2.3.7 How much do you spend on aforementioned activities in 2.3.6 to fulfil irrigation water demand? ……………….. Rs/Year

2.4 Total number of water sources not available in dry season but in other seasons ………….

2.5 Total number of water sources completely dried up ………….

2.6 Do drinking water and irrigation water have the same source [ ] Yes =1 No = 0

3 Community Forest/Van Panchayat

3.1 One-way distance to your community forest/Van Panchayat from house …………… minute walk

3.2 One-way distance to your community forest/Van Panchayat from farmland ………… minute walk

3.3 Community forest/ Van Panchayat location [ ]

Above the farmland = 1 Below the farmland = 2

3.4 Is your Van Pachayat forest dedicated to a deity? [ ] Yes =1 No= 0

3.5 If yes, how many years back was your Van Panchayat forest given to the deity? …………… Year/s

3.6 Dominant tree species. [ ]

Chir Pine …1 Deodar…2 Broadleaved …3 Shrubs….4

Mixed (Broadleaved + conifer)…5 Mixed conifer (Chir Pine + Deodar)……6

3.7 Forest product demand (quantity collected)

Forest products	Unit Cu ft …1 Bhari…2 Sack…3	Annual required quantity	Annual collection		If shortage, how do you fulfill your need? Buying = 1 Cut consumption = 2 Agro-forestry = 3 Others ……….. =4	If you buy, expenses made on purchase per year (Rs/ year)	Market price per unit (Rs)
			From CF/ VP	From other forest			
Timber							
Fuel wood							
Fodder							
Leaf litter							
Other……							

Time required to collect per unit forest products (except walking distance)

Forest products	Unit Bhari = 1 Sack = 2	Time required collecting forest products during……		Time required five years back (hour)
		dry season (hour)	other than dry season (hour)	
Firewood				
Fodder				
Leaf litter				

Part III: Religious Travel (Hat-Kalika, Patal Bhubaneswar, Gwallek Kedar) Information

Introduction

As you are aware, Kailash landscape is called 'Devbhumi or land of Gods' and day-to-day life is closely integrated with the religious places of the region. These religious places are integral to local culture/festivals and development of these places can stimulate the development of the region. In this survey, we would like to get detailed information regarding your travels to these places, the facilities available there, what facilities you expect, etc. We are collecting such information for three prominent cultural centres of your region, Gwallek Kedar, Hat-Kalika and Patal Bhubaneswar temples through a questionnaire survey. We request you to answer regarding places you have actually visited. We will take handwritten notes on your responses and would like to assure you that your response will be completely anonymous and only aggregated results of the questionnaires will be published. We code these places as the following:

Hat-Kalika = HK and Gwallek Kedar = GK

4. Have you ever been to Hat-Kalika (if India) / Gwallek Kedar (if Nepal) in the last five years? [ ]
Yes =1 No=0

4.1 If yes, how many times did you visit Hat-Kalika / Gwallek Kedar? ....times.

4.2 How many times per year? [ ]

4.3 One-way time distance to the Hat-Kalika / Gwallek Kedar from your home ………….. hrs

4.4 How many people from your family are accompanying you? [ ]

4.5 Why do you visit this temple? [ ] Religious =1, Business=2, Social=3, Other (specify)=4

4.6 Do you stay there overnight? [ ] Yes=1 No=0

4.7 If yes, how many nights per trip? [ ]

4.8 If no, then why? [ ]
No hotel=1 No facility=2 Both =3 Close by, so no need to stay=4

4.9 With hotel and facilities, will you stay overnight? [ ] Yes=1 No=0

4.10 If yes to 4.9, will you stay more nights with hotel and facilities? [ ] Yes=1 No=0

4.11 If yes, how many more nights? [ ]

4.12 With hotel and facilities, how many times will you visit the place per year? [ ]

4.13 Will you go there during the non-festival period? [ ] Yes=1 No=0

4.14 What is the mode of transportation to reach there? [ ]
Walk =1 Public vehicle=2 Private vehicle=3

4.15 Your expenses during the last visit (need to know when)……….

Particulars	Quantity
One way travel /transportation cost	.... NPR/INR
One way travel time	.... hours
Time spent at site	.... hours
Food	.... NPR /INR
Lodging	.... NPR /INR
Bell	.... NPR/INR
Bheti (Cash offering to god)	.... NPR /INR
Other materials	.... NPR /INR

