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A Study Report on Economic Valuation of the Churia Region

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Acknowledgement

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1. Introduction and Overview

There is increasing concern in Nepal over the declining status and health of important watershed ecosystems. Watershed ecosystems are vital for they deliver key water quality and quantity services downstream and therefore sustain and promote livelihoods and economic development. Yet watershed conservation and management is increasingly becoming challenging. For example while vital for the delivery of water quantity and quality services, watersheds in Nepal are often occupied by upland dwellers for whom these ecosystems also provide essential goods and services (in the form of food, fodder, energy, medicine, construction materials etc.) for their survival and livelihoods. On the one hand, conservation of watersheds to ensure sustainable water services downstream can come with tremendous hardship and upland livelihood costs, and thus undermine the entire conservation effort. On the other hand, overexploitation of watershed ecosystems can come with high downstream economic costs. It is therefore becoming increasingly apparent that the approach to watershed conservation has to address both upland livelihood and downstream water services delivery concerns in order to ensure sustainable and enhanced upland livelihoods and downstream water services, livelihoods and economies.

Churia hills region is a little known but crucial example of a watershed that provides vital ecosystem goods and services supporting upland livelihoods and downstream populations in the Terai[1]. Churia Hills are the southern-most range of hills in Nepal lying between the plains of the Terai and the mountain ranges of the Himalayas with an elevation ranging from 120m to 2,000m. Most of the Churia Hills region is forested but is also inhabited in many places. Churia is considered to be playing a vital function as a watershed for the downstream Terai plain - where the bulk of the Nepalese population resides and relies on delivered water resources for domestic and agricultural purposes. Churia is also important for safeguarding the lives, livelihoods and properties in the Terai plains by regulating the water flow (reducing the flow in monsoon and ensuring the flow in dry season). Among the range of ecosystem goods and services Churia provides, some of the most important and directly visible benefits include support to upland household livelihoods in terms of Non-Timber Forest Products (fuel wood for energy, fodder and herbs). Common functions of a typical ecosystem are presented in Box 1.

Churia hills accounts for 13 per cent of the total land area of Nepal and accommodates about 13 per cent of the total population (NPC 2004). Churia hill's contributions to the livelihoods of upland dwellers (and nearby communities) are mainly in the form of non-wood forest products while the major contribution to the downstream communities in is in the form of water supply which supports about half of the total population living in this area (Bhabar[2] and Terai), and construction materials such as boulders, pebbles, gravel and

[1] The *Terai* is the southernmost stretch of plain land bordering India and comprises the most fertile belt of the country.

[2] The *Bhabar* is the gently sloping stretch of land lying between Churia hills and Terai plains, along the foothills of Churia. Bhabar serves as an excellent recharge zone for the underground water in Terai plains.

sand. Bhabar and Terai together cover about 23% of the total area and are inhabited by about 50% of the total population. The Terai plain is considered the 'Rice Bowl' of the country and has a share of about half of the total agricultural production of the country. Additionally, Churia contributes water to Dun valleys in the north as well and supports their agriculture.

But despite its tremendous importance, Churia's conservation and management is receiving little attention in official circles partly due to low awareness of its importance and so inadequate funding, and partly the pressing needs for socio-economic development investments. At the same time, Churia faces severe problems of degradation and over exploitation. Churia's natural habitats and ecological processes remain under heavy pressure from human activities compounded by natural factors such as its fragility and high intensity rainfall during monsoon. Common problems that *Churia* faces are soil erosion and landslides which are caused by heavy monsoon rains, frequent forest fire, intensive agricultural activities, encroachments and uncontrolled grazing. The Churia hills are geologically new, fragile and hence naturally prone to disasters such as floods, landslides and erosion. Upland residents suffer from land loss caused by erosion, mass movement and river bank erosion whereas downstream people suffer from flooding, sedimentation and inundation. Changing climate might impose further threats to Churia and the downstream population through climate vagaries, flood damages and impacts to agriculture. The scale of damages is often higher in the downstream Terai and would require huge investment in man-made infrastructure to mitigate or avert them. A more cost effective alternative could be to invest in watershed conservation and management in a way that could sustain and improve downstream water services (both quantity and quality) and sustain and enhance upland livelihoods. The loss of downstream water services can have immense social and economic ramifications for the overall socio-economic development of the Terai and thus the entire country.

Box 1: Ecosystem functions

A natural ecosystem has a range of functions resulting in varied important goods and services for human and other lives. These all can be grouped into four categories:

- *Regulation functions* – regulates essential ecological processes, purification of air and water; regulation of rainwater run-off and drought;
- *Habitat functions* – to wild plants and animals;
- *Production functions* – ecosystem goods for human consumption such as food, oxygen, water, raw materials, energy resources, or genetic material; and the
- *Information functions* – for science,

As is evident, major threats to the Churia Hills are economic and financial in nature, for example, over-exploitation and destructive harvesting of forest products, clearance and modification of natural habitats and ecosystems, alternative uses of investments, and inadequate funding to cover basic conservation and management costs. An overriding issue, and underlying cause of these threats, is the low appreciation and understanding of the economic value of ecosystem goods and services among economic decision-makers, which results in a situation where it is becoming progressively more difficult to justify investment in ecosystems management in the face of pressing needs for socio-economic development and poverty alleviation. In such a situation, upland communities remain uncompensated whether they practice sustainable land and resource management or not,

which contribute to the provision of downstream water services, while the downstream beneficiaries continue to benefit from ecosystem water services at almost no cost. Thus neither the upland communities nor downstream beneficiaries have the motivation and incentives to support conservation of the Churia. In fact, faced with a situation of lack of benefits and incentives for the maintenance and enhancement of the water services and dwindling income-generating and livelihood options, the upland communities are compelled to trade-off long-term livelihood and wider downstream benefits for immediate survival and livelihood needs by adopting unsustainable land and resource practices. The end result is the degradation and loss of ecosystem goods and services, which has dire implications for upland and downstream actors. Yet it is possible to harmonize the interests of both actors to support conservation by providing incentives through rewards to upland communities to undertake sustainable land and resource management.

Churia, Bhabar and Terai area are highly interlinked and any changes in land and resource use in the upper watershed area affects its capacity to deliver ecosystem services for the upland livelihoods and downstream people. Thus, there is an urgent need to demonstrate the economic value associated with conserving upland ecosystems for downstream benefits of goods and services, if planners and decision-makers are to be convinced that investing in watershed conservation and management is worthwhile for socio-economic development. At the same time, it is necessary to find equitable, efficient and sustainable mechanisms by which to reward the upland land and resource managers for the downstream water services they provide.

Towards fulfilling this information gap, The World Conservation Union (IUCN) Nepal, WWF Nepal and CARE Nepal made a joint effort to estimate the economic value associated with major ecosystem goods and services that Churia provides, and to ascertain the possibility of piloting a reward mechanism for Churia conservation and management such as Payment for Environmental Services (PES) as a local self sustaining conservation financial mechanism.

1.1 Study Objectives

This study aims to estimate the economic value of key goods and services provided by Churia hills region to local actors (both upstream and downstream) and will explore the possibilities of developing innovative mechanisms to raise financial resources for the sustainable management of the region, and to overcome current financial and economic constraints to conservation.

More specifically, this study aims:

- To assess the economic value of select goods and services provided by the Churia watershed,
- To assess the possibility of piloting innovative financial measures such as Payment of Environment Services (PES) that can act as incentives supporting conservation and management efforts.

This study aims to contribute to these objectives by designing a framework for addressing the degradation of Churia watershed ecosystems, and at the same time to strengthen the livelihoods of poor upland communities. It does this by valuing the current flow of benefits (goods and services) provided by Churia ecosystem, and the distribution of benefits among different stakeholders, so as to add value to the ongoing Churia Area Program Strategy development.

A key component in informing effective watershed ecosystem management is to understand upland livelihoods and the link to the provision downstream benefits. Generally upper watershed households in developing countries rely heavily on watershed ecosystems goods and services as key inputs to supporting livelihoods. Another important component is to establish the links between the provision of watershed ecosystem services and quantifying in monetary terms the benefits received by downstream users and the costs incurred by upstream providers.

This reflect the emerging concerns that in the absence of economic valuation of watershed goods and services, watershed management options may substantially undervalue the tremendous benefits to the users and consumers of perennial supplies of clean water, or may substantially reduce the potential value to livelihoods by preventing the uptake of other income-generating opportunities. The undertaking of environmental economic valuation and livelihood assessments would help in *capturing and distributing* the many non-marketed benefits provided by watershed services as real financial and economic resources as well as use them to offset the economic and livelihood costs and pressures that upstream providers and watershed ecosystems face. The methodology for this study seeks to the answer following key questions:

1. Who are the beneficiaries of Churia Hills downstream water services, and how much do they benefit?
2. What are the direct and indirect costs of watershed ecosystem management for water service delivery, and who bears them?
3. Is there a significant gap in costs over benefits that require compensation, for some or all (upland) ecosystem service providers?
4. Is there a significant net benefit to (downstream) water users that can be captured as payment for environmental services?

1.2 Scope and limitations of the study

Although there are many conceptual and empirical issues inherent in the estimates provided by this study, these estimates are expected to a) give the relative contribution of ecosystem goods and services to upland and downstream livelihoods b) serve as basis for further and broader analysis and c) stimulate further research and debates. Because only the key goods and services of direct and immediate concern to local communities are considered, and only the irrigation use of downstream water is considered, this study provides only a partial economic value, which would increase with more in-depth and broader analysis.

The foundation of economic valuation in this study, the linkages between land use in Churia hills and downstream water benefits, is based on local communities' perception and their observation on this linkage as well as discussion with experts. The communities and experts believe at least the surface water that reappears down in the river immediately after the Bhabar area originates from Churia, and any change in water availability is due to change in the watershed condition. It is felt that such local perception - based on close observation of changing watershed condition and water availability in the river over time is adequate to provide a good approximation. However, there could be other factors affecting the linkage. For example, there could be contribution of ground water (which in itself is a complex structure made up from different sources) in the river basin even near the point where water reappears; and change in water availability in the river could also be due to changing climate which has reportedly affected the rainfall pattern. To minimize the contribution of groundwater in the river, only a limited length of river water is considered as there is increasing chances of groundwater seepage into the river as it progresses down in the south. Due to lack of information and resource constraints, no hydrological assessment to establish the scientific linkage between upstream land uses and downstream water benefits was possible.

This study includes only four sub-watersheds all in the south face along the length of Churia hills. Given the vast difference in Churia from one place to another with respect to type of forest type, soil and pattern of settlement upstream and downstream the economic valuation of goods and services may not be representative for the Churia region as a whole, and thus, not extrapolated for the whole region.

During the field survey with upland households for this study, we observed that respondents were often reluctant to express what and how much of the goods they collect from Churia, and usually reported lower amounts than they actual collected. Further, some households collect goods and trade commercially, but are often hesitant to report as they know it's an illegal activity. Thus, any value reported for the Churia resources would be somewhere around the lower range of actual value.

The unique contribution of this study arises not only from its use of valuation, but from undertaking it on a wider scale across Churia and determining the value of ecosystem goods and services for the livelihoods of local communities. Besides, this study takes initiative to include water in the valuation.

1.3 Structure of the report

Chapter 1 presents the background, objectives and scope of this study. Four study sites taken for this study are briefly described in Chapter 2. Methodology and study approaches including literature review and processes are presented in Chapter 3, while Chapter 4 presents findings on economic values of different resources and a brief assessment of threats to Churia. Chapter 5 describes different innovative financial mechanisms with focus on payment for environmental services and its applicability in Churia context. An

assessment of policies concerning use of forest resources and major past programs for Churia region conservation are described in Chapter 6, followed by conclusion and recommendations in Chapter 7. References and Annexes are presented at the end of this document.

2. Description of study sites

2.1 Brief Introduction to Churia, Bhabar and Terai

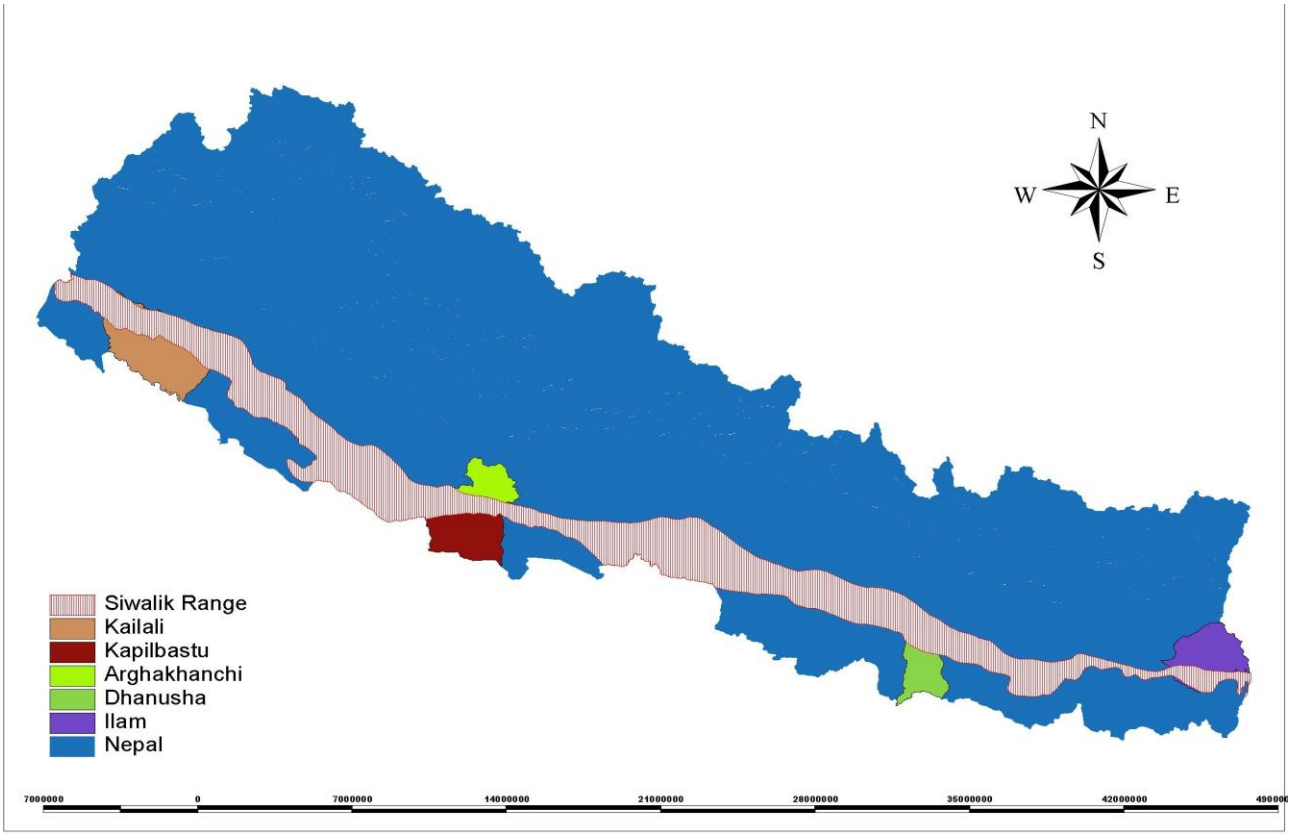
Based on the topographic features, Nepal can be divided into three distinct physiographic regions namely Terai, Hills and Mountains from south to north, and these regions run parallel across the length of country from east to west.

The Terai region is the country's southern flat plain with low elevation (60m in east to 300m in west) and is a northern extension of the Indo-Gangetic Plains. With its width of 25-32 km, and 17% of the total land mass it accommodates about half of the total population of the country. This region is the food basket of the country, and accounts for the half of the total agricultural production.

Lying north to Terai is the rising land called Churia or Siwalik belt with an elevation up to 1800m. It is the southern lowest range of Hills and occupies about 13% of the country's area (NPC 2004). Most part of Churia is covered by forest while some parts are inhibited and cultivated. Increasing human interferences and expanding infrastructures coupled with climate vagaries on top of its own fragile composition are causing serious threats to this region. It has varying elevation, climate and vegetation from one to another part. Churia area has been considered to be very important for conservation to protect Terai and its agriculture.

The rivers/streams that originate from Churia are ephemeral in nature with surplus water flow during four wet months (June-Sept) while very little or no water flow during rest of the year. These streams are characterized by flash floods. Churia is made up of highly fractured sedimentary rocks and have low groundwater retention potential. During wet season, rainfall amount exceeds by far the infiltration rate in the Churia hills; which coupled with its sloppy land generate flash floods, and retains little water to discharge during dry season. During dry season, those streams dry up in the Bhabar area as in the first instance there is little water to flow, a part of which infiltrates in the ground due to its pervious soil, and remaining (if any) water moves underneath the heavy sand/gravel deposited in streams (which has raised the river bed) in this area as opined by hydrologists. The water re-appears few kilometers down in Terai plain area. As the river moves down south in the Terai plains, volume of water is observed increasing which is due to groundwater seepage into it.

Figure 1: Map showing Churia range and the case study sites



Bhabar is a gently sloping narrow belt in between Churia and Terai. There is no clear delineation of Bhabar zone differentiating it from Terai, but this area is usually recognized by its soil structure around the foothills of Churia. Its estimated area is about 4014 sq.km., and is made up of mainly boulders, cobbles and pebbles. Being highly pervious with its coarse formation, it has a higher percolation rate that turns river channels of Churia origin dry during most part of the year in this region. The percolated water contributes to the groundwater of Terai, and thus, this area needs to be protected from unwise infrastructure development to ensure sufficient groundwater recharge in Terai.

2.2 Case Study Sites

This study is based primarily on information collected from four study sites (**Figure 1**) across the length of Churia hills, which were selected in consultation with all the study partners. Assessing the importance of water from Churia to downstream agriculture is an important intention of this study, and thus, selection of sites for case study were limited to few sub-watershed area that drains water into a particular stream. Based on secondary information, this study had identified Ghodaghodi lake (Kailali district), Banaganga watershed (Kapilvastu district), Jaladh watershed (Dhanusha district), and Chanju/Bagdwar watershed (Ilam district). However, after scoping visit to each of these sites, Ghodaghodi Lake was found inappropriate for the scope of this study. No direct (surface) hydrological linkage was found between Churia hills and Ghodaghodi Lake, and neither any direct or indirect linkages could be established through secondary information or through local people's

perception. In this situation, any economic value attributed to Ghodaghodi lake resources couldn't be attributed to Churia and thus, this site was replaced by Kandra watershed in the same district in consultation with WWF. Nevertheless, scoping visit to Ghodaghodi Lake gave better insight about its contribution to local community and its conservation needs, and found it important to study its economic value and explore local mechanism for generating conservation finance from its beneficiaries.

One of the three partner institutions is working for Churia Hill region conservation at each of these four sites. The sites are respectively:

- Chanju/Bagdwar watershed, Ilam – IUCN Nepal's working area
- Jaladh watershed, Dhanusha – CARE Nepal's working area
- Banaganga watershed, Kapilvastu – WWF/TAL working area
- Kandra watershed, Kailali – WWF/TAL working area

At each of these study sites, different coverage area for sample study was defined based on major beneficiary areas as suggested by local communities and respective partner organization working in the particular area.

2.2.1 Chanju & Bagdwar watershed

Site location and settlements: Chanju and Bagdwar watershed is located in Chulachuli VDC of Ilam district in the eastern development region. Chanju and Bagdwar streams originate from Siwaliks and flow close to each other. At this site, the study area is confined mainly to Chulachuli VDC that extends from up hills to Bhabar, while few cases were also taken from Topgachhi VDC (Terai) in Jhapa. Very few households live in the watershed area while majority lives at the foot hills. The study area accommodates about 1323 households including 136 in the hills. Total population is about 7.8 thousands.

Watershed condition: Forest in the lower watershed area is under community forestry while upper part is still state owned. Until few years ago, forest condition in the watershed was observed deteriorating continuously since last two decades due to over-extraction of resources and open grazing of livestock. Besides, some outsider elite people are supposed to be trading timber with the support of few local people. Even some of the community forest members themselves were found involved in illegal trading of bigger trees. Major damage to Churia forest was observed during last two decades; however, since the establishment of community forest groups some 6-7 years ago, positive changes have been realized.

CFUGs have much regulated the use of Churia forest resources and grazing of animals (roughly up to 70%), but haven't been much successful in controlling the illegal extraction of timber. Shrubs and greeneries in Churia hills have been increasing in recent years since the establishment of CFUGs. CFUGs have controlled grazing in the Churia hills and river banks to much extent.