4.16 Main reason for giving Bheti/Bell? [ ]

Regular practice = 1 Mannat (fulfilling of vow) =2

4.17 Do you buy locally available products for your people back home? [ ] Yes=1 No=0

4.18 If yes, how much do you spend (other than travel expenses and Bheti)?........NPR/INR

4.19 If you were provided fuel wood, drinking water, bed, cooking stuff etc. during your visit so you can spend a night, how much would you be willing to pay for such facilities per person per night? .... NPR/INR

5. Indirect Benefit to local economy

5.1. If you are a local person, do you get any benefit from such religious tourism? [ ]

Yes=1 No = 0

5.2 .If yes, describe what types of benefit you get......................

Sell your product=1 Get wage employment=2

Open temporary stall=3 Other ………………. =4

5.3. How much income do you earn during the festival season per year?.............INR/NPR?

5.4 Any other benefits --------- (to capture the multiplier effect on the local economy)....

6. Generalizing cultural value for landscape

6.1 Is there any other religious site that you frequently visit? [ ] Yes = 1, No = 0

6.2. What mode of transport you use? [……..]

Walk = 1 private vehicle = 2 public vehicle = 3

6.3. What is the approximate average time you take to complete one such visit?

6.4. How many times do you visit that place? … times/year

6.5. What are the average expenses for each trip? [ ]

7. Relating Kailash Journey

7.1. Have you ever been on the Kailash journey? [ ] Yes = 1 No = 0

7.2. Do you have plans to visit Kailash in the coming years? [ ] Yes = 1 No = 0

7.3. If yes, which route will you follow to go on Kailash Yatra?

Darchula = 1 Kathmandu Nepal = 2 Other ________ = 3

7.4. No. of days (expected) to make full journey: …………….

7.5. Total spending (expected/actual) for the journey/person ………………….

Annex D: **Questionnaire for Household survey on payment of ecosystem services in Dasharath Chand Municipality, Baitadi, Nepal**

Namaste! We are here to conduct a study on drinking water related issues. You are invited to take part in this research project. Please note that your participation is voluntary and deciding not to participate will not affect your relationship with the researchers or associated organizations. Once you agree to participate, you will be interviewed using a questionnaire. You may choose not to answer some of the questions or all of them if you feel so but your response will be a very important source of information for managing the drinking water supply sustainably in your area. It will take approximately one hour and you may of course decide to stop the interview at any point. You have been selected as a resident of Dasharath Chand Municipality. The purpose of this research is to collect information on various aspects of drinking water. This research aims to raise awareness about the issues associated with water source management, quality of water you use and to provide valuable information to the Municipality and relevant policy-makers to manage drinking water project in a sustainable way. The questionnaire contains alternative policy options related to drinking water source management and household information. There are no right or wrong answers and the choices you make will be useful for future planning and for making relevant policies for the effective management of the drinking water project. We are interested in your opinion and we will take handwritten notes on your responses on a questionnaire sheet.

We would like to assure you that your response will be completely anonymous and only aggregated results of the questionnaires will be used for disseminating and publishing research outcomes.

Thank you very much.

Do you agree to take part in the survey? [ ] Yes =1 No = 0 (find next household)

GPS code: ………………………..

Household code:		Municipality:	Dasharath Chand
Ward no. :		Tole/ Village :	
Time of interview:			

Please show map of the watershed, whenever respondents get confused about location.

Part I: General Information

1. Individual

1.1 Identification of interviewee: [ ] Male =1 Female =0

1.2 Age …………… Years

1.3 Education (see code below): [ ]

Illiterate =1	SLC graduate =5
Informal Education =2	+2 Graduate = 6
Grade 1-5 = 3	Bachelor's graduate =7
Grade 6-10= 4	Masters and above =8

1.4 Ethnicity: [ ]

Dalit =1 Indigenous = 2 Chhetri = 3 Brahmin = 4 Other……... = 5

1.5 Family size:

Total family members	Male	Female

1.6 Occupation of the respondents (see code below): [ ]

Agriculture = 1	Government = 5
Wage labor = 2	Non-government/ private Service = 6
Traditional professional (tailor, blacksmith) = 3	Business (other than hotel/restaurant) =7
Hotel/Restaurant = 4	other (specify) = 8

1.7 Main income source of the household (see code above): [ ]

1.8 Household annual income (see code below) [ ]

Less than 1 lakh =1 1 to 2 lakh = 2 2 to 5 lakh = 3

5 to 10 lakh = 4 more than 10 lakh = 5

1.9 Distance of house from motor road ……………minute walk (put 0 minute if it is on the road)

2. Household and Sanitation

2.1 Living conditions and facility

S.N.	Facility	Response [See code]	Code	
2.1.1	House type		Traditional =1 Concrete (with pillar) =2	Concrete (no pillar)=3 Others (specify) =4
2.1.2	What kind of toilet facility do your households usually use?		Pakki =1 Kachchi (pit toilet)=2	Public toilet =3 Open toilet =4
2.1.3	If Pakki, flush is connected to what?		Piped sewer system = 1 Septic tank = 2 Other system (describe) =3	
2.1.4	If Kachchi, what type?		With slab/ventilated pit = 1 Without slab/open pit = 2	
2.1.5	Waste water outlet connection		Connected to closed drainage =1 Connected to open drainage =2 No drainage = 3	

2.2 Landholding type and size

Land type	Unit Ropani = 1 Aana =2	Area
Irrigated		
Rain fed		
Building area		

3. Water for household use

3.1 Drinking water

3.1.1 Where does your drinking water come from? [ ] (use code from the list)

River/stream =1 Piped water supply =2 Well (Noulo) =3

Spring water (Dharo) = 4 Others (specify……) =5

Is it private or public? [ ] Private =1 Public =2

How far is the drinking water collection point (3.1.1) from your house? ………. min walk (put 0 if connected to house)

If it is river or piped water supply, what is the name of source? …………………

3.1.2 Drinking water demand and supply (in the last 12 months)

Unit Gagri=1 Litre=2	How many units do you require per day?		How many units are available for your household per day?		If the availability is less than the required quantity, then how do you fulfil? Buy =1 Use less amount =2 Use other source = 3 Others (specify.) =4
	For drinking	For other uses	Dry season	Other season	

How much does it cost per unit of water? ………….NPR

How would you rate the current quality of drinking water available to your household? [ ]

Very good =1 Good =2 Ok = 3 Bad = 4 can't say = 5

Do you treat water before drinking? [ ] Yes =1 No =0

If yes, how do you treat water before drinking? [ ]

Filter =1 Boil = 2 Both boil and filter = 3 Pills = 4

Do you pay water fee? [ ] Yes =1 No =0

If yes, how much do you pay? NRs………../Monthly

Part II: New Drinking Water Project

A new drinking water project is going to be launched in Dasharath Chand Municipality. To implement this project every household of the Municipality has contributed some amount of money in addition to a loan from the Town Development Fund. To pay the loan back there will be regular monthly charge for drinking water. As the water comes from the Gwallek area, the quality of drinking water that comes to your household depends on the activities of the people in upstream villages. If the upstream households are engaged in water polluting activities such as using chemical fertilizer and pesticides in agriculture, your drinking water will be more polluted and it will cost more money to purify the water. The existing water management plan does not consider upstream villagers' activities as a factor that affects drinking water quality/quantity. We are exploring the possibility of raising extra money for managing and protecting the source of drinking water for the sustainability of the project.