At present, fuel woods are being heavily extracted by local as well as by few distant people

forcefully, though the current extraction rate is much lower than in past. Besides, a range of medicinal herbs are also collected but not yet for commercial purpose as very few people know the medicinal properties and use of those herbs, and also lacks market information. Some of the available medicinal plans are – *kurilo, madhu, sarpagandha, harro, barro, amala, chiraito, kurilo, gurjo, hadjora, sikari laharo, brufen laharo, pipla, rakta chandan, gokuldhup, saldhup, satisal, jethi madhu, kanchhi madhu, dudhiya, armathe, chandmaruwa, nageswari, pangra, bhalayo, rithha, rajbriksha, chabo, bhote pan etc.* Local community people also report to have observed different birds and animals that had disappeared for quite a long time, such as different birds, rabbit, kaleej, mayur etc.

River, Water and Agriculture: The local communities have observed increasing greenery and shrubs in the watershed area over past few years, and accordingly increase in water availability in the streams downstream. The situation is improving in both the streams in general but better improvement is seen in Bagdwar. River discharge in dry season has increased and numbers of water flow months have slightly increased in past few years compared to the situation a decade ago. In recent years water is seen in the river in the beginning of March while in past it used to appear not earlier than end of March or beginning April. Water from those streams is captured through traditional canals for irrigating the farms. Major crops grown in this area are paddy, wheat, maize and millets. Currently Chanju, Bagdwar and a pond at the foothills formed by Churia, together irrigate some 352 bighas[3] of land. Though water availability condition in those streams is reported as getting better, total land size irrigated has shrunk in a decade due to deepening river bed which makes diverting water to many areas difficult and economically infeasible.

Though not in all areas but mostly and especially towards foothills, people have observed increase in groundwater table in this area. There are evidences of earlier dried-up pumps having resumed working recently. Over last ten years, they have observed about 5-6 ft increase in water table (earlier water was available at 30-40 ft, now at 28-32 ft). Because of increased water table, drilling hand pump has become possible at many places that were not feasible earlier. Some people mostly in southern part of Bhabar also irrigate their farm through extraction of groundwater, but many are reluctant to do so as it turns their agriculture economically infeasible. However, further south in the downstream Terai (Topgachhi, Jhapa area) south to highway, farmers preferred to extract groundwater rather than using available water in those streams. It is because of subsidized electricity for irrigation purposes which makes it cheaper to extract groundwater than employing labour and other costs in tapping river water.

Flood damages: There has been huge land cutting and other flood damages in downstream areas during monsoon. Flood damages are reported more towards southern part of study area. In recent years, the extent of landslides in the watershed and flood damages downstream has reduced compared to situation 7-10 years ago. It maybe because of increasing greenery in the watershed, lower rainfall in recent years, and adoption of control measures at the river banks (grazing control, artificial structures,

[3] Bigha – a local unit for measuring land area; 1 bigha = 20 kattha = 0.667ha

bioengineering, grass cultivation etc.). Due to river control measures, water flows through narrow course and that has deepened the river bed in the study area, and the nearby community finds it difficult to divert water in canal, or incurs extra cost to extract water using pumping sets. During last few years this area is not getting good rains and thus no or little flood damages were observed, but it has adversely affected the agriculture.

2.2.2 Jaladh watershed

Site location and settlements: Jaladh watershed is located in the Dhanusha district in the Central zone of Nepal. There are nine[4] VDCs with a total household of about 11,600 in the Jaladh river command area from foothills to Terai plains. There is no settlement in the upstream area, and a small settlement of about 60 households is located at the foothills while majority live in Bhabar and Terai. The study area at this site extends in south to considerable length up to the tail of Hardinath irrigation canals covering all nine VDCs in the river command area.

Watershed condition: The forest condition in Jaladh watershed is reported to be in very pathetic condition, and further deteriorating over years. Forest in the watershed area has been very much cleaned open by over extraction of forest resources almost openly by nearby, downstream and distant people. Besides nearby communities collecting NTFPs for their household purpose, there are some professional timber and firewood collectors who collect a huge amount of these resources every day. It was reported that some 200-300 people are seen carrying head loads of those resources everyday and selling in local market. Virtually the livelihood of these economically deprived households is fully dependent on that collection.

Additionally, some well organized timber mafia is reported to be active that collect timber from this area. Almost all big trees are reported to have extracted and for further collection, one need to walk longer in the upper watershed area. Further damage is caused by open grazing by nearby communities which finishes almost all greens and shrubs and helps soil erosion flourish during monsoon. Neither the existing CFUGs nor the government machinery seems efficient in controlling such damages to the watershed. It was understood that it is partly because of political reason and partly because local communities are afraid to take any action against such collectors due to their power and threats. Some of the very common herbs available in this area are reported as *Kurilo, amala, satabari, muslo, gurjo, harro, barro* etc.

River, Water and Agriculture: Following the common characteristics of rivers originating from Churia, Jaladh River also dries up in the Bhabar area during dry season and water appears few kilometers down in the river and is captured by "Hardinath Irrigation System" which irrigates large agricultural land in the Terai plains. This irrigation system provides

[4] Pushpawalpur, Hariharpur, Mahendra Nagar, Digambarpur, Gopalpur, Baninia, Kachuri Thera, Laxmipur Bagewa, Tarapatti Sirsia

water to about 10k bighas partially, but full irrigation to major two crops – paddy and wheat were reported to some 5465 bigha of lands. Foothills and nearby Bhabar communities hardly get any water benefit from this river as the river bed is high due to heavy deposition of eroded sand and stones and no water is seen on the surface.
The continued destruction of watershed condition has obviously resulted in declining water availability downstream in dry season, increasing flood damages, declining groundwater table affecting more to foothills and Bhabar communities. The foothills and Bhabar communities are more benefited from Churia forest products but on contrary they get little or no water in the river during dry months and also threatened by out flow of flood water due to raised river bed. Downstream people in Terai plains get more water for irrigation and at the same time often suffer from negative externalities of watershed deterioration.

Foot hills and Bhabar communities increasingly face the shortage of drinking water during dry months. The depth of wells (the major source of their drinking water) goes down and many wells dry up completely, and affect the normal life of people. It increases the labor requirement for fetching water, extra burden to women who collects the drinking water for household, often causes conflicts and quarrels competing for water extraction, and in long term, has imposed a threat of further deterioration of situation. The current situation is stated as much worse than the situation a decade back.

Flood damages: The increasing soil erosion and landslides in the *Churia* hills have resulted huge sediment deposition in the river around the foothills and Bhabar areas, and raised the riverbeds. Due to raised riverbeds, flood water often changes it course and outflows easily to surrounding community damaging river banks and huge amount of fertile lands, livestock and other properties every year, and has also displaced many households away and turned many families landless. On an average, about 200 bigha of land are affected per annum on both sides of river south to the highway, mostly in Auraha, Katait, Andopatti, Echhapur, Tarapatti sirsiya.

A very interesting relation to note at this site is, there used to be more rainfalls in past but less damages due to flood, but now for last few years rainfall has decreased and the flood damage has gone up. People believe, it is because the flood used to flow quietly in past and was spread over longer time, but now high intensity flash flood comes which causes heavy damages, and lasts for relatively shorter time. More damages are observed towards end of Bhabar and beginning Terai range.

2.2.3 Banaganga watershed

Site location and settlement: Upper part of Banaganga watershed is located in Arghakhanchi district and partially in Palpa district while its lower part is in Kapilvastu district in the Western Region of Nepal. Altogether it stretches into 13 VDCs in these districts covering about 14k households including some settlements in the upstream area. The study area at this site covered all those VDCs from upstream to tail of the Banaganga irrigation system.

Watershed condition: During the Maoist conflict over a decade, this area was reportedly under heavy pressure of resources extraction – huge amount of timber is said to have extracted and traded through well established channels and contractors. No estimate for such extraction could be availed. Further, local people in and around Churia depends heavily on forest resources for daily subsistence. Even some far distant people from Terai is said to be collecting herbs and other resources from Churia. They extract timber, firewood and other materials openly as there is no authenticated CFUG nor District Forest Office is monitoring such activities.

Because of district boarder issues between Arghakhanchi and Kapilvastu, lack of community ownership, and lack of monitoring and regulation from District Forest Offices, resources from this area are being openly extracted by local and some distant people. In this area, only one CFUG exist in the upper watershed area which belongs to Arghakhanchi district. However, people in the lower watershed area have been making efforts to conserve the forest by delineating certain patch of forest as 'Mero Ban' (my forest) by particular communities in the watershed area, and trying to register the area as community forest.

Some of the commonly available and locally collected herbs for household use are *dalchini, harro, barro, amala, kurilo, harcharan, bilajor, parse, titepati, pakhanbed, badalpate, isagol, charchare, ganegarjo, saur, kafal, bel, kurilo, kalo masuli, kandamul, etc.* Local people indicate vast availability of those herbs and great potential to support local livelihoods if properly utilized. On the other hand some birds and animals are on disappearance, for example – many birds, flowers including rhododendron.

Water and agriculture: Large area of land downstream is irrigated through Banaganga Irrigation System that originates from Banaganga River about a kilometer down the highway called Laxmanghat. Water in this river is drained from both Banaganga and Koili sub-watersheds. Koili River is estimated to contribute about 60 percent of the total water flow in the river during dry season. A diversion canal from this system guides the water to Jagdishpur reservoir (approx. five km down the headwork) which in turn releases water into a main canal that runs about 20.5 km down in south and irrigates about 6710 bigha of land well for paddy and wheat. Considering all other crops throughout the year, this system is said to irrigate about 10k hacters of land. There is another irrigation system (Shringighat irrigation system) under construction north to highway in the Banaganga River which is expected to come in operation soon and irrigate about 2523 hectare of land. Besides, local farmers in their own initiative have been often diverting water from this river before it reaches to the system, and that has been a subject of conspiracy often between foothills farmers and Terai farmers.

The Jagdishpur reservoir has significance of getting Siberian birds in the winter every year. This study didn't try to value the importance of reservoir itself. However, this reservoir helps filter the sediment carried in the water, and protects downstream agricultural farms. It has now accumulated huge amount of silt at its base, and its cleaning is planned soon to

be done after over 20 years. Local water users have an impression that surface and groundwater level has been declining over years in the irrigation system.

Flood damages: an increasing amount of fertile land at the river banks mostly in Terai area has been reported. Similarly, lots of landslides are reported in upstream area also especially in Thadha and Simalpani. At this site also people have observed increase in flash floods damaging land and properties. There are very little control measures from some organizations initiated but no institution has the clear data on extent of damages caused by this river. It was noted from community workshop that about 40 hectares of agricultural land in the upstream area and over 1k hectares in downstream area are damaged in last one decade. Landslide at one site in upstream has created an artificial reservoir that collects water and poses risk of outburst and damage to nearby downstream people.

2.2.4 Kandra watershed

Location and settlement: Kandra watershed is located in Churia hills in the Kailali district in far western part of Nepal. Study area at this site covered foothills, Bhabar and to some extent in Terai (up to Saraiya). This study area has about 7k households, and there is no settlement in the southern face of Churia hills in this watershed. Two VDCs are settled on the north face – Pandon and Mohnyal and they feel to have ownership of up hills Churia and that often causes conflict with downstream people from south who goes for forest resources collection in this watershed area.

Watershed condition: In general, local people consider the current status of watershed as good but on continuous decline for long and on severe decline in last few years. Upstream people (on the north face of watershed), foothills and Bhabar people, being mostly poor, are highly dependent on Churia forest resources like firewood, herbs, bamboo, timber etc. for their household use while some are fully dependent on it and collects forest resources for commercial purpose. For commercial and household purpose, huge amount of especially timber were reported as being extracted annually from this area, and the case is more severe in recent few years. There are some formal or informal CFUGs at the lower watershed area, while upper watershed area is still under no control and is open used.

Some of the important NTFPs available and extracted are *bet, bamboo, harrow, barrow, pipla, amala, rittha, chiura, kurilo, kalo chiuro, plash flower (dhak), kachur (wild), kalachiuri bark (local people collected for commercial purpose in past but didn't get market), nirbise, dalchini, kachur, babio, simliko, bojo, tama etc.* There are very few people who collect those herbs for commercial purpose. Given huge amount of available herbs, local people feel that it could contribute substantially to local livelihoods if they had proper skills to recognize, extract and market them. These days, about half of the people depend on locally collected herbs from Churia for the treatment of general health ailments. Besides, some animals like *mriga, harin, kalij, neelgai etc.* are seen increasing in the Churia forest and sometimes local people go hunting for bush meats.

Due to open and uncontrolled resources extraction, some high value herbs and timber plants such as *Sissow, Simal, bamboo etc.* are almost disappeared. Recently the CFUGs are making efforts to plant such high value trees. Some of the major causes for damage to Churia forests were identified as poor people living around who have limited other livelihood options; no control from government side and inefficient CFUGs to do so; heavy resources extraction and commercial goat farming with big herds at the foothills areas etc.

River, water and agriculture: Kandra River doesn't have any well structured irrigation canal but irrigation is done through traditional seasonal canals. Water availability in the river is observed declining over years. Earlier, water availability was noticed all round the year but now it has water only during part of the year. Canals from river irrigated only about 500 bigha of land, but total irrigated land in this area is increasing due to increasing dependency of people on groundwater. As riverbed is going down, irrigation in some areas from river water is turning economically infeasible. With appropriate development of infrastructure there is good potential to irrigate most of currently unirrigated farms in the study area, from river. Due to shifting rainfall patterns, many farmers are not able to plant their crops in time and have to depend on alternate source for security, and thus, groundwater extraction is becoming very common in this area. Some people who have been using groundwater for many years have experienced decline in this source as well. Wells and hand pipes are now disappearing due to drying up and declining water, but southern plains, not much change in groundwater level is reported. Many water sprouts in the Churia hills and foothills have dried in recent few years.

Flood damages: Frequency of flood has declined over years but intensity of water in the flash floods has increased that cause more damages. Due to thinning of watershed forest, more flash floods area generated and more damages in the downstream especially in Terai part is caused. Huge amount of sediments are deposited in foot hills and Bhabar area, and water flows from its beneath. However, in very recent few years, such damages has declined for reasons like declining rainfall and thus lower floods, and increasing greenery around the river banks. It is observed that more land cut is in the area with human settlement, maybe because human interferences make the river bank more fragile.

3. Methodology and Approach

3.1 Total Economic Valuation (TEV) Frameworks:

The Total Economic Valuation (TEV) framework provides a systematic approach for assessing the total economic values of all the goods and services produced by a resource-based system (Pearce 1993). TEV includes the use value and non-use value of a resource (**Table 1**). The use value may be further classified as direct use value (consumptive, non-consumptive), indirect use value, and option value (option, bequest). The economic values of selected goods and services are calculated from their direct use values, while other values (indirect uses, option, non-use) are not considered in this study.

Table 1: Total Economic Valuation Framework

USE VALUES	NON-USE VALUES
Direct values: refer to ecosystem goods and services that are used directly by human beings. They include the value of consumptive uses such as those providing energy, shelter, foods, timber, medicines, agricultural production etc. and non-consumptive uses include values for enjoyment of recreational and cultural activities.	***Existence values:*** *(or non-use or passive use values)* refer to the intrinsic value that people enjoy simply by knowing a resource exists, regardless of their current or future use possibilities. This is the most difficult type of value to estimate, since in most cases it is not reflected in people's behavior and is thus unobservable.
Indirect values: are derived from ecosystem services that provide benefits outside the ecosystem itself in maintaining and protecting natural and human systems. Examples include maintenance of water quality and flow, and flood control which often benefits downstream people; nutrient retention and micro-climate stabilization; carbon sequestration which benefits the entire global community. As many of these services are not priced due to lack of market, and also often difficult to measure the quantities of these services, measuring indirect use value is considerably more difficult.	
Option values: the premium placed on maintaining a resource for future possible uses, either by oneself (option value) or by others/heirs (bequest value). Example of option value could be one's willingness to pay today for the option to use the resource tomorrow. Provisioning, regulating, and cultural services may all form part of option value to the extent that they are not used now but may be used in the future. **Bequest** values refer to the present generations' desire to bequest the resource for future generations.	

3.2 Economic Valuation Tools

For the goods and services brought to the market, economic value is indicated by market price determined by their demand and supply. However, in case of environmental goods and services which are often not brought to the market or are traded in imperfect markets, their true economic value is usually underestimated causing inadequate attention in decision-making and inefficient resource allocation. Inadequate recognition of the value of those goods and services would result in depletion, degradation and overexploitation of the environmental resources and eventually lead to loss of social welfare since these resources form the basis for the basic livelihood of a considerable number of households in developing countries.

Over the past few decades, while economic valuation of ecosystem goods and services, especially non-market ones has received much attention, still it remains a work in progress (Boyd and Banzhaf, 2005). Many tools and techniques have been devised and used widely for valuing the non-market benefits and costs associated with the environmental and natural resources. All the existing valuation tools can be broadly categorized into *revealed preference methods, stated preference methods* and *cost based methods* (**Figure 2**). Revealed preference methods rely on observed behavior about the individual preferences for the environmental and natural resources either through direct market or through surrogate markets. Stated preference methods elicit respondents' preferences for non-market goods and services directly through surveys and the value measures are commonly expressed in terms of willingness to pay (WTP) or willingness to accept (WTA) compensation, either of

which can be defined in terms of the quantities of a good an individual is willing to substitute for the good or service being valued or in terms of monetary units (Freeman, 1993).

Commonly-used tools for valuing environmental goods and services

Direct Market Valuation: Some goods and services are commercially traded in market such as many NTFPs, timber, recreation etc. The simplest and most straightforward way of valuing such goods and services is to look at their market prices — what they cost to buy or what they are worth to sell. To obtain economic value, all the product prices needs to be first corrected for any price distortions and the associated costs with resource extraction and transportation be deducted. Market price does not account for consumer surplus[5] and thus underestimates the true economic value.

Indirect Market Valuation: When there are no explicit markets for services, we must resort to more indirect means of assessing values. It includes tools like *avoided costs, replacement cost, factor income/effect on production, travel cost, hedonic pricing,* etc.

Effects on production: economic processes often rely on environmental resources as inputs. Where the output produced so has a market, it is possible to look at the contribution of environmental goods and services to the output in order to assess its value.

Travel costs method (TCM): this is one of the revealed preference approaches wherein the value of an environmental resources is determined from expenditure people make to reach and enjoy the recreational site. Spending such as on transport, food, equipment, accommodation, time, etc. can be calculated, and a demand function constructed relating visitation rates to expenditures made. These travel costs reflect the value that people place on leisure, recreational or tourism aspects

Hedonic Pricing: Some environmental goods and services are valued based not fully on its own qualities but there could be some environmental attributes contributing to the value. For example, a house located at beautiful landscape may be valued more than a similar house located elsewhere. The additional amount one would be willing to pay for the house at beautiful landscape my provide information on the value of that landscape. This tool can measure only use values and depends on observable data resulting from the actual behavior of individuals.

[5] The additional amount that consumers would be willing to pay over what actually they paid.