The quality and quantity of drinking water from the proposed drinking water project rely on the activities of upstream communities in Gwallek area. There are several strategies to maintain and improve the current quality and quantity of water available to Dasharath Chand Municipality. Here, we propose a strategy that encourages the community of Gwallek area to improve sanitation and forest management by providing support for income generating activities. These activities include the promotion of organic agriculture, regularization of grazing in upstream, management of sanitary materials and dead animals, and sustainable management of forest. Since, these activities impose a cost on upstream households but help to improve water quality in your area, water users of Dasharath Chand Municipality including your household may need to contribute to create a fund and use the money for encouraging upstream households to implement these activities. We propose to collect the required fund through an additional increment in your monthly water bill for the next 10 years. Your decision would have an implication on water quality/quantity that the city would get, as the decision will be implemented if the majority of the households agree to contribute. What do you think of the idea of supporting income generating and conservation activities in the upstream area increasing your households' monthly water bill? [ ]

Good =1 Bad =2 cannot say= 3

In this part, we want your opinion about the improvement of the Gwallek Watershed condition for the next 10 years. Remember, there is no right or wrong answer; we just want your opinion. You will get "four choice situations" and there are three alternatives in each "Choice Situation". The choice situation consists of two policy alternatives and one option where there is no-change from the current policy. Alternatives will be labelled as "Alternative 1", "Alternative 2" and "Current Situation". The "current situation" implies that there is no or very low support for motivating upstream community to change their livelihood activities. In order to support the upstream community, your household needs to make an additional contribution per month, which may increase your household expenditure and reduce household saving given your monthly income. We propose an additional amount in water fee, which will be used to support the upstream community for the next 10-year period. This increment will be included in Alternatives 1 and 2. In 'Current situation" no additional water fee will be charged.

The alternative conditions are described by means of the following attributes (the current scenario is the average drawn from focus group)

Attributes	Description	Levels
Water quantity	This is defined as availability of water during the dry season in private tap, as after the new project every household will be connected to pipe-borne water supply system. Currently, there is no private tap and households are getting water from public tap, which is shared by 8-10 households.	i. 25 liter/person/day* ii. 50 liter/person/day iii. 75 liter/person/day iv. 100 liter/person/day
Water quality	The quality of drinking water from the new source. The current situation of water quality is drinkable only after a normal treatment such as boil and filter; and using tablet. The new drinking water project may have better quality of water after treatment in treatment plant and the maintenance of the water quality requires eco-friendly activities upstream.	i. Drink after both filter or use of tablet* ii. Drinkable from the tap
Drinking water supply	The schedule of water supply to household. Currently, it is irregular.	i. Irregular* ii. One time daily iii. Two times daily

Water source man-agement fee	A new fee for water source management, which is additional to the monthly water fee. This is expressed as monthly charge for water source protection and management.	i. NPR. 0/month* ii. NPR. 10/month iii. NPR. 25/month iv. NPR. 50/month v. NPR. 75/month

Note: * denotes the levels in current scenario.

In each situation, please choose the alternative that best describes your expectation. Please consider what you think is best. When you select, please consider your household income after necessary expenses such as food, housing, clothing, and child schooling have been met.

Background information about answering the question

If you choose alternative C (status quo) in all choice situations, give your reasons for why you prefer the current situation. See code [ ]

Option	Code
I prefer the current situation	=1
I don't care since this is the government's responsibility	=2
I don't have enough income	=3
I can contribute labour but not money	=4
I can get water from nearby or from my own property	=5
I don't believe this will improve the situation	=6
Other …………………	=7

Do you think water provision is a service provided to you by the forests?[ ] Yes =1 No = 0

Have you ever heard about watershed management activities? [ ] Yes =1 No = 0

Have you attended any forest/environment management related training?[ ] Yes =1 No = 0

If you get necessary water each day from the new project that you can drink directly without treatment, then will you be willing to pay Rs XXX/month? [ ] Yes =1 No = 0

If no, then how much is your household ready to pay for drinking water? NPR.........../month

As you know, the sources of the proposed water supply come within the Gwallek watershed. Do you think activities upstream (Gwallek area) may influence water distribution of the new project?

the water quantity available to your city [ ] Yes =1 No = 0

the water quality available to your city [ ] Yes =1 No = 0

If yes, what activities do upstream communities need to manage to improve the water.
(please write preference order)

S.N.	Activities	Rank
6.6.3.1	Dead animal management	
6.6.3.2	Grazing	
6.6.3.3	Forest management	
6.6.3.4	Household waste and sanitation	
6.6.3.5	Agriculture practices (chemical fertilizer and pesticides)	
6.6.3.6	Water intensive horticulture crops (soya bean, rice, maize)	
6.6.3.7	Cleaning of water sources	

Now the management of Gwallek watershed is also a subject of your concern. So are you ready to contribute to the management activities of the Gwallek watershed conservation? [ ] Yes = 1 No = 0

If yes, would you like to pay an additional Rs XXX per month for Gwallek Watershed Management? [ ] Yes = 1 No = 0

If no, how much is your household ready to pay for Gwallek Watershed Management? NPR………./month

In the case of the new drinking water project, do you think there should be separate fee structure to hotels and offices? [ ] Yes = 1 No = 0

If yes, how much should be for hotel? [ ]

times that of your household = 1   2 times that of your household = 2
times that of your household = 3   3 times that of your household = 4

How much for office? [ ]

1.5 times that of your household = 1   2 times that of your household =2
2.5 that times of your household = 3   3 times that of your household =4

Part III: Religious Travel (Hat-Kalika, Patal Bhubaneswar, Gwallek Kedar) Information

Introduction

As you are aware, the Kailash landscape is called 'Devbhumi or land of Gods' and day-to-day life is closely integrated with the religious places of the region. These religious places are integral to the local culture/festivals and development of these places can stimulate the development of the region. In this survey, we would like to get detailed information regarding your travels to these places, the facilities available there, what facilities you expect, etc. We are collecting such information for three prominent cultural centres of your region, Gwallek Kedar, Hat-Kalika and Patal Bhubaneswar temples through a questionnaire survey. We request you to answer on places you have actually visited. We will take handwritten notes on your responses and would like to assure you that your response will be completely anonymous and that only aggregated results of the questionnaires will be published. We code these places as the following:

Hat-Kalika = HK and Gwallek Kedar = GK

Have you ever been to Gwallek Kedar in last five year? [ ] Yes =1 No=0

If yes, how many times did you visit Gwallek Kedar during the last five years? ....times.

If more than five times, did you visit every year? [ ] Yes = 1 No = 0

How many times per year? [...........]

How many people from your family accompanied you? [ ]

Why do you visit this temple? [ ]

Religious = 1 Business = 2 Social = 3 Other (specify) = 4

Did you stay there overnight during the last visit? [ ] Yes=1 No=0

If yes, how many nights per trip? [ ]

What is the mode of transportation to reach there? [ ]

Walk =1 Public vehicle=2 Private vehicle=3

What was your last visit time/year to the Gwallek Kedar? ....year

Your expenses during the last visit (need to know when)..........

S.N.	Particulars	Quantity
7.8.1	One way travel /transportation cost	.... NPR
7.8.2	One way travel time	....hours
7.8.3	Time spent at site	.... hours
7.8.4	Food	.... NPR
7.8.5	Lodging	.... NPR
7.8.6	Bell	.... NPR
7.8.7	Bheti (Cash offering to god)	.... NPR
7.8.8	Other materials	.... NPR

With fuelwood, water, cooking material and lodging facilities, will you stay overnight? [ ]
Yes=1. No=0

For facilities mentioned above, how much you will pay per night per person? .... Rs.

Thank you!

Annexes for Chapter 2

Annex 2A: Results from Truncated Poisson Estimates

Table 2A.1: Truncated Poisson Estimates of Trip Generating Function (Patal Bhuwaneshwar)

Variables	Zero Truncated Poisson Estimates		
	M1	M2	M3
Travel cost	-6.93e-05***	-7.50e-05***	-7.17e-05***
	(1.66e-05)	(1.69e-05)	(1.67e-05)
Alternative site TC	-2.02e-05	-1.41e-05	-1.62e-05
	(1.52e-05)	(2.09e-05)	(2.10e-05)
HH income (base <50k)	-0.169	-0.327*	-0.360*
	(0.179)	(0.196)	(0.197)
Male	0.268*	0.201	0.132
	(0.150)	(0.241)	(0.244)
Respondent age	0.00690	0.00750	0.00890
	(0.00827)	(0.00898)	(0.00916)
Urban	-0.213	-0.411**	-0.353**
	(0.151)	(0.175)	(0.175)
Group size	-0.0128	0.00708	0.0115
	(0.0257)	(0.0262)	(0.0268)
Site quality (base: Average)			
Good			15.96
			(1,400)
Very good			15.97
			(1,400)
Recreational purpose	-0.209	-0.327	-0.343
	(0.286)	(0.296)	(0.297)
Respondent education (base: below 12th grade)			
Bachelor's		0.289	0.324*
		(0.190)	(0.193)
Masters and above		0.700***	0.666***
		(0.254)	(0.255)
Constant	0.788**	0.538	-15.47
	(0.355)	(0.455)	(1,400)
Pseudo R^2	0.17	0.19	0.21
Observations	188	185	185
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1			