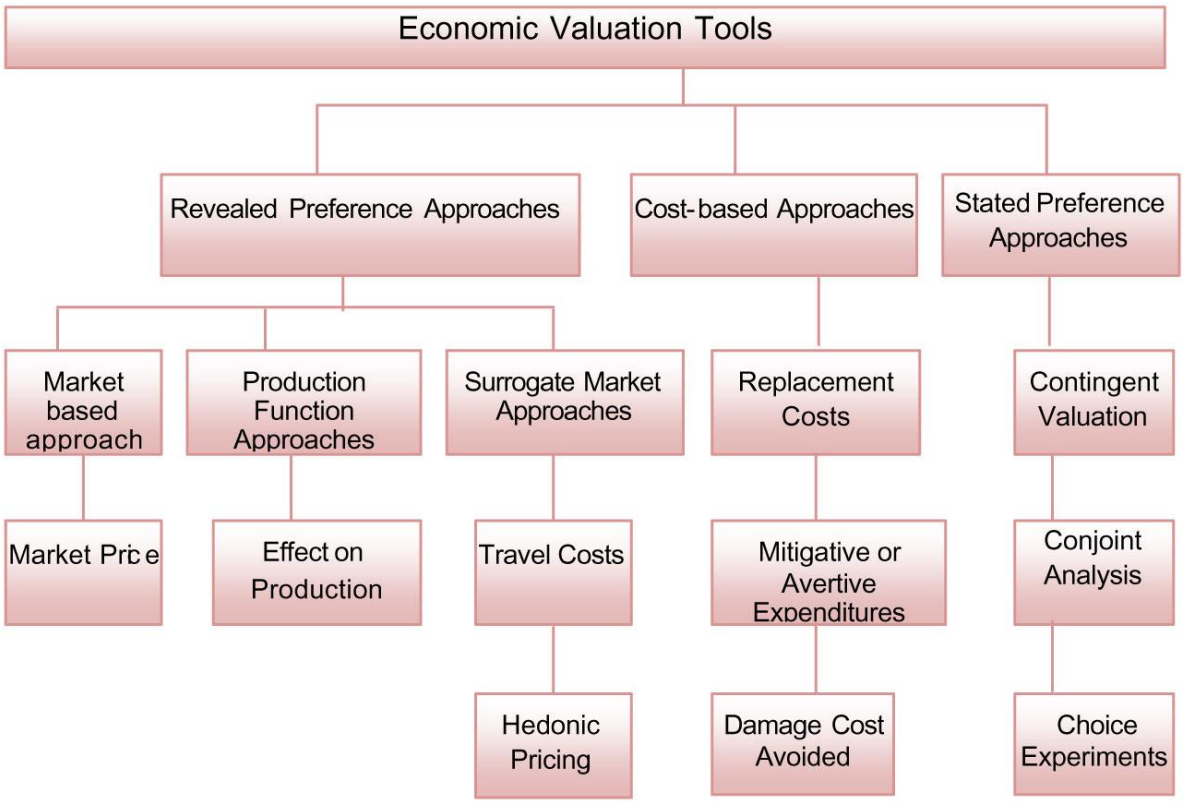


Figure 2: Economic Valuation Tools

Contingent valuation: Even where environmental goods and services have no market price, and no close replacements or substitutes, they frequently have a high value to people. Contingent valuation techniques infer the value that people place on goods and services by asking them their willingness to pay for them (or willingness to accept compensation to tolerate a loss) under the hypothetical scenario on environmental improvement, damage prevention, etc. Contingent valuation techniques are one of the few methods that can be used to assess option and existence values.

Avoided costs or mitigative or avertive expenditures: It estimates the costs involved in taking action to mitigate or avert the negative effects of the loss of environmental goods and services, so as to avoid economic damage. It is the upfront payments required in order to avoid the economic damages. The costs involved in taking such measures can be taken to represent the economic losses foregone by conserving the environment.

Replacement costs: Even where environmental goods and services have no market themselves, they often have alternatives or substitutes that can be bought and sold. These replacement costs can be used as a proxy for the resource and ecosystem values, although usually represent only partial estimates, or under-estimates.

3.3 Literature review

Economic valuation of the ecosystem's goods and services is relatively a new concept,

especially in the developing world. Available literature on economic valuation of different ecosystems in Nepal were reviewed to understand the status of environmental economic assessment of natural resources and of payment for environmental services in Nepal; to identify important goods and services and their contribution to different stakeholders' livelihoods; and to identify the appropriate methods for assessing the economic values of goods and services that Churia provides. Beside these, many studies from outside the country were also reviewed to supplement the tools and techniques for assessing economic values.

There are few examples of economic valuation of ecosystem goods and services undertaken in Nepal. Some of the related studies in economic valuation in Nepal are those by Emerton and Iftikhar 2006; Niraula 2003; Rana 2004; Kanel and Sigdel 2004; Karki 2002; Kanel and Varughese 2000; Houghton and Mendelsohn 1997; Ujjwal 2000; etc. A recent study completed by IUCN in the Shivapuri National Park area has estimated the economic value of water used for irrigation, electricity generation and domestic water supply. Beside this, no effort seems to have made in valuing use of water resources in Nepal. These studies have used different methods of valuation for traded and non-traded goods and services, depending upon availability of resources and information.

Economic valuation methods place consumer preferences in the center and thus ecosystem goods and services are valued by people based on welfare they obtain from them. The economic valuation methods focus on the exchange value of ecosystem services, which is the trading ratio of these goods and services. If they were to be traded on markets, the exchange value would simply be their market price (Winkler, 2005). There are a range of economic valuation methods devised to estimate the exchange values when market is absent or doesn't adequately reflect the economic values (e.g. Farber et al., 2002; Boumans et al., 2002; Daily and Ellison, 1999; El Serafy, 1997; Costanza et al.,1997).

In Nepal, Winrock has promoted a PES-like mechanism, under the RUPES project, with the objective of promoting sustainable livelihoods among upland communities in the Kulekhani watershed of Nepal. Located about 50 km southwest of Kathmandu, Kulekhani watershed in Makwanpur district covers an area of 125 km2 and contributes water to two hydropower plants generating a total of 92 MW electricity (about 17% of Nepal's total installed hydropower capacity). About eight thousand upstream households are now benefit from hydropower benefit sharing provided to them for their conservation efforts in the watershed. Their conservation efforts have added over NRs 3 million to the revenue by lowering sedimentation and making more water available for the generation of electricity.

Review of available literatures shows that most of the studies are focused on to value goods from natural ecosystems and little attention is aimed towards valuing the services. Though studies are limited, it definitely shows that efforts have been made to introduce economic evaluation methods and economic instruments in Nepalese context. No valuation study was found for the water resources from Churia hill region.

Churia region is quite often reported to be the major recharge zone for Terai groundwater,

however, this study couldn't benefit from any literature verifying mentioning it on concrete grounds. Due to lack of information, linkages between Churia conservation and water availability downstream couldn't be established. Though hydrologists believe that Churia certainly plays role in ground and surface water contribution to Terai, no empirical study is available to show the extent of relationship.

3.4 Valuation tools used

This study measures the direct use values under TEV framework for the selected goods and services, regardless of whether they are currently marketed. For the goods services that are commercially traded in the market, their values are determined from market prices. For those goods and services which are not traded in the market, different approaches were adopted such as opportunity cost of time they spend in extraction of resources, and through the contribution of a resource to the production of a good.

Lots of resources are being extracted illegally by distant unidentified people, estimates for which could not be availed. But discussion with communities in Churia around indicates that illegal channels accounts for the major share of total resources being extracted from Churia, and they focus more on high value resource such as timber and especially Sal (*Sorea robusta*). Due to lack of estimate for the resources collected by distant people, no valuation effort was made for such resources.

Based on the literature survey for the available economic tools and their application, this study found it appropriate and used following methods for valuing specific goods and services. The study estimates the annual collection of resources at the current prices of 2007. Major goods and services valued in this study are mainly NTFPs and timber collected from the Churia region, and sand/stones and surface water utilized from the rivers under study. Collection of sand/stones from rivers is usually contracted out by District Development Committee without considering any environmental implications. However, information on contract amount for a particular stream under study couldn't be obtained in all cases, and thus, their values are calculated from estimated quantity extracted and amount paid per unit. Other resources are valued as:

3.4.1 Valuing forest ecosystem goods

There are many recent attempts to capture the value of NTFPs that are consumed for subsistence or informally traded; some examples are Shone and Caviglia-Harris, 2006; Mahapatra and Tewari, 2005; Delang, 2006. They use a wide range of valuation techniques depending upon the context. As many of the NTFPs are not traded in the established markets, estimating their value is often harder than that of timber benefits. Most commonly extracted forest ecosystem products from Churia hills are firewood, fodder, herbs, bamboo and timber. Those goods are usually collected for own household use while some are involved in trading those resources in local and distant markets. Valuation work in this study considers the total reported quantity of resources collected legally or

illegally. For the traded goods like firewood, herbs, bamboo and timber, market prices are available and thus, often *stumpage price*[6] is used to value them. The cost of extraction and transportation is usually in the form of opportunity cost of labor employed in those activities and finally enters as income to the household. However, in this study the market values are directly used as the value for those traded goods which also includes the labor costs involved in their extraction and transportation, and gives gross values. For fodder which is generally not traded, opportunity cost of labor involved in its collection was used as the value, at the rate official wage rate of Rs.100 for eight hours a day.

3.4.2 Valuing Water as a good

In this study water is regarded as an intermediate good and its contribution in agricultural productivity is measured. Agriculture being the major user of water in the downstream area, this study has limited its focus to the value of irrigation water. The value of water to a user is the maximum amount the user would be willing to pay for the use of the resource. Despite the technical difficulty of valuing water for irrigation due to the lack of a market, several methods have been devised to ascertain the value of water in different uses. Some of the methods available for valuing water as an intermediate goods are producer's demand function, residual imputation, value-added, and alternative cost. The residual imputation method is one of the most prominent techniques employed to estimate the value of water as an intermediate good in agricultural production, and hence applied in this study as well.

The residual imputation method

This method is often used for valuing irrigation water for which a market price is not available. In this method, the total value of output is allocated among each of the inputs used in the production process, i.e., the additional contribution of each input in the production process is determined. If appropriate prices can be assigned (market prices) to all non-water inputs, the remainder of total value of product is imputed to water (the residual input in our case). The method is based on assumption that the prices of all resources are equated to their *value of marginal product*[7] which exists in perfectly competitive markets for agricultural inputs. In such situations, a rational producer goes on adding inputs up to the point where the value of marginal products is equal to the cost of the additional inputs.

The residual imputation value of water can be derived by using a production function where the output (Y) is produced using four factors of production namely capital *(K)*, labour *(L)*, other natural resources *(R)*, and water *(W)*

[6] Market price net of extraction and transportation costs.

[7] The *value of marginal product* of an input is the incremental amount in total revenue due to one additional unit of this input. It is equal to the marginal physical product of the input multiplied by the price of the commodity produced.

$Y = f(K, L, R, W)$ ..... (i)

In this production function, total value of output/product (TVPY) is represented by:

$TVP_Y = P_K \times Q_K + P_L \times Q_L + P_R \times Q_R + P_W \times Q_W$ ..... (ii)

Where,

P_i stands for price of input 'i' (i = K, L, R, W), and

Q_i is the quantity of input 'i' used

$P_i \times Q_i$ represents the share of input 'i' in the value of output 'Y'.

When all variables in equation (ii) are known except P_W and Q_W, the contribution of water to production process of a crop can be derived as:

Value of water $(P_W \times Q_W) = TVP_Y - (P_K \times Q_K + P_L \times Q_L + P_R \times Q_R)$ .....(iii)

Equation (iii) gives the net benefit imputed as the value of water input in a crop produced. However, this technique may give misleading result in case if any important input is omitted. In such case, the productivity of omitted input gets attributed to the residual claimant (water in our case) and inflates its value.

Alternately the value of irrigation water in the Nepalese context, where input prices often don't reflect the real price, could be estimated by comparing the difference in net returns from irrigated and unirrigated farming for a crop within a homogenous farming area having similar other factors such as soil type and climate. This difference amount could be attributed to the irrigation water. This method allows the separation of normal profits from the value of the water.

3.4.3 Cost benefits distribution:

A number of local groups depend heavily on forest goods and services for their livelihoods, and yet have often been marginalized from watershed management related decision-making processes. These include, for example, women, the landless, indigenous communities and the extremely poor. Different stakeholder groups often heavily differ in perceiving costs and benefits from ecosystems.

Understanding the magnitude and mix of net benefits received by particular groups gives an idea on which groups are motivated to conserve or destroy an ecosystem and why, and helps design a more effective conservation approaches. This study has therefore taken into account their livelihood circumstances, and explored the needs and opportunities for mechanisms which can provide them with tangible economic rewards for the provision of ecosystem water services.

3.5 Data Collection

3.5.1 Desktop Study/Secondary information collection

A desktop study was conducted to find available information concerning economic valuation studies within Nepal, with a focus on the Churia area. This study examined important goods and services provided by Churia region, their contribution to livelihoods, water linkages between upstream (Churia hills) and downstream (Terai plains), appropriate sites for conducting case studies etc. Further several concerned people/organizations were visited to collect any relevant information available on these subjects.

3.5.2 Scoping Visits

Scoping visits were made to the identified case study sites to assess their relevancy, and to understand the important goods and services offered by this region and the linkage between Churia watershed and upstream/downstream people's livelihoods. During these visits, district level offices of forest, soil conservation, and agriculture, and CFUG members, key persons from the local communities were visited to get better insight into the importance of Churia for the local communities and costs of Churia conservation. Further, published and unpublished secondary information from concerned organizations were collected. The desktop study combined with information gathered from scoping visits helped in selecting key goods and services to be included in the study.

3.5.3 Selection of key goods and services:

There are a range of important goods and services of local, national and global relevance (production, cultural and recreational, biodiversity conservation, carbon sequestration etc.), provided by Churia, and valuing them would be of great importance from a 'national accounts' context. However, due to the lack of secondary information on economic aspects of Churia resources coupled with limited time and resources available for this study, only a few key goods and services that contribute directly to the livelihoods of upstream and downstream people were selected.

Across the four sites, major NTFPs (firewood, fodder, herbs, bamboo) and timber from Churia hills, and surface water for irrigation and sand/boulders from concerned streams were considered in this study. Different stakeholders and partner organizations were consulted in the selection of those goods and services

Since water is turning into a scarce good in many parts of the world and because developing nations are more vulnerable especially in the face of climate change, it is important to make decisions about conservation and allocation of water that are compatible with social objectives such as economic efficiency, sustainability and equity. In Nepal, the majority of people depend on agriculture for their livelihoods and over two thirds of cropped lands are still rain fed. Any threat to irrigation water availability or change in rainfall pattern would severely affect agriculture and especially the livelihoods of

the poor who depends on subsistence farming. As several academics hold that water will be 'the oil of the twenty-first century', improved water resources management gains importance, and considering water as an economic good and assigning economic value to it can be one of the most important tools in this respect. However, the task of water valuation has been a complex and controversial issue as it is available without cost at some locations while at a high cost at others.

Though linkage of upstream land uses and downstream water availability is not clearly neither established through this study, the surface water use for agriculture in the downstream is valued in this study as the local people strongly believe this relation does exist. Attaching economic values to those key goods and services would help spark the idea of economic valuation of marketed and non-marketed good and services, and to explore the possibility of piloting innovating conservation mechanisms.

3.5.4 Primary Data Collection from Field

Primary data were collected through household interviews, community level workshops and semi-structured interviews with the key informants from the study areas. The collected information was processed using excel and SPSS statistical package.

a) Household survey

A household survey was conducted through personal interview using a structured interview schedule. The interview schedule includes both quantitative and qualitative information on the type, output and seasonality of livelihood activities at different times and for different groups. Mainly the information sought through the household survey pertains to the household's demographic structure, socio-economic status of the household, main livelihood options, inputs to and outputs of agriculture and livestock, their observation and perception on changing level of surface and ground water availability in relation to Churia land uses, main water uses, dependence on Churia resources for livelihoods etc. The interview schedule used for this study is enclosed as Annex 1. To the extent possible, a senior member of the household was interviewed.

Sample size: Care is taken to cover a representative sample of the population that includes different socio-economic groups from upstream area to downstream plains at each study site. Special attention was given to cover the water beneficiaries from the concerned streams. Stratified random sampling was used to identify sample households for the survey, strata being physiographic zones (Up hills, Foothills, Bhabar and Terai) at each study site in the first step, and socio-economic classes in the second step. A manageable, yet

Table 2: Sample household distribution

	Study Site					%
Physio-region	Chanju Bagdwar	Jaladh	Banaganga	Kandra	*Total*	
Up hills	6		23		*29*	***8.4***
Foot hills	37	3	3	9	*52*	***15.1***
Bhabar	20	4	5	18	*47*	***13.7***
Terai	11	67	69	69	*216*	***62.8***
Total	*74*	*74*	*100*	*96*	*344*	***100.0***
%	***21.5***	***21.5***	***29.1***	***27.9***	***100.0***	

representative, sample size was decided upon beforehand based on consultation with key local persons about the size and nature of the population. The total sample size for a study site was distributed among different strata in proportion to population in each of them. Distribution of sample households across the study sites and physiographic sections is presented in Table 2.

This spatial distribution of sample households is based on respondents' view of their physiographic location. As there is no clear demarcation of these zones, there can be minor changes in this table especially because at transitions from one to another zone, local households are not entirely sure of which zone they belong to.

b) Community workshops

Consultation workshops with participation of people representing different socio-economic groups, CFUG members, irrigation users and key informants from upstream, foothills and downstream were organized at each study site. These workshops sought to collect information regarding important goods and services being provided by Churia hills, the scale of their uses and users, their perception on hydrological linkages between upstream and downstream, area irrigated by surface water and crops benefited. Besides, information was also elicited on how the conservation status of Churia hills is changing over years and if there is any visible change observed in water availability in the downstream area, and their perception of whether such changes downstream could be attributed to land use changes upstream. These workshops were organized in consultation and with the full support from partner organizations wherever they are present in the field.

4. Results and Discussion

4.1 General features of sample households

This section provides demographic information of the sample households in the study areas. To the extent possible, information is kept brief with self explanatory tables and graphs.

Population and gender: Considering the whole population of all four study sites, the average family size is 6.7 persons. Variation in family size across the study sites is presented in Table 3. Family size was observed differing across social classes (caste) as well (Brahmin/Chhetri 6.3, Dalits 6.8, and Janajatis and others 7.0). Male constitutes little more than half of the population in general (52.6%) but much higher in Jaladh (59.4%) area and even less than half in Chanju Bagdwar area (48%).

Table 3: Family size of sample HH (Av. No.)

Study Site	Chanju Bagdwar	Jaladh	Banaganga	Kandra	Total
Up hills	6.5		7.1		7.0
Foot hills	5.6	12.0	11.3	6.9	6.6
Bhabar	6.6	8.0	7.4	6.2	6.6
Terai	5.8	7.3	6.4	6.8	6.8
Overall	6.0	7.5	6.8	6.7	6.7

Age group: the whole sample population was divided into different age groups to see the proportion of economically productive population and other dependent categories. In general about 58% of the population was between 16-50 years which is seen as the most productive age group, while about a third of population falls in the child group up to 15 years of age and rest were in the elderly group (Table 4).

Table 4: Age group of sample population

Study sites	Age groups (years)				
	01-15	16-50	51-60	60+	Total
Chanju Bagdwar	26.4	60.1	7.5	5.9	100
Jaladh	28.3	59.3	7.3	5.1	100
Banganga	31.4	58.4	6.2	3.9	100
Kandra	34.8	56.2	4.9	4.1	100
Total	30.7	58.3	6.4	4.6	100

Educational status: In general, a little less than half of the total sample population didn't have any formal education; it varied from lower of about 28% for Jaladh and Chanju Bagdwar area, to higher of about 60% in Kandra area (Figure 3). With respect to educational status, Jaladh and Chanju Bagdwar areas seem better. Very few people have obtained education beyond school level. Further, educational level among females is relatively poorer with about only half of their population having some formal education (Figure 4).

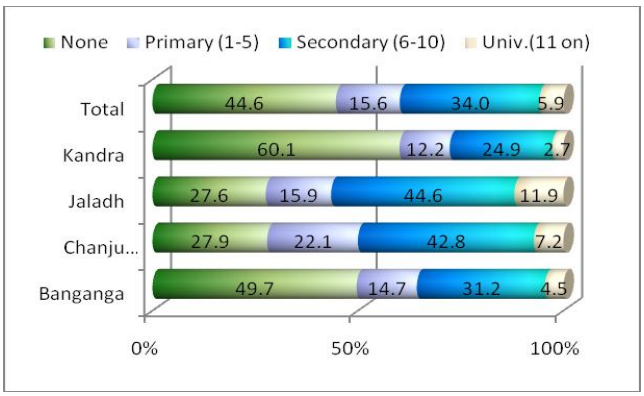


Figure 3: Educational status across study sites

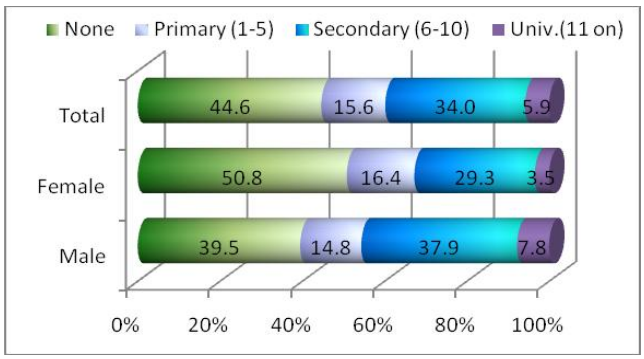


Figure 4: Educational status vs. sex

Religion and socio-economic status: majority of sample population followed Hinduism (85.5%) followed by little over 7% each of Buddhism and others. Chanju and Bagdwar reflected a good mix of different religions with higher proportion of Buddhism and others (Figure 5). According to prevailing so called social classes, which determines to a greater extent the access of people to different resources and status in the community, about one–third of sample population belonged to higher caste called Brahmin/Chhetri, about 24% to Dalit group who are considered socially lower class, and about 45% in Janajatis and others in general. Some of the significant variations were seen in Jaladh site wherein the higher caste people were just about 2.7% with majority of Janajaties (Yadavs and Saha made it higher), and in up hills where Brahmin/Chhetris dominates others with about 59% of their population (Figure 6).