Table 2A.2: Truncated Poisson Estimates (Patal Bhuwaneshwar day visitors)

VARIABLES	Zero Truncated Poisson Estimates		
	M1	M2	M3
Travel cost	-0.000194***	-0.000205***	-0.000166**
	(6.02e-05)	(6.57e-05)	(6.54e-05)
Alternative site TC	-2.37e-05	-1.61e-05	-2.32e-05
	(1.81e-05)	(2.47e-05)	(2.50e-05)
HH income (base <50k)	-0.160	-0.440*	-0.519**
	(0.209)	(0.233)	(0.242)
Male	0.332*	0.268	0.180
	(0.171)	(0.281)	(0.289)
Respondent age	0.00293	0.00797	0.00635
	(0.00896)	(0.00973)	(0.00993)
Urban	-0.0207	-0.329*	-0.269
	(0.156)	(0.192)	(0.190)
Group size	0.0225	0.0508*	0.0549*
	(0.0285)	(0.0290)	(0.0296)
Site quality (base: Average)			
Good			14.55
			(872.9)
Very good			14.65
			(872.9)
Recreational purpose	-0.336	-0.548	-0.601
	(0.431)	(0.443)	(0.446)
Respondent education (base: below 12th grade)			
Bachelor's		0.366*	0.390*
		(0.204)	(0.205)
Masters and Above		1.019***	0.978***
		(0.284)	(0.284)
Constant	0.846**	0.261	-14.29
	(0.391)	(0.545)	(872.9)
Pseudo R^2	0.11	0.15	0.16
Observations	108	105	105
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1			

Table 2A.3: Zero Truncated Poisson Estimates (Chandak-Aunla Ghat-Hat-Kalika)

	Zero Truncated Poisson Estimates	
Variables	M1	M2
Travel cost	-0.00120***	-0.00120***
	(6.18e-05)	(6.16e-05)
Alternative site TC	7.58e-05	7.62e-05
	(4.75e-05)	(4.77e-05)
HH income (base <50k)	0.0357	0.00494
	(0.0365)	(0.0372)
Male	0.179***	0.116***
	(0.0309)	(0.0340)
Age	0.00847***	0.0104***
	(0.000987)	(0.00108)
Family size	0.0142**	0.0117*
	(0.00695)	(0.00698)
Dalit	-0.211***	-0.165***
	(0.0336)	(0.0353)
Respondent's education (Base: less than 5th grade)		
More than Grade 6		0.151***
		(0.0342)
Constant	2.563***	2.424***
	(0.0612)	(0.0689)
Pseudo R^2	0.15	0.16
Observations	305	305

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 2A.4: Zero Truncated Poisson Estimates (pooled sample)

	Zero Truncated Poisson Estimates	
Variables	M1	M2
Travel cost	-0.000737***	-0.000738***
	(4.18e-05)	(4.21e-05)
Alternative site TC	0.000728***	0.000729***
	(2.74e-05)	(2.74e-05)
HH income (base <50k)	0.0278	0.0278
	(0.0263)	(0.0263)
Male	0.0764***	0.0763***
	(0.0233)	(0.0233)
Age	0.00716***	0.00720***
	(0.000760)	(0.000779)
Family size	-0.0241***	-0.0241***
	(0.00453)	(0.00453)
Dalit	-0.241***	-0.240***
	(0.0284)	(0.0288)
Respondent's education (Base: less than 5th grade)		0.00516
More than Grade 6		(0.0238)
	2.659***	2.655***
Constant	(0.0470)	(0.0505)
Pseudo R-squared	0.13	0.13
Observations	443	443

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 2A.5: Per Person per Trip Use Value of Cultural Services at KSL Area in NPR (USD) – Poisson Estimates

Patal Bhuwaneshwar	M1	M2	M3
Full Sample (Table 2A.1)	23,088 (222)	21,333 (205)	22,315 (215)
Day visitors (Table 2A.2)	8,248 (79)	7.805 (75)	9,638 (93)
Hat-Kalika visitors (Table 2A.3)	1,333 (13)	1,333 (13)	
Gwallek Kedar visitors (Table 2.7)	3,300 (32)	3,413 (33)	
Pooled sample of three watersheds (Table 2A.4)	2,171 (21)	2,168 (21)	
KSL Area			
Cultural (use) value for three sites	-	212.8 million (2.04 million)	-
Cultural value for KSL area (use value for local residents only)	-	19.04 billion (183.4 million)	-

Annexes for Chapter 3

Annex Table 3A.1

	Total water collection time in a day (dry)	Log of Total water collection time in a day (dry)	Total cost (income foregone) of water collection in a day (dry)	Total cost (income foregone) of water collection in a day (other)	Total cost (income foregone plus storage cost) of water collection in a day (dry)	Log of total cost (income foregone plus storage cost) of water collection in a day (dry)
Hat-Kalika	49.475 (4.05)**	0.641 (5.43)**	25.059 (5.94)**	1.248 (0.91)	15.211 (3.29)**	0.363 (3.63)**
Chandak-Aunla Ghat	57.216 (5.26)**	0.807 (7.03)**	29.74 7.64)**	15.864 (11.59)**	21.053 (5.03)**	0.601 (6.07)**
distance between house and road	0.369 (4.10)**	0.002 (6.00)**	0.126 (4.43)**	0.004 (0.92)	0.134 (4.31)**	0.002 (5.72)**
gender of the respondent	-0.108 (1.85)	-0.003 (4.30)**	-0.031 (1.52)	-0.005 (0.48)	-0.103 (4.33)**	-0.005 (6.31)**
Age of the respondent	-0.473 (0.08)	-0.068 (0.96)	0.477 (0.22)	-0.038 (0.05)	-0.875 (0.37)	-0.085 (1.35)
HH occupation = govt. job	-0.317 (1.39)	-0.003 (1.28)	-0.083 (1.06)	-0.079 (3.19)**	-0.149 (1.74)	-0.003 (1.36)
HH occupation = other than agriculture and govt	-8.849 (0.61)	-0.287 (2.03)*	-3.709 (0.79)	-0.983 (0.81)	-2.943 (0.55)	-0.217 (1.86)
Percentage of females in family	10.269 (1.42)	0.207 (2.06)*	3.628 (1.44)	1.291 (1.43)	5.087 (1.73)	0.127 (1.46)
Familyhighedu=primary	-21.914 (1.42)	-0.076 (0.36)	-7.834 (1.41)	1.586 (0.76)	-11.132 (1.8)	-0.167 (0.9)
Familyhighedu=secondary	-7.64 (0.69)	-0.159 (1.44)	-2.559 (0.67)	0.9 (0.7)	-3.877 (0.9)	-0.104 (1.09)
Familyhighedu=graduate	13.944 (0.65)	-0.105 (0.31)	4.717 (0.58)	3.581 (1.32)	3.323 (0.39)	-0.093 (0.33)
Dalits caste	-21.584 (1.51)	-0.42 (2.15)*	-9.053 (1.81)	-1.253 (0.73)	-12.92 (2.39)*	-0.429 (2.39)*
Traditional house type	-8.279 (1.42)	-0.119 (1.7)	-3.061 (1.37)	2.785 (3.09)**	-5.938 (2.49)*	-0.158 (2.45)*
Toilet (pukki)	5.843 (1.12)	0.058 (0.89)	1.602 (0.85)	-0.868 (1.17)	3.948 (1.89)	0.073 (1.25)
Irrigated land areas	0.823 (0.13)	-0.006 (0.07)	1.447 (0.61)	-0.013 (0.01)	1.241 (0.5)	0.055 (0.75)
Total land areas	-5.702 (0.09)	-0.444 (0.44)	-4.56 (0.17)	-20.303 (2.36)*	-30.48 (1.2)	-1.041 (1.09)
Income (50k – 1 lakh)	0.673 (1.9)	0.006 (1.79)	0.22 (1.81)	0.076 (1.98)*	0.332 (1.97)*	0.004 (1.29)
Income (1 lakh -3 lakhs)	26.791 (3.17)**	0.304 (3.51)**	9.593 (3.30)**	2.133 (2.35)*	10.683 (3.38)**	0.301 (4.12)**
Income (3 lakhs – 5 lakhs)	16.75 (1.8)	0.176 (1.61)	6.518 (2.03)*	3.229 (2.87)**	8.915 (2.48)*	0.276 (3.06)**
Income (more than 5 lakhs)	50.742 (2.03)*	0.391 (2.08)*	16.4 (2.09)*	3.407 (2.01)*	21.237 (2.44)*	0.355 (2.02)*
Livestock	-38.823 (0.47)	0.046 (0.07)	-12.027 (0.43)	1.862 (0.47)	-2.583 (0.08)	0.063 (0.1)