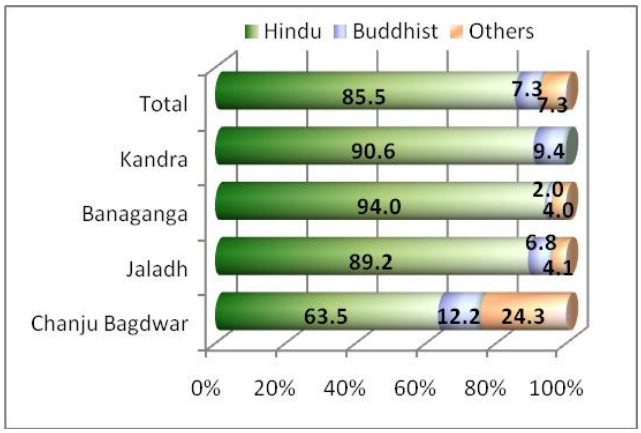


Figure 5: Religion of sample population

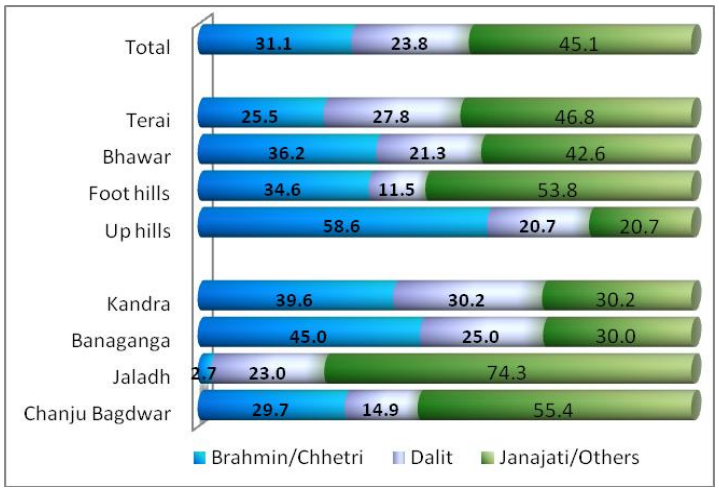


Figure 6: Social classes (caste) of sample population (%)

Economic status: to have some sense of how Churia resources contributes to people in different economic categories, an effort was made to see if access to Churia resources varies among people of different economic status. To do so, the sample households were categorized into three groups based on per capita total income from all sources. Bottom 40%, middle 35%, and upper 25% formed these three groups EC1 (i.e., economic class 1, relatively poor), EC2 and EC3 (relatively better) respectively (Table 6). Among agrarian communities, land holding size also forms a good indicator of the economic status of people. Average land holding size per household in the study area is about 26.1 Kattha, which varies around 21 kattha in Banaganga and Kandra areas to 27.5 in Chanju Bagdwar and 38.7 Kattha in Jaladh area (Table 7). Another important source of livelihood is livestock, which is seen in average almost three times higher (9.8) in number in up hills compared to the size in Terai (3.4). From Terai, moving north towards upstream, the size of livestock raised is at increasing order (Table 5). This may be due to better access of Churia and nearby people to fodder at little or no cost. In the Churia and nearby areas, goats constitute a little over half of the livestock size and it indicates a possible threat to Churia if open grazing is not under control.

Table 6: Distribution of sample HH across Economic classes (%)

	EC1	EC2	EC3
Chanju Bag..	59	27	14
Jaladh	24	39	36
Banaganga	41	37	22
Kandra	36	35	28
Up hills	45	34	21
Foot hills	52	35	13
Bhabar	47	30	23
Terai	35	36	29
Total%	40	35	25

Table 7: Average land holding size (kattha)

	Chanju Bagdwar	Jalad	Banaganga	Kandra	Total
Up hills	18.8		33.8		30.6
Foot hills	32.1	38.3	11.5	16.8	28.2
Bhawar	27.4	27.5	11.1	16.3	21.7
Terai	18.3	39.5	18.4	22.8	25.9
Total	27.5	38.7	21.4	21.1	26.1

Table 5: Av. No. of livestock in sample HH

Study sites	Av. #	Physio-zone	Av.#
Chanju Bag..	6.3	Up hills	9.8
Jaladh	2.3	Foot hills	7.0
Banaganga	4.4	Bhabar	5.0
Kandra	5.6	Terai	3.4
Overall Av.	4.7		

Occupation: As in the other areas of country, majority of population in the study areas depends primarily on agriculture for their livelihood. It varies from 60% in Jaladh area to about 75% in Kandra. The rest of them are involved in various activities like personal own business, government job, private job, wage laborer, and so on (Figure 7).

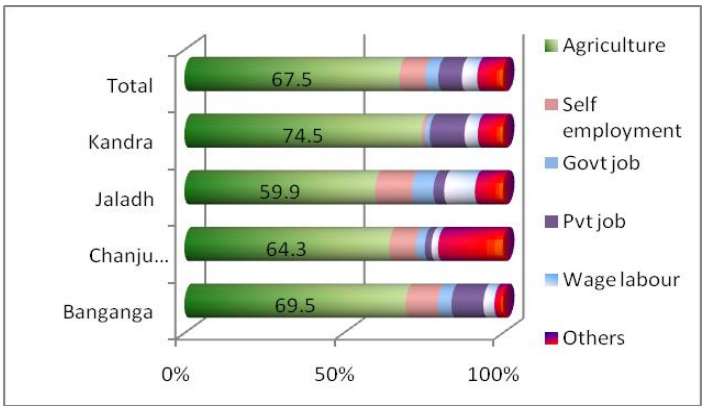


Figure 7: Primary occupation of sample population

4.2 Estimated Economic Values of Churia Resources

a) Economic value of Irrigation water:

Agriculture is the major livelihood option for the majority of the rural population in Nepal. In the study sites, it accounts for about 31% of the household income in general and ranged from 23% in Jaladh to some 35% in Kandra. Major crops grown in the downstream area are paddy and wheat followed by maize. Though the streams emanating from Churia contribute water mainly for the irrigation of paddy, wheat, and some other crops, in this study value of water is estimated only for the use in paddy and wheat.

As detailed in the methodology section, a producer-level profit maximization model is used to estimate the value of water in paddy and wheat cultivation under current practices. Based on this model, residual imputation method is used which accounts irrigation water as an intermediate good used for the production of those crops, and the value of an intermediate good is defined as the net economic contribution of that good to the value of the final output. This is most widely used methodology for valuing irrigation water (Young 1996). Detailed calculation of production costs of these crops is provided in Annex 2. Among the production costs, material inputs include cost of seeds, fertilizers and pesticides. Labor cost includes the cost of hired labor and own labor. These households earn a good share of their agricultural income by hiring themselves out as agricultural laborers, however, own labor cost is adjusted down to 80% to account for the usual tendency of overuse of own labor in the farm due to lack of alternate opportunities or with the hope to get better yield. Labor cost is calculated at existing wage rate in the particular study areas.

Animal and machinery costs include drought powers and machineries used at different stages from plowing to harvesting, and also partially include the human labor involved in operating the machinery. Operating interest is calculated for all the major costs for five months at the existing bank rate of interest. Returns to management account for the value of the managerial knowhow of the producer and is set at five percent of the gross output value, which is widely used and considered relatively standard (Young 1996). The product

price indicates the farm gate price. In estimating the economic costs, effort is made to adequately capture cash and noncash costs of production, except for land rent and machinery depreciations. For all the machineries used, existing rental rate is used which is assumed to cover depreciation as well.

At Chanju/Bagdwar and Kandra sites, farms are irrigated through traditional canals, and the major cost involved in using the water is in the form of labour employed for diverting water to the farms and maintaining the canals, and these costs are accounted for in the labour cost of crops produced. Other costs involved are the water fees paid by water users and the amount spent by the government for canal management. In Jaladh and Banaganga, water is distributed to agricultural farms through well structured canals (Banaganga Irrigation System, Laxmanghat & , Hardinath Irrigation System) and nominal fees of Rs. 2.00 and Rs. 3.00 per kattha per crop are charged respectively at these two sites by water users committees for maintaining the canals. Government spends about Rs. 500-1000 thousands annually for the maintenance of main canal of Banaganga irrigation system, and about Rs. 150 million has been estimated for cleaning the Jagdishpur Lake which works as a sedimentation pond that helps supply clean water to agricultural farms. Sediment deposition has raised the lake bottom substantially and its cleaning is planned soon. Once cleaned it is expected to serve for another 20 years. Similarly about Rs. 40 million cost is estimated for sediment cleaning, repairing and maintenance in Hardinath irrigation system in Dhanusha, of which about Rs.15 million is already secured from other sources and spent. This cost is to incur after about three decades of its service. Given the period it served before cleaning and large area irrigated, it adds nominal cost to the cost of production. Except for water fees, farmers do not pay for any other expenses, and all of the cleaning and maintenance costs are born by (or to be secured from) different sources. However, these costs have been accounted for in calculating the economic value of water.

The average costs of production for paddy is calculated at Rs. 737 per kattha (≈US$340/ha[8]), which varies slightly across study sites (Annex 2). Major components of this cost are labor cost (37.5%) followed by animal and machineries (26.8%) and material input costs which includes water fees paid by farmers (23.0%). Similarly, per kattha cost of production of wheat is estimated at about Rs. 728, and its major components are material inputs (31.6%), animal and machineries (30.9%), and labor costs (26.2%).

Economic returns to water measure the contribution of water in its current use to the total value of the output. The average economic returns to water from two major crops, paddy and wheat, are calculated on per kattha land basis. Return to water is seen higher in paddy compared to wheat (Table 8). Particularly in Chanju and Bagdwar areas wheat is not that commonly grown because of lower productivity realized, and because most farmers choose to grow mainly paddy and maize. On average, the value of water per kattha as an input to paddy production is calculated about Rs. 500 (≈US$231/ha), and about Rs. 258 (≈US$119/ha from wheat. Returns to water in these crops varies greatly across the study sites. For example, in the case of paddy, it varies from a lowest of about Rs. 350 in Kandra

[8] US$1= NRs.65; 1 hectare = 30 kattha of land

area to even slightly more than double (Rs. 763) in Banaganga area. In Banaganga irrigation canal, water comes not only from the Banaganga watershed but about half of the dry season water is contributed by the Koili River, and the watershed condition of Koili is said to be better than that of Banaganga. Thus, to estimate the contribution of solely Banaganga sub-watershed, the presented water value is to be halved.

In terms of beneficiaries of water, a clear pattern is observed from north to south, i.e. from the foot hills south towards the in Terai plains (Table 8). Terai farmers seem to have benefitted almost twice (Rs.819/kattha) compared to foot hills farmers (Rs.442/kattha). This study acknowledges that such difference across the length of river/streams may not be only due to difference in water quality and quantity; however, the approach adopted fails to account for such differences and attributes the total difference in economic returns to water availability for irrigation. Nevertheless, given the difference in soil structure across north to south it is evident that the situation of water availability in the streams and groundwater is completely different in those physiographic zones. Terai plains has profound surface and ground water while due to soil structure of northern region, i.e., Bhabar and foot hills areas, water is hardly retained in soil and available longer for use in agriculture.

Table 8: Economic value of water per kattha in irrigated agriculture & beneficiaries

Physio-zone	***Foot hills***	***Bhabar***	***Terai***	***Total***
Econ. value of water from paddy (Rs./kattha)	397.3	315.5	541.2	499.8
Econ. value of water from wheat (Rs./kattha)	44.3	251.3	277.3	258.2
Total value of water (Rs./kattha)	441.6	566.8	818.5	757.9
Study sites	***Chanju/Bagd***	***Jaladh***	***Banaganga***	***Kandra***
Econ. value of water from paddy (Rs./kattha)	478.9	491.5	762.9	349.5
Econ. value of water from wheat (Rs./kattha)	114.5	205.6	248.3	322.8
Who bears the cost & how much?	***Chanju/Bagd***	***Jaladh***	***Banaganga***	***Kandra***
Canal maintenance/yr/kattha (govt) (Rs.)	0.0	0.0	2.8	0.0
Sediment protection /yr/kattha (Rs.)	0.0	9.1	27.9	0.0
Total cost (Rs.) / crop/ yr/ kattha	0.0	9.1	30.7	0.0
Irrigated area (kattha)	***Chanju/Bagd***	***Jaladh***	***Banaganga***	***Kandra***
Irrigated paddy	7040	109300	134200	10000
Irrigated wheat	4600	109300	134200	10000
Total value of water in irrigation (M Rs.)	***3.90***	***76.19***	***135.70***	***6.72***
Econ. value of water in irrigation (M Rs.)	***3.90***	***74.19***	***127.45****	***6.72***

* About half of the dry season water is contributed by Koili river, the adjoining sub-watershed

This study couldn't find any specific costs allotted by any section of society for the management of those watersheds under study, however, there are some costs borne by other than beneficiary farmers downstream for the management of irrigation canals (at Banaganga and Jaladh). Some costs are borne by the government while the rest comes from different sources. All these costs are deducted from the total value of irrigation water to know the economic value of the current flow of water at these four study sites. The total economic values of water at these sites are presented in Table 8 which shows huge difference in values. The sites with systematic irrigation canals irrigate a much larger land area and have greater economic values compared to the sites with no structured canals

(Chanju/Bagdwar and Kandra) wherein land is irrigated through temporary small canals.

b) Economic value of Churia forest resources utilized:

The commonly collected forest resources at all the study sites are fuel wood, fodder, timber and herbs. Fodder and little bit of herbs were found to have collected for own use while fuel wood and timber are collected for both household use and for trading.
The local unit for fodder and fire wood is *bhari* (one head load). To provide with an idea on their weights, they are converted using factors of 30 kg and 35 kg respectively for a *bhari* of fodder and firewood.

There are a range of medicinal herbs available in the Churia forests but due to lack of knowledge on them, only a few common herbs are being extracted usually for home remedy purpose. However, local communities feel that proper recognition and extraction of those herbs could generate huge revenues for local development. Bamboo is also available in some areas and collected sometimes, though the current status is said to a pathetic compared to few years ago in terms of bamboo availability. Only in very few cases collection of bamboo was reported, thus, herbs and bamboos were recorded directly in the local values and put together in this analysis.

On average, 2.02 MT of fodder, 1.62 MT of firewood and 23.7 ft3 of timber are being extracted by a household annually (Table 9). The value of all these resources together makes about 10.7 thousands rupees on average per household per year. Use level of those goods varies greatly across the four study sites, ranging from a minimum in Banaganga and maximum in Kandra. In Kandra area, all these resources are used at a higher scale than at any other site, and particularly the timber extraction is very high (58.3 ft3). In Jaladh area also timber extraction is higher in relation to other resources. The total benefit from these major Churia forest resources account to 3.8 thousands in Banaganga to a maximum of 22.5 thousands in Kandra per household per annum compared to an average of 10.7 thousands. Jaladh and Chanju/Bagdwar have these figures 5.8 and 9.6 thousands respectively. The values presented here for traded goods such as fire wood, timber and herbs are gross at the market prices and doesn't account for the labor costs involved in their collection and transportation.

An interesting trend can be seen in the resource use pattern along the north south trajectory of the study sites. As seen earlier the number of cattle and especially goat raised in and around Churia hills is higher, an increasing amount of fodder is being collected towards these areas. This trend is just opposite in terms of timber - higher amount is extracted towards south, maybe because they have better access to market and also need more for construction. However, in terms of total benefit from Churia forest resources, Bhabar stands first with optimum use of all of those resources. The fodder collection indicated for Terai households are mostly limited to its northern part which is relatively nearer to Churia hills. This is worth mentioning especially as the two of study sites, viz., Jaladh and Banaganga had a relatively larger study area stretched down to the south plains and covering the irrigation beneficiaries. In those areas, the fodder collection is

done by only a few households from the Terai plains that are relatively nearer to Churia, and this can be observed in the disaggregated data in Annex 3.

Table 9: Average quantity and value of Churia resources collected per HH per annum

	Quantity of goods			Estimated value of collected goods ('000 NRs.)				
	Fodder (MT)	Firewood (MT)	Timber (ft3)	Fodder	Firewood	Timber	Herbs & others	Total
Chanju Bagdwar	2.52	1.42	18.47	2.59	3.73	3.10	0.16	9.6
Jaladh	0.62	0.69	14.59	1.25	1.89	2.41	0.24	5.8
Banaganga	1.52	0.80	0.96	1.86	1.71	0.16	0.12	3.8
Kandra	3.23	3.34	58.31	7.56	4.97	9.86	0.15	22.5
Up hills	6.68	1.55	2.07	5.87	3.51	0.35	0.27	10.0
Foot hills	2.76	1.35	22.82	3.89	3.22	3.84	0.22	11.2
Bhabar	2.08	2.22	15.83	5.41	4.20	2.72	0.08	12.4
Terai	1.20	1.56	28.47	2.63	2.76	4.79	0.15	10.3
EC1	1.30	1.20	6.04	1.43	2.62	1.01	0.17	5.2
EC2	2.35	1.77	21.55	4.60	3.24	3.64	0.18	11.7
EC3	2.71	2.07	54.89	5.20	3.65	9.24	0.12	18.2
Total	**2.02**	**1.62**	**23.67**	**3.48**	**3.09**	**3.99**	**0.16**	**10.7**

Examining benefits across the economic classes indicates that all of these resources are being more intensively collected more towards higher economic classes (total value 5.2 thousands in EC1 to 11.7 in EC2 and 18.2 in EC3) against the general conception that the poor collect more resources. More disaggregated data of these resources use pattern across different study sites, physiographic zones and the economic classes are provided in Annex 3, Annex 4 & Annex 5.

c) Summary of different resources' value:

This study indicates that Churia makes a huge contribution to different local communities. The total economic value of annual flow of different resources from Churia is estimated at 490.3 million rupees (Table 10). Water uses downstream and other Churia forest resources annually contribute about Rs. 212.3 million (43.3%) and Rs. 277.6 million (56.6%) respectively. Additionally, there is a minor contribution of sand/boulder values. Total value of water use is estimated by per kattha return of water times total kattha of land irrigated. There were differences across the sources in reported area of land irrigated in different areas, however, the information that came from community level workshop is considered more authentic as that is the joint view of many people sitting together. The estimated value should form the minimum benefit derived as due care was given in analysis to avoid overestimation.

Water uses include irrigation water and the value of fish farming being practiced in Jagdishpur Lake at Banaganga site. The annual fish culture contract amount (Rs. 0.2 million) of this lake is accounted as benefit, as the main water source of this lake is the same irrigation canal, water from which is being valued in this study. Though there are many issues arising regarding fish farming in this lake from biodiversity conservation view

point, and the lake being the hosting place for migratory birds, these issues are kept out of discussion in this study.

Table 10: Total economic value of annual flow of different resources from Churia (Million rupees)

Goods/ Services	Chanju Bagdwar	Jaladh	Banaganga	Kandra	Total	%
Water uses	3.90	74.19	127.45	6.72	212.26	*43.3*
Churia goods	12.68	73.37	33.77	157.79	277.61	*56.6*
Sand/Boulder	0.00	0.04	0.13	0.25	0.42	*0.1*
Total	**16.58**	**149.60**	**161.35**	**164.76**	**490.29**	*100.0*

The total value of Churia goods are estimated by average benefits per household multiplied by estimated number of households benefited. Usually the Churia goods are collected by hills and nearby people and hardly anyone comes from a distance for routine collection. Banaganga and Jaladh study areas stretch long in south plains, and south tail people hardly reported any collection from Churia. Though it is hard to mark the exact number of beneficiary households, a best estimate was arrived through community workshops. The reported number of total beneficiary households are 1323 (Chanju/Bagdwar), 5707 (Jaladh), 8780 (Banaganga), and 7000 (Kandra).

Additionally, it was understood that a huge amount of timber and firewood was extracted illegally for commercial purpose at all the four sites, but huge extraction was reported at Jaladh and Banaganga only. At Chanju/Bagdwar and Kandra it is regulated to some extent by local communities through CFUGs, however, in the case of Jaladh and Banaganga the CFUG either does not exist formally or are not strong enough to regulate it. A rough estimate on such commercial extraction of forest resources was obtained for Jaladh site. At Jaladh, on an average 150–250 head loads or bicycle of timber and fire woods are collected by distant people everyday usually for commercial purpose. Additionally, some people collect timber and fire wood in a slightly larger amount (about 15-20 carts) everyday, however, at the time of survey it was noticed that very recently the existing CFUGs (Balajar Matiyarba, and Pusbalpur CF) were actively monitoring such collection and had caught and seized few carts. Based on eight months a year collection, an estimated value of such commercial extraction at Jaladh site can be put at Rs. 40.3 million per annum, of which only timber accounts for Rs. 33.7 million and rest is fire wood.

Collection of sand/boulders/pebbles were done from almost all but Chanju/Bagdwar streams where people use neighboring river 'Ratuwa' for this purpose as they say it has better quality sand/boulders. Usually DDCs contract out the collection of such materials from rivers/streams in the respective district, and there is no study or efforts made to understand if such collection has any adverse impact on local environment or watersheds. In some cases, Maoists were also found charging equal money from the contractor of the rivers (e.g. Banaganga). Some people in Kandra though didn't know the exact consequences but had objected to such haphazard collection of river resources. The value of sand/boulders collected is based on quantity collected during eight months times the charge levied per unit by the contractor/DDC, and is presented in the Table 10. Besides those direct monetary values, it also supports large number of wage labor through involvement in this work.

In terms of total economic benefit, every site received around Rs. 30-34 million except Chanju/Bagdwar wherein only a value of 3.4 million was realized. Such variation is mainly related to the number of beneficiaries of Churia goods, and land irrigated by Churia water. At Chanju/Bagdwar site the current beneficiary area is very small. Though water is available in the river down south of the study area that could be made use of in agriculture, but local people found it costly and time consuming to extract irrigation water from river. With subsidized electricity for irrigation purpose they find it is easier and cheaper to pump out groundwater rather than using river water. The cost and drudgery of using river water for irrigation has increased due to the deepening river bed.

d) Contribution of Churia forest resources to local livelihoods:

All the major income flows to a household from different sectors were estimated including the contribution of Churia goods to see its role in the livelihoods of local communities. On average, a typical household has a total annual income of 85k which varies substantially across the study sites and economic classes (Annex 6). In absolute terms, Churia goods contribute about Rs. 10.7k per household in the study area which makes about 13% of the total household economy (Figure 8).

This contribution is higher in Chanju/Bagdwar (17.5%) and Kandra area (23.6%) while much lower in Jaladh and Banaganga – around 5% (Figure 9). As can be generally expected, this contribution is higher towards nearby communities, i.e., foothills and Bhabar (Figure 10) and also towards lower economic classes (Figure 11). Though the percentage contribution of Churia goods to total livelihoods is higher towards lower economic class people, it is much less in terms of absolute value.

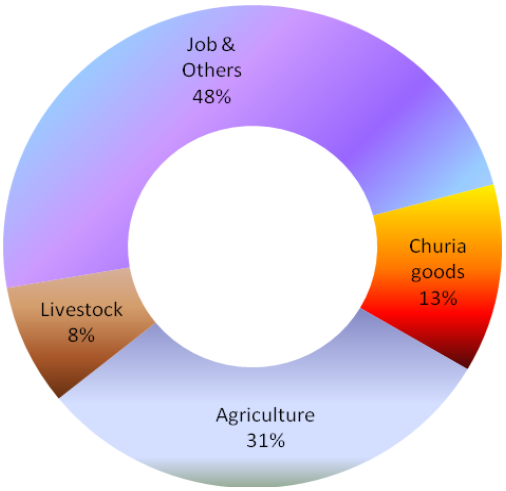


Figure 8: Different sector's contribution to livelihood

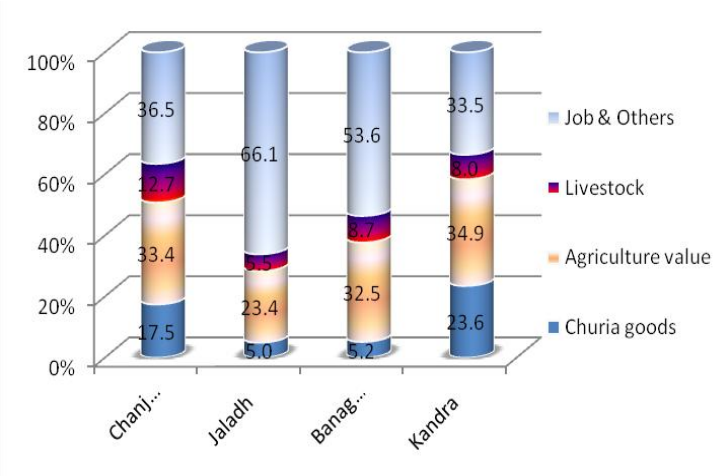


Figure 9: Churia goods contribution across study sites

For example, EC3 households have an annual benefit of Rs. 18.2k compared to 11.7k in EC2 and only 5.2k in EC1 (Annex 6).

Additionally, a huge amount of goods collected commercially reaches different sections of the community, the bulk of which is understood to reach to higher economic classes.

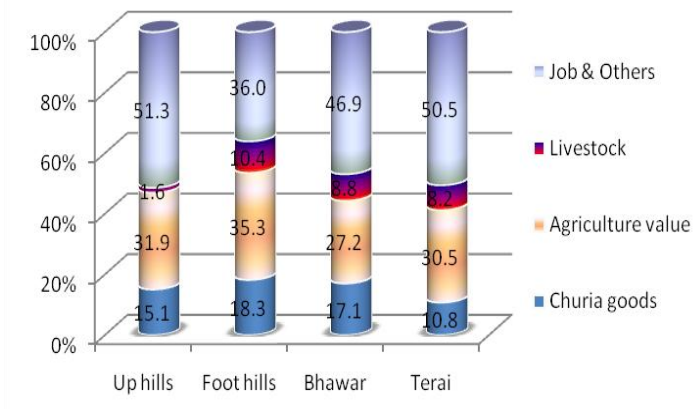


Figure 10: Churia goods contribution across physiographic zones

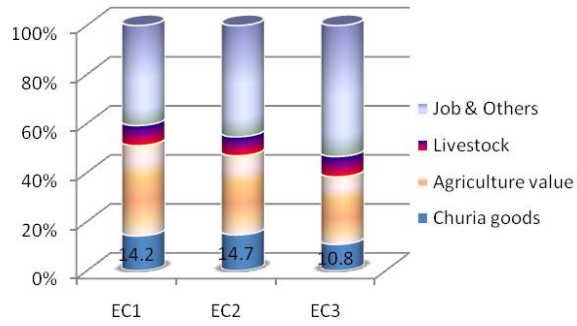


Figure 11: Churia goods contribution among economic classes

5. Innovative Financial interventions

With increasing recognition of a need for ecosystem management to ensure a continuous supply of ecosystem goods and services, a number of innovative financing mechanisms have been adopted in different countries, especially when public budgets for this purpose are inadequate. Finance mechanisms vary according to their ecological, social and political context (Scherr et al., 2004; Powell et al., 2002) and can be broadly categorized into three groups each requiring varying level of government's involvement – public payment schemes, voluntary contractual agreements, and open trading under regulatory cap or floor. Brief description on each of them is provided later in separate section. This section intends to keep focus on 'payment for environmental services', which is a kind of voluntary contractual arrangements, and its possibilities in Nepal.

5.1 Payments for Environmental Services (PES)

5.1.1 Introduction to PES

Payment for Environmental Services is widely recognized as an innovative conservation financing mechanism to achieve the dual goal of environmental conservation and poverty reduction in developing countries. It has been a useful tool where traditional command and control approaches have failed, and the state's fund is inadequate for conservation. It is a mechanism to improve the provision of indirect environmental services in which those who provide environmental services get paid for adopting desired changes that secure ecosystem conservation and restoration ('provider gets') and those who benefit from the services make direct, contractual and conditional payments ('user pays'). PES has been effective tool in achieving sustainable environmental services as the people who produce such services are motivated to so through direct rewards as a compensation to follow desired changes in the land use and other environmental management aspects.

Wunder (2005) has identified four types of ES that currently stand out: 1) carbon sequestration and storage (electricity companies is paying farmers for planting and maintaining additional trees), 2) biodiversity protection (conservation donors are paying local people for setting aside or naturally restoring areas to create a biological corridor), 3) watershed protection (downstream water users are paying upstream farmers for adopting land uses that limit deforestation, erosion, and flooding risks, and 4) landscape beauty (a tourism operator is paying a local community not to hunt in a forest being used for tourists' wildlife viewing).

The popularity of PES is increasing with respect to water related ecosystem management. In watershed management the basic premise of PES is the upstream-downstream hydrological dependency, wherein upstream peoples provide hydrological benefits to downstream water users. However, it becomes an important issue to determine the type of land use that can generate desired hydrological benefits eligible to receive compensation. Though how much the beneficiaries should be willing to pay maximum for a service and how much should the service providers be willing to accept for generating the services through desired activities are derived from economic value of the service for beneficiaries and the opportunity cost of service providers. However, a survey in Latin America has indicated that PES negotiations are rarely based on economic value of services but on expected aversion of expenditure that an otherwise diminished or degraded water resource base would bring to their water dependent business.

Other non-economic reasons for service beneficiaries to participate in the PES are prospect of the PES to provide a mechanism for conflict resolution between up- and downstream water users, or additional benefits users may acquire from a "green" brand image and philanthropic work. Similarly for the service providers, when their actual economic benefits of providing the environmental service may be lower than other opportunity costs, some other motivation factors to participate could be as: agreeing voluntarily today rather than being forced through regulation later; latent threats of losing out their productive land to protected areas; or seeing PES as an informal recognition of their land titles, etc. (Halsema, 2005)

Some commonly marketed hydrological benefits are as below, which are often lumped together and marketed as general hydrological services rather than marketing individual benefits in practice.

- Improvement of water flow, especially increase of dry season flows;
- Soil conservation and minimization of sedimentation;
- Reduction of agricultural source pollution; and
- Improvement of microbial water quality.

With respect to PES, Costa Rica has demonstrated great success through experimenting different schemes. Costa Rica established tax-based economic incentives for the reforestation sector through its first Forestry Law in 1979, and thereafter a number of appealing and incentive based schemes have been developed incorporating learning from previous policies and schemes and implemented over time (Watson et al. 1998; Chomitz et

al. 1998, Pagiola, 2002, Rojas and Aylward, 2003). Many countries around the globe are implementing different schemes for collecting payments to finance watershed protection.

5.1.2 PES initiatives and possibilities in Nepal

Though much has been achieved in PES in some countries, it is still an emerging science in and at rudimentary stage among developing countries in general. In Nepal, few random efforts towards setting up PES mechanism are made recently; it still remains fairly new concept to most stakeholders. Some of the important efforts made in Nepal are a) Kulekhani watershed conservation wherein the major water beneficiary is a hydropower, and certain percentage of its royalty is ensured for the development activities in the upland communities (with Winrock Nepal's support), b) feasibility studies – one important study is by IUCN in the Shivapuri National Park Nepal. Likewise there are some PES related studies conducted by ANSAB also. In this park, upstream residents have been generating huge economic benefits downstream in terms of enhanced water supply for domestic, irrigation and power generation uses. Community forestry and buffer zone programs of Nepal are also the PES-like initiatives as they try to provide incentive to local community to seek their efforts for the conservation.

Opportunities:

Nepal's rich natural resources and biodiversity are on continuous deterioration thought it has large potential to support the local communities and the economy if properly conserved and utilized. PES mechanism seems to have greater importance in Nepal as the state's conservation fund is inadequate, and the poverty and conservation issues are to be addressed together. The concept is emerging in Nepal now, and many organizations have shown interest and are at different stage trying to establish feasibility for PES in the country.

Basic policies and institutional infrastructure required to set up PES schemes are also already in place. The National Park and Wildlife Conservation Act-1973, The Local Self Governance Act-1999, The Electricity Act-1992, The Forest Act-1993, among few others, contains the concept of benefit sharing. The current coalition of eight major political parties have also agreed to pass the new law on revenue sharing from environmental services such as water resources to be distributed more to local districts where the revenue generated and to other districts in Nepal. With dual objective to develop incentive systems for resource conservation and to improve the livelihood, Ministry of Local Development has developed guidelines to use environmental funds collected from the natural resource use, emphasizing to reward local people, especially the poor, who contribute to provide environmental services. Some initiative has been taken at case basis (e.g. Kulekhani hydropower) advocating allocation of certain benefits for the upstream service providers; this has to be brought to the national policy that facilitates the process elsewhere in the country.

Some of the major challenges identified are:

- Lack of scientific studies establishing linkages between watershed ecosystem management and hydrological services generated. So far this sector has received no attention though there are lots of efforts of watershed management;
- Lack of awareness about PES concept among people, resource managers and policy makers and thus, lacks recognition in national policies;
- Lack of property rights in the hills, which makes adds complexities to design and implementation of PES schemes.

Possibility in Churia region:

Some of the pre-requisite conditions to decide on feasibility of hydrology-based PES application can be summarized as:

a) A perceived increasing pressure and deterioration of the hydrological status of the watershed – generally manifested in increasing water scarcity and deterioration of water quality;
b) Demand for water, and thus, willingness to pay for improved hydrological services downstream, e.g. water supply, hydropower, food and beverage industry, agriculture etc.
c) Established linkages between upstream land uses and downstream hydrological benefits, that enables convincing people to pay for the conservation.

Potential beneficiaries in the downstream could be asked to invest only if some assurance could be provided that proposed management actions will result in the delivery of expected hydrological services. Though in our case, we face with lack of such established linkages and other scientific uncertainties, a positive aspect is most of them have experienced and observed certain level of relationship between upstream watershed conservation and dry season water flow downstream (Figure 12). As indicated in this figure, about 85% of respondents believe that such relationship (good & strong) exists, while some 14% respondents were skeptical about it. At Jaladh site, 95% of respondents believe strong relationship maybe due to their practical experience with water shortage and clear observation on deteriorating Churia watershed condition.

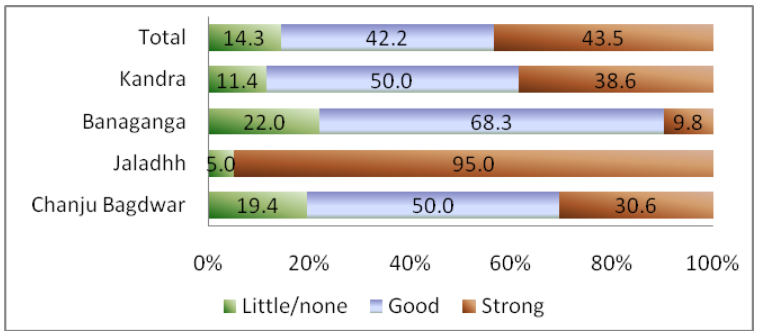


Figure 12: Relationship between watershed conservation and dry water flow downstream (% of respondents)

Further, they were asked about their observation on changes in watershed conservation status and resulting changes during last one decade. Majority of respondents at all sites except Jaladh believe that forest condition in Churia is getting better (Community forest efforts, and improving shrubs/ greenery) while about 80% of people at Jaladh site and some at other sites believe that its declining (Figure 14) due to overexploitation of mainly bigger trees for timber and fuel wood. Those who observed improving forest condition, based their observation mainly on increasing greenery and also reported increased water for agriculture downstream, increased forest resources flow, and declining flood and landslides damages (Table 11). They also indicated the factors contributing to such improvement; these are mainly the regulated resources use due to community forestry, and efforts of different organizations in awareness creation. And those who reported decline in forest condition at different sites felt decline in water availability for agriculture downstream. It is evident that different people perceived the changes differently, which maybe partly because of lack of full and careful observation and partly maybe they base their observation on different aspects of the same thing. However, what majority of people believe, gives a better approximation towards reality.

Table 11: Effects of changes in watershed condition (Improvement or Decline) over last one decade (% of respondents)

Resulting change ▶	Due to Improvement				Due to Decline
Study sites ▼	Benefit to agriculture (water qnty)	Greenery & resource flow improving	Floods/ landslides damage declining	Total	Adverse effect on water/ agric.
Chanju/Bag..	25.0	25.0	50.0	100.0	95
Jaladh	54.5	9.1	36.4	100.0	91
Banaganga	34.3	54.3	11.4	100.0	90
Kandra	20.3	72.5	7.2	100.0	97
Overall	27.3	53.8	18.9	100.0	92

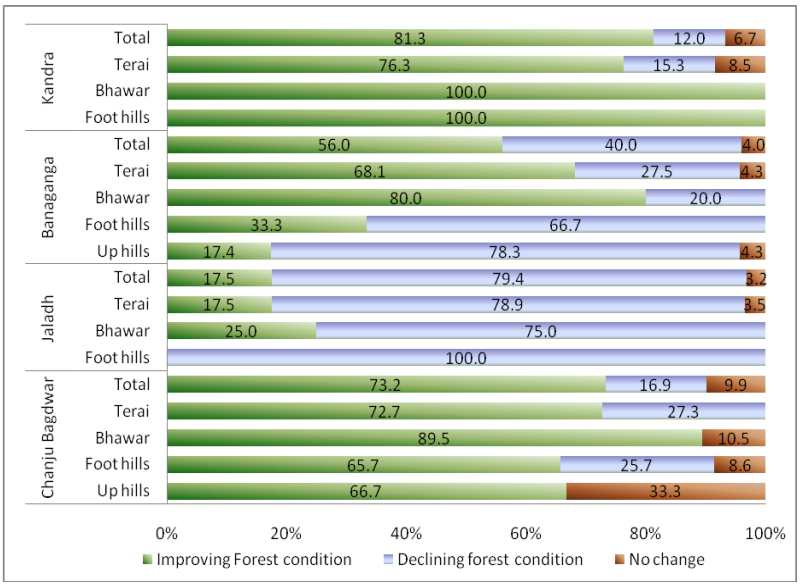


Figure 14: Watershed forest condition change over last one decade (% of respondents)

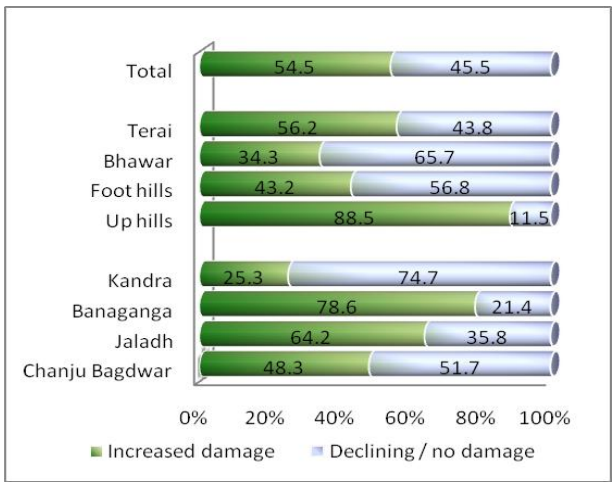


Figure 13: Change in floods & landslide damages over past one decade (% of respondents)

One of the burning problems related to hydrology downstream is increasing flood damages, and for mitigating this problem local communities are willing to pay some premium. About 55% of respondents have closely observed or faced with landslides and flood damages, and believe that such damages are increasing, varying from only 25% at Kandra site to a maximum of 79% at Banaganga site (Figure 13). They believe that on an average 60% of such damages could be attributed to deteriorating watershed condition. However, literature suggests that upstream conservation can only control up to 5-10% of land cut/siltation downstream, which turns this relationship unappealing for PES with respect to flood control.

In this study, not even a very general trend on flood damages and watershed condition could be established, as the last 4-5 years have been experiencing climate vagaries with respect to temperature and rainfall intensity and pattern.