Livestock	-1.593 (1.77)	-0.007 (0.78)	-0.576 (1.84)	0.049 (0.46)	-0.47 (1.34)	0 (0.02)
Deodar in south east	-88.286 (4.65)**	-1.09 (6.20)**	-30.292 (4.92)**	-8.303 (4.38)**	-33.299 (4.55)**	-1.187 (8.69)**
Native Broadleaf in North east	-1.554 (0.15)	-0.216 (1.92)	0.275 (0.07)	-9.109 (4.57)**	-1.73 (0.37)	-0.255 (2.32)*
Native Broadleaf in West	-33.235 2.34)*	-0.427 (3.38)**	-11.184 (2.03)*	-11.413 (4.72)**	-15.736 (2.74)**	-0.473 (3.95)**
Native Broadleaf in South east	-27.244 (2.93)**	-0.372 (3.45)**	-9.923 (2.82)**	-7.427 (4.07)**	-12.46 (3.29)**	-0.38 (3.50)**
Native Broadleaf in South west	-55.721 (4.82)**	-0.794 (6.02)**	-20.46 (4.66)**	-14.261 (6.85)**	-22.006 (4.78)**	-0.661 (5.46)**
Mix in North east	-34.012 (2.97)**	-0.497 (1.72)	-13.449 (3.24)**	-6.98 (3.41)**	-16.174 (4.03)**	-0.398 (3.38)**
Mix in West	-12.629 (1.01)	-0.316 (1.84)	-5.2 (1.06)	-0.906 (0.5)	-3.683 (0.64)	-0.329 (1.75)
Mix in South east	-32.928 (4.08)**	-0.629 (5.41)**	-12.202 (3.92)**	-8.185 (5.86)**	-9.608 (2.81)**	-0.428 (3.72)**
Mix in South west	-24.078 (2.02)*	-0.354 (2.04)*	-8.73 (2.06)*	-7.103 (4.36)**	-5.941 (1.28)	-0.119 (0.71)
Conifer-mix in North east	-70.687 (5.22)**	-1.995 (1.8)	-26.725 (4.13)**	6.548 (0.69)	-27.182 (4.28)**	-1.639 (1.66)
Conifer-mix in West	-60.135 (3.61)**	-0.22 (1.23)	-21.398 (3.72)**	-7.213 (3.27)**	-28.42 (4.15)**	-0.346 (2.08)*
Conifer-mix in South east	-90.921 (3.45)**	-0.959 (1.92)	-30.423 (3.52)**	-5.375 (1.48)	-35.338 (4.00)**	-0.659 (2.37)*
Conifer-mix in South west	-1.575 (0.08)	0.503 (3.27)**	-3.806 (0.58)	-6.318 (3.62)**	16.585 (2.29)*	0.503 (3.66)**
Constant	32.37 (1.16)	3.898 (13.81)**	7.663 (0.8)	10.323 (3.20)**	25.204 (2.52)*	3.386 (13.87)**
Observations	950	950	950	950	950	950
R^2	0.25	0.23	0.26	0.33	0.27	0.23
Absolute values of robust t statistics are in parentheses						
* significant at 5%; ** significant at 1%						

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