From above discussion and responses, it seems local people believe that there exists some level of linkage in Churia hills conservation and downstream water benefits, and flood damages. At the same time they have been facing increasing shortage of water for irrigation at times every year, and more often in recent few years due to climatic vagaries. About 70% of respondents felt that they usually have to forego some crops in a year or cause damage to the crops due to water shortage, while 30% of them felt this problem only now and then (Figure 15). This figure also indicates a clear trend of declining severity of water shortage from upstream towards down in Terai, as the people towards south can partially (to the extend they feel economically feasible) fulfill their requirement from groundwater too. With respect groundwater also, about 41% respondents believed declining water table making it more costly and economically infeasible to extract for agriculture (Figure 16). Declining groundwater availability is noticed more at Chanju/Bagdwar and Jaladh sites while

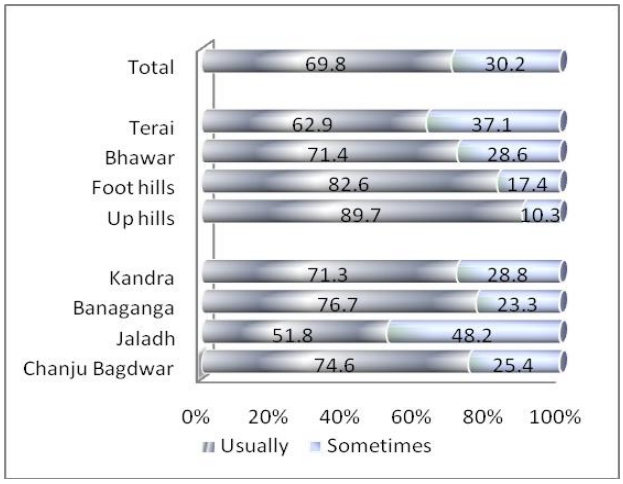


Figure 15: Shortage of water faced for irrigation (% of respondents)

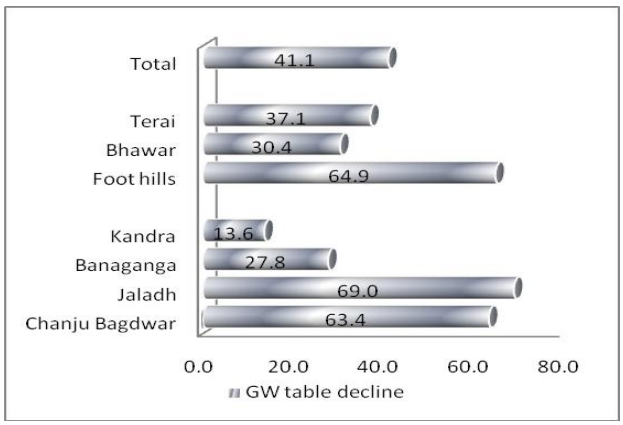


Figure 16: Groundwater table and availability declining (% of respondents)

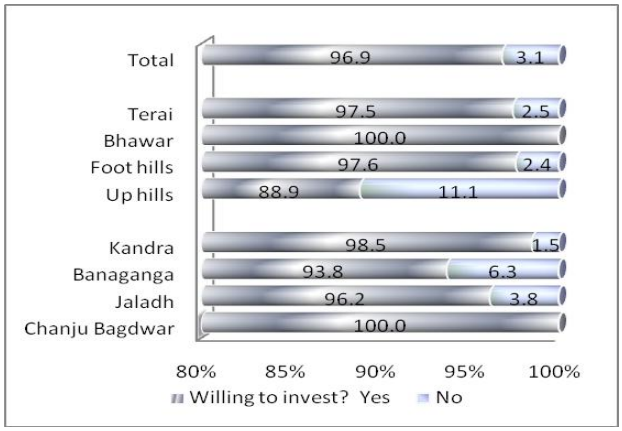


Figure 17: Willingness to invest for Churia conservation (% of respondents)

relatively lower towards Banaganga and Kandra sites.

Having been faced with different level of water shortage especially for agriculture, about 97% of respondents expressed their willingness to contribute financially or in kind for the Churia conservation (Figure 17), however, they should be assured of desired outcome. No effort was made to elicit the level of contribution but just to get indication on their willingness which also indicates how important they see the conservation of Churia hills. Further, even people in up hills area intend to invest if they can get assured supply of water for their agricultural farms from any source. These all indicates to potentiality of PES in this region.

However, this study also indicates that though upstream settlement in the Churia hills depend relatively more on Churia resources (which is natural due to their limited livelihood options), the higher scale of damage seems to have caused by outsiders' invading the area, downstream people mostly from foothills and Bhabar (resource collection table), and in this case feasibility for piloting PES and its implementation effectiveness becomes dubious. Additionally, most of people who expressed their willingness to contribute for Churia conservation indicated their kind support and not the cash, and also they were a bit skeptical on if this can really be solved through Churia conservation.

Further, some respondents also raised issues against PES which might need careful examination and dealing. Some of the downstream people raised concern of their natural right to use water resources flowing down the river, and on the groundwater extracted over their land. Though they understand the water availability is being threatened over years, they would be reluctant to pay and there is possibility of free rider problems. Some people also expressed that upper catchment is managed or will be managed well because these are mostly under community forest and they have incentive to do so. They manage community forest for their own sake and not for the downstream benefit, and thus, they would be willing to contribute only if additional hydrological benefit could be assured/ demonstrated through additional management approaches in the upstream. However, it makes the piloting of PES difficult. It is often easier if water users could be convinced to pay for existing services by demonstrating the existence of a threat than to pay for restoration to increase the level of services, and that is how many PES schemes around the world has worked out.

Ways ahead:

Shortage of water they face for their agriculture, their perception on positive relation between Churia hills' conservation and downstream water availability and heavy flood damages, and finally their willingness to contribute for the Churia conservation for the assured supply for water in future, all indicates positively to feasibility for PES-like mechanisms in this region. However, huge amount of homework would be needed before going into real design for such schemes, such as detailed hydrological linkage study, convincing people to invest, strengthening local organizations to take the facilitating roles, creating enabling policy frameworks etc. which are detailed below under separate topic.

On the other hand, we have a big question on whom to pay for conserving the watershed? There seems little population in the southern face of Churia watersheds that is supposed to contribute water to downstream Terai, and they are not even the major agent to cause damage. Upstream dwellers certainly depend more on Churia resources, but their scale of resources use is still lower than outsiders (downstream people). Thus, any incentive provided to upstream people (which are not even available at all the sites; in the study area only two of four sites have some settlements upstream) and their effort to conserve Churia may not be sufficient to yield desired level of hydrological changes. Furthermore, often the upstream dwellers do not own property right of land holdings they have been cultivating, which makes the PES implementation complex and may have legal difficulties. Thus, PES as such does not seem a feasible tool for all watersheds in the Churia hills, however, it should be decided on case basis for possible watersheds, and may be piloted at one site where there is significant number of population living upstream who could make real impact through land use changes and regulated resources collection. While at other sites with no defined upstream land managers, alternate mechanisms need to be thought of. One possibility could be to set up a Conservation Fund wherein money can be pooled from different sources including services beneficiaries and government budget, and utilized through local community based organizations for conservation activities and in setting up some resources flow monitoring mechanism which would help future designs of conservation program.

Further needs:

Given those opportunities and challenges, a general assessment is done to see what we need to do further to promote PES in Nepal. Further efforts are needed at ground level to national level policy making; some of the major activities foreseen at this stage could be:

Capacity building on PES: PES being new concept for Nepal, many stakeholders, service providers and beneficiaries are not aware of it. Capacity building among concerned government and non-government organizations and policy makers, and general awareness creation among local communities upstream and downstream are important.

Enabling institutional, legal and policy structures to support PES implementation: Though existing legal and policy structures broadly supports the sharing of locally generated benefits from natural resources, further refinement is necessary to ensure the benefits to service providers mainly at the cost of service beneficiaries to attain sustainability of the schemes.

Piloting of PES mechanism: In Nepal, it seems more feasible for PES pilot project to focus on water resources especially for water supply and hydropower. In recent years hydropower sector is drawing attention from a range of investors also from private sector. Winrock Nepal has been working at one hydropower site, and there are many other sites to be explored/studied. Similarly with regard to domestic water supply, PES may be taken as pilot at few municipalities which are gross beneficiaries at the cost of upstream water suppliers. IUCN has recently studies and observed huge potential of PES in Shivapuri

National Park, Nepal which supplied about a fifth of drinking water to Kathmandu valley. Given severe scarcity of drinking water in Kathmandu valley, further motivation to upland communities to conserve the watershed to generate increased amount of water would be a commendable step.

Information dissemination: Learning from the pilot demonstration, best practices cases, gaps, incremental costs of upstream land use changes and associated downstream water benefits (supply and quality), and other policy relevant information are to be compiled and disseminated. This would help communicate about PES to wider mass of people, replicate in other areas, and in making the policy and institutional environment more favorable to PES implementation.

5.2 Brief description of major innovative financial mechanisms

5.2.1 Public payment schemes

As the watershed services are often considered a "public good" (which are non-rival and non-excludable, that means nobody can be refused to use them even if they do not pay for it) for the use of which people are reluctant to pay (Landell-Mills and Porras, 2002), public payment schemes are relevant and common financial mechanism used to protect watershed services. The government provides the institutional foundation for the conservation programs and directly invests in it as well through the fund generated by some type of fee or tax. Often it requires the government to make favorable policies that supports:

- creation of or increases in water fees;
- the ability to apply water fees directly to watershed protection;
- means to provide incentives to land owners
- the ability to apply and enforce environmental easements
- establishing oversight, monitoring and regulation compliance mechanisms
- implementing fines for non-compliance to with agreements on land use or discharge limits by either "buyer" or "seller."

Box 2: New York City Water Management

About 90 percent of the New York City's water supply comes from the Catskill and Delaware watersheds at remarkably low prices. To ensure quality standard of water supplied, it needed to construct a huge filtration plant with an estimated cost of about US$5 billion in the early 1990s.

Taking innovative approach, federal, state, and municipal governments in cooperation with local communities and local organizations made joint efforts to adopt alternate measure – the watershed management with an investment of US$1.5 billion over a ten-year period. Major management activities included land acquisition, rehabilitation of septic systems, flood control measures, environmental education, and stream corridor protection projects, as well as new regulations on the use of water. The program, formalized in 1997 recently issued its first five year report which indicates good result so far.

Some of the examples of public payment schemes include

a) payments to fund management activities such as purchase of permanent conservation easements
b) Contract farmland to set aside for conservation or change land management practices.

In many developed countries, government agencies have provided for decades financial incentives to farmers to keep agricultural land out of production or shift it to alternative uses (Rodrigo and Russman, 2005). For example, in Europe, 14 countries spent an estimated $11 billion between 1993 and 1997 to divert over 20 million ha into long-term forestry contracts (OECD, 1997). In the 1990s, the United States Conservation Reserve Program spent about $1.5 billion annually on contracts for 12–15 million ha (Clark and Downes, 1999). Yet another very appealing example is from Catskill watersheds in New York (Box 2).

c) Programs to co-finance investments in afforestation or sustainable forest management. Examples include a watershed management in Colombia wherein part of the fund is availed through a 6% tax on the revenue of large hydro-electric plants. In Costa Rica, a PES scheme developed for the protection of watershed is funded by partly a fuel tax and rest amount is generated through payments from services users. In Ecuador, municipal water companies in Quito, Cuenca, and Pimampiro impose levies on water sales, which are invested in the conservation of upstream areas and payments to forest owners (Landell-Mills and Porras, 2002).

d) Payments for the confirmed presence of endangered wildlife species.

5.2.2 Voluntary contractual arrangements

These area self-organized private deals directly between private parties (buyers the service users and sellers the services producers). For example, the negotiations may be between individuals or between associations of buyers and sellers, i.e. water users and upstream landowners, to implement agreed upon management practices. Government intervention is very limited but sometimes very crucial especially in enforcement of property rights and contractual agreements. This kind of arrangement is very commonly known as payment for environmental services which is dealt as separate section in this document.

Some examples include:

- Downstream water users paying land managers upstream for managing forest cover in the designated watershed. Some examples: Kulekhani hydropower (Nepal) pays certain portion of its revenue to upstream community for watershed management. In Cauca Valley Columbia, downstream farmers paid additional water fees for the watershed protection to ensure minimum dry season water flow (Box 3). Similarly,

Box 3: Cauca Valley Watershed Management

In Colombia, the Cauca Valley Corporation (CVC) is a government body established to develop and protect the natural resources of Cauca Valley including watershed management and efficient water allocation among different users. Due to increasing population pressure water scarcity grew up in the valley and the CVC had insufficient financial resources to deal with this water shortage issues. The first affected groups being the farmers, associations of rice farmers and sugarcane producers voluntarily agreed to support with additional fees to finance watershed management practices in upland areas to ensure minimum flows during the dry season and to reduce sedimentation in irrigation canals. They formed partnership with the CVC to be able to legally implement negotiated contracts with upland people for better watershed management and to pool up with public funds. The associations' additional fees to the CVC are used to support reforestation, erosion control on steep slopes, land purchases, protection agreements for springs and stream buffers, and economic development in upland communities. There are preliminary evidences that this program has helped stabilize the watershed, and that stream flow has improved.

Japan has been charging water users to compensate upstream land owners successfully for over 100 years (Richards, 2000). In Costa Rica a hydropower company pays US$ 10 per ha/year to a local conservation NGO for hydrological service in the Peñas Blancas watershed. In the town of Heredia, the drinking water company earmarks a portion of water sales revenue for reforestation and forest conservation.

- A Non Governmental Organization (NGO) partners with local people to restore degraded land.
- A pharmaceutical company paying for access to a certain area or for the collecting work by local people of potentially valuable organisms.

5.2.3 Open trading under a regulatory cap or floor

In open trading scheme the government defines a mandatory level of a specific ecosystem service to be provided, but it's up to the regulated party to choose either to comply directly with the requirement or to pay and negotiate with others to achieve the prescribed level. In this scheme government sets an upper limit or "cap" on the total emissions or discharges of particular pollutants. The regulated parties are free to trade (buy or sell) the given limits which they often decide based on who could meet the requirements at what costs. For example, the existing carbon emission trading in many developed countries enables companies and landowners to make economic decisions as to whether it is cheaper to lower their emissions or to buy credits from others who have been able to do so. Due to the requirement of a strong regulatory framework this mechanism is not that common and tends to be used more in developed countries.
Some examples include:

- Wetland mitigation banking in the USA
- Tradable Development Rights
- Salinity credit trading in New South Wales, Australia
- Carbon emission offset trading, etc.

6. Programs, policies and threats to Churia conservation

6.1 Policies related to forest conservation and use of goods and services

A brief review of existing policies concerning forest conservation and the use of selected goods and services were done to assess how supportive these policies are.

The majority of the Nepali populace directly depends on forests for their need of timber and non-timber forest products. This would adversely affect the forest health in absence of proper conservation policy and enforcement. Lots of efforts have been made to conserve the forest sector and to promote incentive based participatory conservation approaches that support the livelihoods of local people in Nepal. The current Forest Act (1993) has evolved through a series of amendments over last few decades. Forest Act 1957, imposed

restrictions over use of forest products by the people living in and around Churia who depended on forest resources for their subsistence. Later in 1961 the forest was classified into government, community, leasehold, religious and private forests, and the management by other than government was provisioned after 1978. Following the severe deforestation and the emergence of illegal timber trade during 1970's in Churia, the Master Plan for the Forestry Sector Nepal, 1989 was brought into implementation that promoted the concept of participatory management – through the transfer of management and user right to Forest Users Groups (FUG). This Master Plan aims to meet the basic needs of people for fuel wood, timber, fodder, and other forest products on a sustained basis; to protect the land against degradation by soil erosion, floods, landslides, desertification, and other effects of ecological imbalance; and to conserve ecosystems and genetic resources.

Though the idea of user rights transfer was sparked in the Master Plan for the Forestry Sector, due recognition of local peoples' indigenous practices of forest management and their rights to forest resources was given later in the Forest Act 1993. It recognized CFUG as a legal entity and provided the legal measures for handing over the management responsibility and user right of forest areas to local communities, and also specified norms for forest products collection. The primary objective of community forestry is to rehabilitate degraded hills and improve the growing stock, while meeting the basic needs of the local communities. About 35 percent of the total population of the country have benefited from this program so far. In the Churia region also large areas of forest are already handed over while many requests are still pending, causing more pressure to this region. The Forest user groups are entitled to manage the forest and use the forest products as per mutually agreed upon work plans, while the ownership remains with the state. However, from the national forests such uses of resources are prohibited. It is also provisioned to hand over any part of the national forest as a leasehold forest for the purposes of selling, distributing or utilizing forest products through collection, plantation, tourism, agro forestry, and /or wildlife farming as long as these actions conserve and develop the forest.

Similarly, with the view to conserve biodiversity, participatory conservation measures are adopted for the management of protected areas' buffer-zones. About 20 percent of the country's land is under protected areas that provides goods and services in different forms to local, national and global economy. There is a provision to invest 30 - 50 percent of the park revenue for community development and buffer-zone conservation activities. This would serve as an incentive to the local people for their active participation in the conservation activities and sustainable use of biodiversity.

In line with the poverty reduction objective of the 10th Five Year Development Plan, the forestry sector policy has also adopted a two pronged objective – poverty reduction and conservation of biological resources, and emphasized promotion of eco-tourism. A Biodiversity Trust Fund is proposed under the National Biodiversity Strategy as a means to finance conservation activities. The 20 year Agricultural Perspective Plan, 1994, tries to establish the link between agriculture productivity and forest conservation. It recognized the importance of conserving Churia watersheds for sustainable agriculture in Terai,

Bhabar and Dun and as a recharge station of the Terai groundwater. Water Resource Development Strategy, 2002, also emphasized it through promoting local participation. Similarly, Bio-diversity Conservation Strategy 2002 mentioned that Churia should be conserved as a protected forest but did not specify any specific program for its conservation. Poverty Reduction Strategy Paper (PRSP), the Tenth Five Year Plan (2002-2007) of the government of Nepal, has promoted the concept of 'integrated watershed management' for the Churia range through local participation and in coordination with agriculture and water resource authorities.

The Churia area has been facing increasing encroachment especially from poor and landless people. Lots of efforts were made in the past to resolve the squatters' resettlement issues but often had limited success. There existed Act an act and policies for land use pattern (Land Act 1964) but it has never been put into practice. One of the basic problems with Churia conservation is an inadequate understanding of the underlying complex relations between conservation and livelihoods of local people. Churia conservation is often treated as a stand-alone issue, disregarding the livelihood of the people who depend on Churia resources for their subsistence. To give a practical example, if the local communities in and around Churia are to use non-forest based energy with the view of promoting conservation, alternate energy must be made available at a lower cost than the opportunity cost of collecting fuel woods from the forest. However, one common form of alternative energy for cooking – the LPG, costs about Rs. 1,100 which is beyond the reach of a poor family. At current wage rate one has to work 11 days to earn just for a cylinder of LPG! This situation compels local residents to enter into the forest illegally for meeting their basic needs for fuel woods, fodders as well as other products for sustaining livelihoods. Despite so many promises through a series of related Acts and regulations, there seems very little effort in the real ground. There seems lack of due attention to and lack of specific plans and policies for Churia conservation, and also poor implementation of existing policies. Some of the important Acts, regulations and plans related to forest sector, NTFP collection & trade are:

- Master Plan for Forestry Sector, 1989
- Forest Act, 1993; Forest Regulation, 1995
- Soil Conservation and Watershed Management Act, 1982
- National Parks and Wildlife Conservation Act, 1973; Rules 1974
- Conservation Area Management Rules, 1996
- Himali National Parks Rules, 1980
- Wildlife Reserve Rules, 1977
- Buffer-Zone Management Rules, 1996; Guidelines 1999
- (EIA) Guidelines, 1993
- Plant Protection Act 1972; Rules 1975
- Export Import control Act; Regulations 1997
- CITES, 1975
- Aquatic Life Conservation Act,1961
- Water Resources Act, 1992
- Environment Protection Act, 1996; Rules 1997
- EIA Guidelines for Forestry Sector, 1995
- National Environmental Impact Assessment

6.2 Churia area development programs and achievements

Realizing the importance of Churia range conservation many organizations have been working in its different parts mostly trying to address conservation as well as needs for local livelihoods. Some of the important past and current programs are highlighted in this section.

JIWAN Program: Three Danish NGOs – CARE Danmark, Danish Forestry Extension (DFE) and the Foreningen af Folkehøjskoler I Danmark (Danish Folk High Schools Association - FFD) have formed an alliance to design and implement the Jaladh Integrated Watershed and Natural Resources Management Program (JIWAN Program, "Jiwan" mean "life" in Nepali) in Nepal. The program is being implemented and locally managed by CARE Nepal in the Jaladh river catchment area in Dhanusha district, in the southeastern part of Nepal, and intends to promote conservation through innovative financial mechanism while addressing the local livelihoods at the same time. This project was built on experiences gained from Churia Watershed Management Project that was implemented in Sarlahi and Mahottari districts.

CHULI Programme: Being implemented by CARE Nepal, this programme intends to improve the livelihood security of people especially the poor, vulnerable and socially excluded women and men in the Churia hills, Bhabar and downstream regions of three districts – Sarlahi, Mahottari and Dhanusha districts through equitable and sustainable community-based natural resource management.

Terai Arc Landscape Project: this program is implemented jointly the Government of Nepal (Department of Forest and Department of National Parks and Wildlife Conservation) in Collaboration with WWF Nepal, and intends to protect endangered species and restore natural habitats through effective participation of local communities and resource managers and beneficiaries. It proposes to restore and maintain forest corridors linking 11 protected areas between Nepal's Parsa Wildlife Reserve and Royal Chitwan National Park to India's Rajaji National Park. Some of the strategies adopted by the Terai Arc Landscape program to address the issues of watershed degradation are: a) better awareness and understanding about the importance of Churia watersheds, b) promotion of community forestry so that communities protect their own resources through various activities, c) promotion of various income generation activities and, d) promotion of alternative energy to reduce pressure in the natural resource base.

Practical Innovations for inclusive conservation and sustainable livelihoods project is being implemented by IUCN Nepal with assistance from SDC. It aims to promote biodiversity conservation, environmental justice and sustainable livelihoods in Nepal, and works on two different components at two separate locations in the Churia region. The benefit sharing component is being implemented in Doti district which works to enhance economic incentives to poor and marginalized natural resource dependent households to manage medicinal and aromatic plants and NTFPs equitably and sustainably, while the

landscape governance component is being implemented in Ilam district for promoting better governance systems and enable local stakeholders to effectively and equitably manage conservation landscapes. Beneficiaries of this project are poor and socially excluded households and women dependent on biodiversity for livelihood security.

Churia Watershed Management Project: this project was implemented jointly by CARE Nepal and Dept of Soil Conservation and Watershed Management, Government of Nepal, with the funding support from Danida. It aimed to improve the livelihood security of poor and vulnerable people in the Churia Hills, Bhabar and downstream regions of Sarlahi and Mahottari districts by improving the watershed conditions in the upstream areas.

Biodiversity Sector Program for Siwalik and Terai (BISEP-ST): SNV Nepal has initiated this program that covers eight Churia districts in the Central Development Region, including Terai and Siwalik. It works with Government of Nepal through MoFSC. This program aims to build the capacities of local communities and institutions working in forest conservation to enable them manage the forests on their own. It endeavors to promote forest management through collaborative efforts of all users and stakeholders at different levels; manage forest for poverty alleviation through the conservation of biodiversity; and to promote livelihood opportunities through providing access to the sale of biological resources.

Rural Community Infrastructure Work (RCIW): this program is aimed at improving the livelihoods of the most vulnerable households in few food deficit districts – Siraha, Saptari, Udaipur and Dhsnusha. This program is supported by GTZ and WFP and is working with the District Soil Conservation Offices (DSCOs). WFP's food for work program provides food as payment for the conservation work carried out by poor and marginalized communities. These are some of the noted programs implemented in Churia area for its conservation, while there are many other small scale efforts from different local and other organizations.

6.3 Assessment of the major threats to the Churia area:

By virtue of fragile structure and soil composition of Churia hills it is more vulnerable to any external shock beyond a threshold. However, this reason has been under increasing pressure due to increasing human interferences. Some of the threats to it are natural while many are man-made. Some of the common threats identified through community workshops are open grazing, forest fire, overexploitation of resources, and in-migration and encroachment.

Some of the common underlying causes to those threats are burgeoning population pressure and their increasing need for resources and infrastructure development, and at the same time, state's failure to provide incentive based conservation mechanism that could motivate local community to mitigate such threats. Minute analysis and understanding of the causes of those threats could help design better conservation programs in the future.

6.3.1 Open grazing:

Open grazing of cattle and goats has been a common practice in and around Churia and at the river banks. However, in the areas where forests area now managed by local community, grazing has been much regulated. Grazing at the river banks were also reported to be causing severe problems in land cutting as it exposes the loose soil to rains and generates erosion. People in the study area believe that shrubs play vital role in erosion control and in increasing the water filtration rate, and goats are the major culprit damaging the growth of those shrubs. Goat causes heavy damage through voracious grazing of grasses and shrubs in forest/watersheds and river banks.

The number of cattle and goats raised is higher in and around Churia region, and more than half the livestock population is made up by goat (Table 5). Paradoxically, conservation and development organizations are also promoting goat farming as a livelihood option among poor communities in and around Churia. Though much regulated in other areas, it is still openly grazed in Jaladh and Kandra area. In Kandra area, besides local communities, many people from outside (downstream) come to the foothill with their goat herd temporarily for four to five months every year after the agricultural season (rice planting), and raise them and raise them living in temporary shed. Lower areas of Churia hills are already under informal management of local communities and they do not allow goat to graze in their area, and thus, goats are taken in the upper watershed areas these days. About 50-60 such temporary sheds are estimated existing in the foothills of Kandra study site, each with a goat size ranging from 50-150. The total number of goats estimated in those sheds range from 6k to 10k, which grazes in Churia hills in addition to those owned by local communities. Because of availability of free grazing option, people in the area prefer goat rather than cattle. In one of the small settlement at foothills with only 11 households, about 300 goats but only 1 buffalo were found.

Construction of such temporary sheds and arrival of people with goat herds are increasing in recent years. It is causing not only destruction of green shrubs but also about 4-5 thousands of small and medium sized different trees are being fallen for fodder leaves in the shortage of shrubs to graze every year in this reason. This way, the area is losing many important shrubs and plants, and exposes sloppy surface to intense rains generating huge mass of soil erosion.

6.3.2 Resources over-exploitation:

Churia forest resources are seen highly exploited in the areas where there is no CFUG and no sense of ownership by local people. Besides heavy resources use by local people, many timber mafias are active in different parts of this region involved in extracting and trading important tree species. At none of the site under this study, government organization was seen involved in monitoring and control of resources extraction. Many high value trees and other resources are almost disappearing from the forest in overexploited areas, and the adverse impacts of upstream damages is already realized in the downstream areas

now manifested mainly in declining surface water in the rivers and declining groundwater table also resulting in drying up of well which are used for drinking water purpose. Should the trend continue, it'd threaten the livelihoods of huge population of poor and vulnerable communities.

Sand/boulders/pebbles etc. are heavily extracted from various rivers including three of the four study sites. With urbanization and increasing demand for infrastructure with increasing population, extraction of sand and stones is increasing substantially. Also these are now exported to India. Usually DDC contracts out such collection from rivers in its jurisdiction.

However, there is no any study on its environmental consequences of such extraction if there could be any. Some people in the study area believed that heavy extraction from river would tend to pull more of such materials from Churia, and were found worried on its potential dangers. Further, they mentioned that some studies must be done to identify the level and areas for such collection to keep the local community safe in days ahead, and also opined that its benefit must be shared with local communities. Though LSG contains the concept of benefit sharing, but was not seen in practice. Contractors were observed charging different amount for the same resources in different areas. There is other thought also on such collection which looks at its positive aspect. Some people believe that the bridges on the highway are more damaged if riverbed is high, and thus, extraction of sand/boulders from river helps protect the bridges.

6.3.3 Encroachment

To Churia area has been a constant problem for decades. Since the eradication of Malaria in early 1950s people started moving southward from hills and mountains in search of opportunities and started settling in Churia and surrounding areas at state owned lands, clearing forest, cutting fuel wood and other resources haphazardly. Growing population in and around Churia, increasing number of landlessness due to natural calamities are further causing illegal settlements and forest clearances. Figure 18 and Figure 19 indicates the in-migration of people in the study areas over time. Let's look specifically the in-migration to up hills, foot hills and Bhabar zones (in Figure 19) as these areas are important for water contribution and damages control to south plains. Bhabar has been considered as

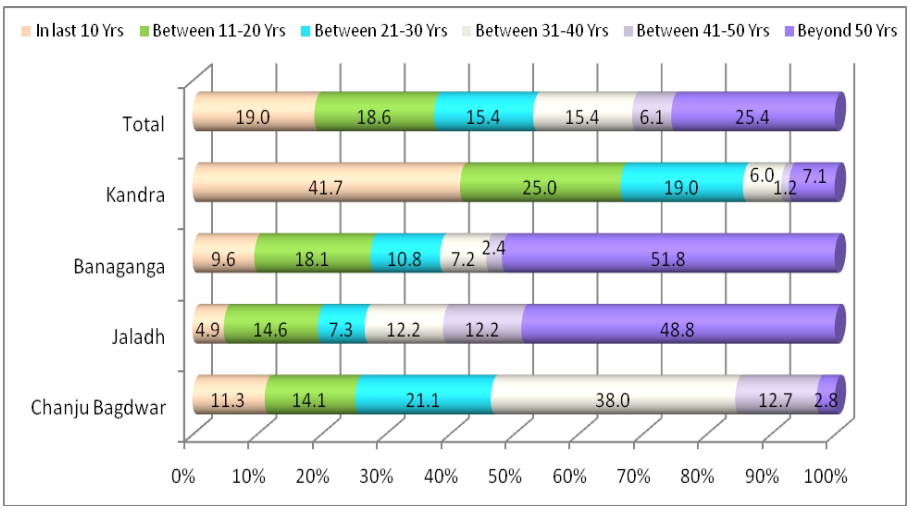


Figure 18: In-migration to study sites over time

the major important zone for groundwater recharge in Terai, and any encroachment to this area affects this provision in long term. However, about half of the current households in foothills and Bhabar have come and settled during last 30 years, and to show the trend, about one-third of current households in Bhabar area have in-migrated during last 10 years. Due to such faster rate of increasing population and subsequent demand driven infrastructure development in this region indicates to devastating threat for groundwater in south plains.

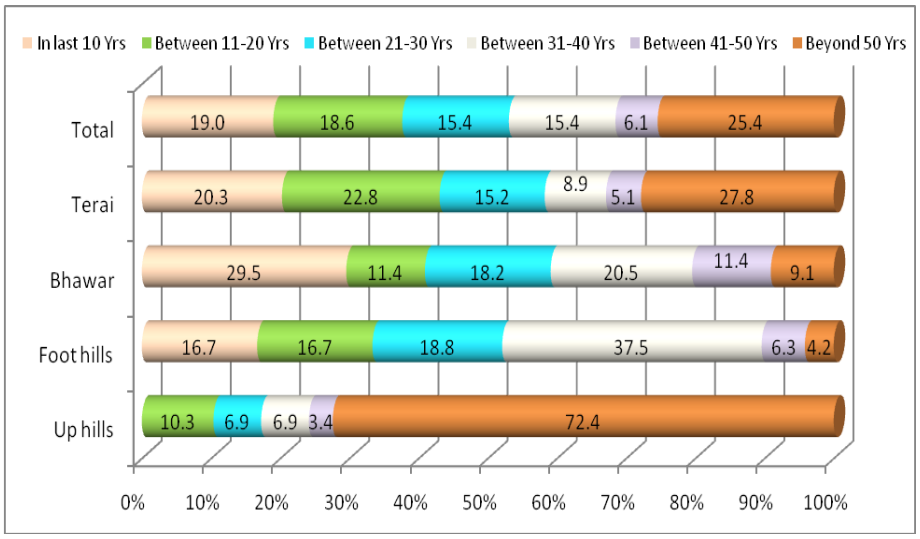


Figure 19: **In-migration to study sites across physiographic zones**

About one-third of total sample households still do not have their ownership over the lands they have in possession, but are state owned lands. Most of them are in Chanju Bagdwar area and Kandra area, and especially in foothills and Bhabar zones (Figure 20).

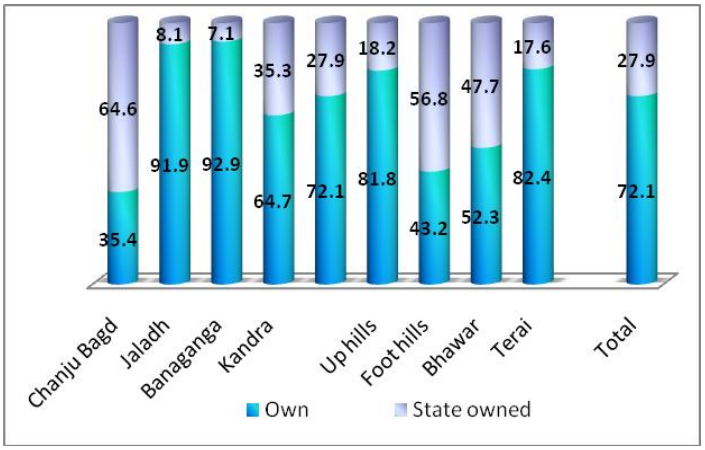


Figure 20: Land ownership status among sample HHs

There have been many efforts in past to find solution for illegal squatters in this region but lack of political will and maybe many other reasons have often resulted in very limited success so far. The Management Plan for the Bagdwar and Chanju Sub-watersheds of Chulachuli VDC (2002-2006) prepared by IUCN mentions that over 100 squatter households have built simple huts at some 18 hamlets in that area and engaged in cultivating the land as well as supporting timber mafia by working as loggers.

6.3.4: Forest fire

Forest fire is commonly seen in the Churia forests many times a year during dry months. Forest fire is caused naturally as well as by human to fulfill their interest. In the area where CFUG exist, they try to control human activities causing fire, and also take care once the fire is caught. However, in the other area under state ownership, once fire is caught in forest somehow, usually it lasts for many days and goes on spreading around causing damage to thousands of hectares of forest areas until there is rainfall to settle it down.

Annually, about 4k hectares of forest damage was reported only in Jaladh watershed area.

Forest fire not only damages the forest trees but destroys the whole ecosystem of the watershed, birds, animals, insects, plant species and important shrubs. Destruction of plants and greeneries consequently affects water quality and quantity downstream, and enhances landslides. Further, often it affects the nearby communities by damaging their lives and properties and affecting health through smokes.

Self generated fires are often caused by friction in bamboo and some other inflammable plant species, or through the friction of stones. During dry season, once the fire is sparked it is easily caught in dry leaves. In the case of Jaladh, forest fire frequency is reported to have declined due to lack of trees and thus dry leaves during dry season. Similarly in Chanju and Bagdwar watershed almost no forest fire is observed these days mainly due to control measures taken by CFUG and increasing greenery.
For man-made forest fire, there are many reasons why people put fire in the forest:

- local people with land on slopes put fire in the upper forest area to get nutritious ash flown down by rain water to their agricultural fields,
- wood smugglers put on fire to burn shrubs and enhance visibility to outsiders/control authorities coming in,
- with the hope to get coal and ash for commercial purpose,
- animal herders put on fire with the hope of new grass regeneration,
- to control leech and other insects population which otherwise makes the movement in forest difficult,
- unknowingly through burnt cigarettes, etc.

Lower frequency and intensity of forest fires were reported in community managed forests compared to open forest where there is no one to take care of once it starts burning. Thus, it seems, better control over forest fire could be achieved through formation of local guardianship, e.g. CFUG, creating conservation awareness and showing them the benefits of conservation.

7. Conclusion and Recommendations

Churia hills are observed to make a have significant contribution to the livelihoods of people in and around this region by providing some basic needs goods, and services. Major benefits derived by local communities are mainly fuel woods, herbs, timbers, water for agriculture, fodder for livestock, etc. while water benefits reach to even distant communities in the Terai directly (surface) or indirectly through groundwater recharge. Thus, protection of this region is very important and needs special attention. This study was carried out with the major objective to assess the economic value of selected goods and services from Churia region that are of direct relevance to the livelihoods of surrounding communities, and to see the possibility of piloting innovative financial mechanisms for the sustainable management of the region. Major findings and a few recommendations could be summarized as below:

1. **Water benefits:** water benefits accrue to downstream communities from the foothills to the Terai plains. It's use in agriculture was evaluated mainly in two major crops, and it showed a huge benefit – about Rs. 500/kattha of paddy and Rs. 258/kattha from wheat in average. The benefit per kattha varied from one to another area and in different zones from north to south – increasing level of benefit per unit of land is seen from north to south (from foothills towards Terai plains). Jaladh and Banaganga river water is used in farms through structured canals, and thus, irrigates a much larger area of farms compared to Chanju/Bagdwar and Kandra rivers wherein water is canalled through temporary structures which are vulnerable to damages and requires more labor/cost every year. The estimated total economic value of irrigation water at study sites ranges from Rs. 3.9 million and Rs. 6.72 million in Chanju/Bagdwar and Kandra respectively to Rs. 74.19 million in Jaladh and Rs. 127.45 million in Banaganga. It clearly indicates a great potential for benefitting downstream agriculture and capturing huge economic benefits through development of well structured irrigation canals in many of the rivers originating from Churia.

2. **Forest resources benefits:** forest resources such as fodder, fuel woods, medicinal herbs, timber etc. contribute significantly to the livelihoods of surrounding communities. The overall benefit in economic terms per household per annum is estimated at Rs. 10.7k. Among study sites, this benefit per household is less in Banaganga and significantly higher in Kandra wherein all the resources are extracted in larger quantities. The benefit across the north-south trajectory doesn't vary much; nearby communities to Churia get more benefits from fodder, fuel woods, and medicinal herbs while distant communities target timber extraction. According to economic classes, per household resource use is higher among economically better off families. In the sample households, relatively better-off economic groups of people are found to have more than three times the amount of resource extraction compared to the poor households group. Interestingly this is against the general belief that poor are the ones who damage natural resources more. Forest resources constitute about 13% of the total household income. Besides those figures, a huge amount of timber is being extracted for commercial purposes by some local as well as distant people through a well established "mafia".

   Such illegal collection and over-extraction of resources by surrounding communities needs to be controlled urgently to sustain livelihoods of local communities and downstream benefits in the future. And for this to happen, a very important aspect is the political will to do so; and secondly to promote incentive based conservation approaches through local communities, e.g., handing over national forests to community especially the areas rich in NTFPs which are more prone to over extraction; strengthening community groups to make better economic use of their forest resources that supports conservation as well as livelihoods together; people in and around Churia, forest users, collectors and traders need to be made aware on existing policies and their roles in conservation, possible benefits, etc.; promotion and adoption of PES, etc. However, to design a good conservation program and approach,

information on important resources being extracted, legal and illegal users, quantity extracted, market etc. assumes greater importance and thus, appropriate mechanisms must be developed to monitor these aspects fully for a year or two. Though illegal extraction of especially timber was reported at all the sites, most severe problem was reported in Jaladh and Banaganga areas. In those areas, informal resource monitoring stations could be set up mobilizing local clubs/CBOs or young unemployed, at few common routes of resources transportation and in the way to avoid double counting.

3. **Churia area management:** there exists an array of policies and regulations and decades of efforts, however, not much has been achieved in terms of conservation due to an inadequate understanding of the inherently complex nature of its problems. Somehow these policies have not been able to address adequately the conservation and the livelihoods of resources dependent people together. At this juncture of time, there is growing understanding and concerns for its linkages with and importance for downstream communities, and thus, all the three regions, viz., Churia, Bhabar and Terai have to be looked through an integrated approach as there exist vital economic relations among these areas. For example, fast population growth and uncontrolled infrastructure development in Bhabar has been become a growing threat to groundwater in the Terai plains, as Bhabar contributes a lot to groundwater body through rainwater percolation. There is a need to link up the use of land and forest resources to biodiversity conservation through economic incentives to local people and safeguarding their traditional livelihood strategies.

   Given the importance of Churia conservation and its multifaceted problems ranging from undue resources extraction to land rights and encroachment, establishment of a separate entity/portfolio for the Churia area management is deemed very important. This entity should take up all the issues related to Churia conservation from field implementation up to policy levels, promote innovative and participatory conservation approaches, and consolidate and streamline all the efforts from different sectors made for its conservation.

   For achieving adequate attention to conservation of important resources, assessment of benefits and costs associated with ecosystem services should form an inevitable part of the environment related decision making processes, and the values be reflected fully in the decisions. Forest users, collectors and traders need to be recognized as legitimate stakeholders and be involved in policy development process.

4. **Innovative approach for management:** The concept of PES has been gaining ground in recent years. There is a growing realization that hydrological functions of land use are of importance and that improved access to clean water and reduced vulnerability to disasters such as floods, landslides and water pollution etc. can actually improve livelihoods of local communities. In the case of watersheds, many studies have shown that watershed and forest protection has been much more effective where communities had an incentive to protect the area and where beneficiaries themselves contributed to the project costs. It has been an efficient mechanism in the cases where

state's command and control systems have failed. In current study of the Churia area, though hydrological relations couldn't be established scientifically, community people believe the existence of such relations and are willing to contribute for Churia conservation for the assured supply of sufficient water in the future. Besides, there are other positive signs indicating the possibility to capture downstream benefits through some PES-like innovating financial mechanism. However, the major complexity is due to lack of defined land/resource managers upstream, as these resources are being exploited by surrounding as well as distant communities. Thus, PES or like mechanism could be initiated in this area as a pilot project at one or two sites where there are significant number of people living upstream who could make real impact through land use changes and regulated resources collection. While at other sites with no defined upstream land managers, alternate mechanisms such as Conservation Funds could created to capture the benefits from beneficiaries and pooling resources from other sources, and this Fund could be utilized through local community based organizations for conservation activities and in setting up some resources flow monitoring mechanism which would help future designs of conservation program.

5. **Further research:** The issue of payment for environmental services is still in its infancy and there is big gap in knowledge that limits our ability to incorporate adequately the value of ecosystem services into policy decisions. Further research is required to determine what ecosystem functions support the provision of specific benefits, how their key parameters can be measured or estimated, and how efficient economic incentives can be created to encourage the sustainable supply of ecosystem services. More important in the Churia region is to establish the hydrological linkages scientifically and covering multiple uses of water for better capturing the downstream benefits.

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Annexes

Annex 1: HH survey questionnaire used for this study

घर धुरी क्र.सं .....
स्थान : डाँडामाथि/फेदी/ भावर/तराई

चुरीया क्षेत्रको आर्थिक मूल्याँङ्कण
आई.यू.सी.एन, डब्बलु.डब्बलु.एफ, केयर नेपाल

घरधुरी सर्भेक्षण फारम

क. साधारण

१. पारिवारिक जानकारी

उत्तरदाताको नाम		**धर्म** हिन्दु(१) बुद्धिष्ट(२) क्रिश्चियन(३) मुश्लिम(४) अन्य(५)	**जाति** ब्राम्हण/क्षेत्री (१) दलित (२) जनजाति (३) अन्य (४)
प्रश्नकर्ता र मिति			
गाउँ र वाड नं			

२) यो ठाउँमा कति वर्षदेखि बसोबास गर्दै आउनु भएको हो ? ..... यसअघिको बसोबास कहां थियो ? .....

३) परिवारका सदस्यहरुबारे निम्न विवरण दिनुहोस् ।

क्र.सं.	सदस्य/घरमूलीसँगको सम्बन्ध८	उमेर (वर्ष)	लिङ्ग म.(१), पु.(२)	शिक्षा (३स्कूल वर्ष)	पेशा		
					प्राथमिक	द्वितिय	पेशा संकेत
१.	घरमूली						१. कृषि/पशुपालन २. स्वरोजगार ३. सरकारी जागिर ४. प्राइभेट जागिर ५. ज्यालादारी ६. अन्य
२.							
३.							
४.							
५.							
६.							
७							
८.							
९.							
१०							

1. ८घरमूलिको श्रीमान् वा श्रीमति-१, छोराछोरी-२, बाबुआमा -३, अरुहरु-४
अशिक्षित-०, शिक्षित-ह

ख. धन/सम्पत्ति

४. तपाईसँग निम्न सरसामानहरु छ की ?

सामानहरु	छ/छैन	कैफियत	घर	
			घर/कोठाको संख्या	
टि.भि.				
मोटरसाइकल/कार			किसिम	पक्का १ कच्चा २ अर्ध पक्का ३
ट्याकटर				
थ्रेसर			प्रभूत्व	मालिक १ सहायतामा २ भाडामा ३
अन्य				

५. खाना पकाउनको लागि कुन इन्धन प्रयोग गर्न हुन्छ ? एक भन्दा बढी भएमा मूख्य तथा अन्य इन्धनहरु संकेत गर्नुहोस ।

दाउरा मट्टितेल ग्यास विधुत अन्य.....

६. कृपया तपाईसँग भएका जग्गा बारे निम्न जानकारी दिनुहोस ।

जमिनको किसिम	**आ^नो जग्गाको मात्रा/स्वामित्व तथा मूल्य**				
	आफ्नो कति छ ?	*अधियामा लिएको*	*अधियामा दिएको*	*कूत रु./वर्ष*	*हाल जमिनको मूल्य/एकाई*
सिंचित जमिन (खेत)					
असिचित जमिन (बारी)					
अन्य, यदि भए					

७. तपाईको जग्गाहरु तपाई अथवा परिवारको कुनै सदस्यको नाममा दर्ता भएको छ ? छ छैन,
यदि छैन भने जग्गाधनी को हो ? घरभएको जग्गाको ..... खेत बारीको .....

ग. कृषि/पशुपालन

८. गत वर्षको खेतीपाती बारे निम्न विवरण दिनुहोस ।

जमिनको किसिम	विवरण	बाली १	बाली २	बाली ३	कैफियत
सिंचित जमिन	बालीको नाम				
	खेती गरिएको क्षेत्रफल				
	उत्पादन मात्रा				
	समय अवधि (महिना)				
असिंचित जमिन	बालीको नाम				
	खेती गरिएको क्षेत्रफल				
	उत्पादन मात्रा				
	समय अवधि (महिना)				

९. गत वर्ष तपाईको बालीहरुको उत्पादन तथा बिक्रिबारे जानकारी दिनुहोस् ?

क्र.सं	उत्पादन मात्रा (के.जी)	बेचेको मात्रा (के.जी)	विक्रि मूल्य रु./के.जी	खरिद मात्रा (खानको लागि)	मूल्य/के.जी	विउको लागि राखेको मात्रा	कैफियत
गँहु							
धान							
मकै							
कोदो							
तरकारी							
अन्य १							
अन्य २							

१०. खेतीमा अन्दाजी लगानी प्रति वर्ष ?

गत एक वर्षमा	किसिम/ विवरण	गँहु	धान	मकै	कोदो	तरकारी	अन्य
विऊ किनेको (के.जी)८							
जम्मा मूल्य यातायात सहित							

घरसम्म ल्याउन लागेको समय							
किनेको मल (के.जीं)							
जम्मा मूल्य यातायात सहित							
घरसम्म ल्याउन लागेको समय							
किटनाषक खरिद जम्मा (रु.)							
अन्य							

८ आफूले बचाएको विऊ बाहेक

११. गत वर्ष कृषिको लागि कति कामदार, जनावर र औजारहरु प्रयोग गर्नु भयो ? (जोत्नेदेखि बाली भित्रियाउन सम्म)

बाली १ : .....

क्रियाक्लाप	आफ्नै			ज्यामी			कैफियत
मानव श्रम	पुरुष	महिला	बच्चा	पुरुष	महिला	ज्याला८/ दिन	
जमिनको तयारी (जोत्न, नर्सरी तयारी, मुख्य खेती तयारी, लेभलीङ्ग)							
रोपाई (विउ छर्ने, राप्ने)							
गोडमेल							
सिचाई							
मल/किट्नाषकको प्रयोग							
बाली कटाई /थ्रेसिङ्ग							
जनावर शक्ति		**प्रयोग गरिएका औजारहरु**		ट्याकटर	थ्रेसर	पम्पीङ्ग सेट (सिचाई)	अन्य
हल गोरु संख्या		दिन वा घण्टा					
भाडा दर रु.		भाडा					

८ महिला र पुरुषको लागि फरक भए, दुबै ज्याला दर उल्लेख गर्नुहोला ।

आ ैनै बस्तु तथा औजारहरु प्रयोग गरे पनि आ ैनो क्षेत्रमा प्रचलित भाडा दर उल्लेख गर्नुहोस

बाली २ : .....

क्रियाक्लाप	आफ्नै			ज्यामी			कैफियत
मानव श्रम	पुरुष	महिला	बच्चा	पुरुष	महिला	ज्याला८/ दिन	
जमिनको तयारी (जोत्न, नर्सरी तयारी, मुख्य खेती तयारी, लेभलीङ्ग)							
रोपाई (विउ छर्ने, राप्ने)							
गोडमेल							
सिचाई							
मल/किट्नाषकको प्रयोग							
बाली कटाई /थ्रेसिङ्ग							
जनावर शक्ति		**प्रयोग गरिएका औजारहरु**		ट्याकटर	थ्रेसर	पम्पीङ्ग सेट (सिचाई)	अन्य
हल गोरु संख्या		दिन वा घण्टा					
भाडा दर रु.		भाडा					

बाली ३ : .....

क्रियाक्लाप	आफ्नै			ज्यामी			कैफियत
मानव श्रम	पुरुष	महिला	बच्चा	पुरुष	महिला	ज्याला८/	

						दिन	
जमिनको तयारी (जोत्न, नर्सरी तयारी, मुख्य खेती तयारी, लेभलीङ्ग)							
रोपाई (विउ छर्ने, राप्ने)							
गोडमेल							
सिचाई							
मल/किट्नाषकको प्रयोग							
बाली कटाई /थ्रेसिङ्ग							

जनावर शक्ति		**प्रयोग गरिएका औजारहरु**	ट्याकटर	थ्रेसर	पम्पीङ्ग सेट (सिचाई)	अन्य
हल गोरु संख्या		दिन वा घण्टा				
भाडा दर रु.		भाडा				

१२. तपाईले प्रयोग गर्ने सिचाईका स्रोतहरु के के हुन् ?

	कुलो	खोला	जमिनबाट तानेर	ईनार	पोखरी	कैफियत
प्रयोग गरेको स्रोत (चिन्ह लगाउनु होस)						
प्रत्येक स्रोतबाट सिचाई गरेको बालीहरु						
सिचाईको मुल्य/कर (यदि भए), कस्लाई						
अन्य खर्च						

१३. तपाईको खेतमा सिचाई नपुगेको भए, किन ? ....

१४. विगत ५-१० वर्षमा निम्न कुराहरुमा फरक/परिवर्तन अनुभव गर्नु भएको छ ?

विवरण	विगत	हाल८	परिवर्तनको प्रमुख कारण
बालीको चक्र			
कृषि कर्महरु			
बालीको उत्पादकत्व			
बाली १:			
बाली २:			
बाली ३:			

८ उत्पादन (स्थानिय एकाईमा) प्रति एकाई जग्गा (स्थानिय एकाईमा)

१५. कृपया तपाईसँग भएका गाई बस्तुहरुको जानकारी दिनुहोस् ?

प्रकार	हालको संख्या	विगत ३ वर्षमा					विगत १ वर्षमा				
		किनेको संख्या	मूल्य / एकाई	बेचेका संख्या	मूल्य/ एकाइ	आफै खाएको संख्या	अरु बस्तु (वार्षिक)	उत्पादित मात्रा	विक्रिको मात्रा	मूल्य/ एकाई	कैफियत
गाई							दुध				
भैसी											
बाख्रा											
भेडा							ऊन				
कुखुरा							अण्डा				
अन्य							अन्य				

१६. आफ्नो गाई बस्तुहरु चरनको लागि कहाँ लग्नु हुन्छ ? मौसम अनुसार जानकारी दिनुहोस् ?

१७. गाई बस्तु /कुखुरा पालनमा तपाई र तपाईको परिवारले कति समय विताउनु हुन्छ ?

को	हिउँद	वर्षा	कैफियत

वयश्क			
बच्चा (१५ वर्ष सम्म)			

१८. गाई वस्तु/कुखुरा पालनको लागि वार्षिक औषधि उपचार खर्च रु.....

१९. गाई वस्तु/कुखुरा पालनको लागि घाँस/दाना किनेको भए, वार्षिक खर्च रु.....

घ. चुरीया सम्बन्धि समुदायको धारणा

२०. तपाईको विचारमा चुरीया कतिको महत्वपूर्ण छ र यसको संरक्षण गर्नु किन आवस्यकछ ?

२१. तपाईको विचारमा चुरीयाबाट के-के महत्वपूर्ण बस्तु तथा सेवाहरु पाइएको छ ?

२२. चुरीया बाट तपाईको घरलाई केही फाईदा भएको भए, कृपया गत वर्ष बारे निम्न जानकारी दिनुहोस ।

बस्तु/सेवा	हिउँद		वर्षा		बेचेको		वनका किसिम		
	मात्रा (मासिक)	खर्चित समय/म.	मात्रा (मासिक)	खर्चित समय/म.	मात्रा (बार्षिक)	मूल्य/एकाई	खुल्ला/राज्य	सामुदायिक वन	प्रयोगका सर्तहरु
घाँस									
दाउरा									
काठ									
बाँस									
जडिबुटी									
अन्य.....									

२३. चुरीयाबाट हाल तपाईले पाएको यी फाइदा वरावर तपाईलाई नगद आम्दानी उपलब्ध गराएमा सो संकलन गर्न छोड्नुहुन्छ?

क) हो ख) होइन ग) विक्रिको लागि जम्मा गर्न छोड्छु तर आ^नो प्रयोगको लागि संकलन गर्छु ।

२४. चुरीया वन बाट बस्तुहरु संकलन गर्दा गत वर्षमा कुनै समस्या भोग्नु भएको छ ?

समस्याको किसिम	कति पटक	समस्या समाधानका लागि खर्चित समय	समस्या समाधानका लागि खर्चित रकम	कैफियत
वन विभागबाट कारवाही /सजाय				
जंगली जनावरबाट ज्यानको खतरा				
स्वास्थ्य समस्या, यदि कुनै भए				
अन्य समूहसित विवाद				
अन्य				

२५. तपाईको विचारमा को/कुन समूदाय /समूह चुरीयाबाट बढी लाभान्दित भएका छन् र कसरी ?

२६. यस (.....) चुरीया जलाधारको हालको संरक्षणको अवस्थाकस्तो रहेकोछ ?
२७. यस जलाधारको अवस्थामा विगत १० वर्षमा कस्ता परिवर्तनहरु देखिएको छ (कृषि/वन्य उत्पादन/संकलन/चरण आदि)

क) सप्रिएको भए,
१) के ले गर्दा सप्रिन मद्दत गरेको ?

२) देखिएका परिवर्तनहरु के-के हुन ?

३) यसरी सप्रिनमा डाँडामाथिका, फेदिका, भावर तथा तराईका बासिन्दाहरुको कस्तो भूमिका रहेको छ ?

ख) विग्रिएको भए,

अ) मुख्यतः कुन समुदाय/समुहले नोक्सान पुर्‍याएका छन् र कसरी ?

आ) जलाधारको बदलिदो अवस्थाका कारण के-के असरहरु तपाईले महशुस गर्नु भएको छ ?

१) मुख्यतः

२) नदि/कुलोको पानीको उपलब्धतामा कुनै असर ? (मात्रा- समग्रमा, सुख्खा मौसममा०

३) पानीको मात्रामा असर परेको भए, कृषि/सिचाईमा यसले कस्तो प्रभाव पारेको छ ? (उत्पादकत्व वा बालीचक्रमा प्रभाव, वा कुनै बाली उत्पादन गर्न असमर्थ)

४) यो जलाधारक्षेत्र तथा यस खोला/नहरमा पानीको उपलब्धतामा के-कति सम्बन्ध रहेको महशुस गर्नु भएको छ ?

५) जलाधारक्षेत्रमा परिवर्तनलेगर्दा सतहमूनिको पानीको मात्रा वा गुणमा केही फरक अनुभव गर्नु भएको छ ? यदी छ भने, के-कस्तो परिर्वतन? (मौसमी फरक बाहेक)

२८. वितेको केही वर्षमा तपाईले बाढी पैरो मा के-कस्तो परिवर्तन अवलोकन गर्नु भएको छ ?

क) देखिएका परिर्वनहरु.....

ख) तपाइको विचारमा देखिएका यी परिर्वनहरु चुरीयाको अवस्थामा भएको परिवर्तनसँग कतिको सम्बन्धित छ र जलाधारको राम्रो संरक्षणबाट त्यस्ता विनाशहरु कति सम्म रोक्न सकिन्छ ?

ग) विगत ५ वर्षमा खेतमा बाढीको पानी जमेर, तपाईले कुनै बाली गुमाउनु भएको छ (नोक्सानीको प्रतिशत कति) वा कुनै बाली उत्पादन गर्नसक्नु भएनकी ?

घ) विगत ५ वर्षमा तपाईले बाढी पैरो बाट खेती योग्य जमिन गुमाउनु भएको छ ? यदि छ भने कहिले र कति ?

२९. वितेको ३ वर्षमा तपाईले सिचाई र घरायसी प्रयोगको लागि पानीको अभावको सामना गर्नु भएको छ ?

प्रयोग	समस्या परेको महिना	कति हद सम्म	गुमाएका अवसरहरु?	कसरी व्यवस्थापन गर्नुभयो?
सिचाई				
घरायसी प्रयोग				

३०. चुरियाको राम्रो संरक्षणबाट यदि धेरै वा राम्रो पानी उपलब्ध गराईएमा, यसबाट तपाईलाइहुने अनुमानित फाइदाको वापत केहि रकम चुरिया संरक्षणकालागि सहयोग गर्न इच्छुक हुनुहुन्छ ?

३१. तपाइको घरपरिबारले प्रयोग गर्ने खाने पानीको विवरण

प्रमुख स्रोतहरु	प्रयोग गरेको	पानीको उपलब्धतामा मौसमी परिवत		१० वर्षमा भएको परिर्वतन८
		सुख्खा मौसम	वर्षा मौसम	
धाराको पानी				
टियुबवेल/हाते पम				
ट्यान्क/पोखरी				
खोला/कुलो/ताल				

अन्य				

८क्षेत्रमा, पानीको मात्रामा, पानीको गुणमा वा अन्य

ङ) घरायसी खर्चको विवरण

३२. कृषि र पशुपालन आम्दामी बाहेक तपाईको घरपरिवारको वार्षिक आम्दामी र खर्च कतिजतिछ ? (महिनावारी खर्चको आधारमा अनुमान गर्ने)

वार्षिक खर्च			वार्षिका आम्दामी		
विवरण	जम्मा रु.	कैफियत	स्रोतहरु	जम्मा रु.	कैफियत
खाद्य सामाग्रि खरिद			स्वरोजगार		
लुगाफाटा			जागिर/सेवा		
शिक्षा			ज्याला मजदुरी		
स्वास्थ्य			पेन्सन		
धर्म/संस्कृति			अनुदान		
अन्य			अरुहरु		

३३. गत ३ वर्षमा आफ्नो खर्च धान्न पैसा सापट लिनु भएको थियो की ?
यदि हो भने, कृपया निम्न जानकारी दिनुहोला ।

ऋणको स्रोतहरु	ऋणको रक	व्याज दर	ऋण लिनुको उद्देश्य	तिरेको अवस
साथीहरु/आफन्तहरु				
स्थानिय जमिन्दार				
सामूदायिक समूह				
बैंक				
अरुहरु				

धन्यवाद

Annex 2: Economic value of water uses in irrigation

Value of water in irrigated paddy cultivation (Rs/kattha)

	Chanju Bagdwar	Jaladh	Banaganga	Kandra	Average	% of Tot cost
Material inputs, water costs	109.4	153.4	183.5	192.5	169.1	23.0
Labor costs	280.9	305.5	224.1	275.0	276.3	37.5
Animal & machineries costs	202.0	182.4	168.4	216.0	197.3	26.8
Subtotal	592.3	641.3	576.0	683.5	642.7	
Operating interest	29.6	32.1	28.8	34.2	32.1	4.4
Returns to management	57.9	61.3	72.0	56.2	61.8	8.4
Total costs of production	**679.9**	**734.7**	**676.8**	**773.8**	**736.7**	**100.0**
Yield (kg/kattha)	85.2	93.6	129.7	100.3	103.9	
Product price/kg	13.6	13.1	11.1	11.2	11.9	
Total product value	1158.7	1226.2	1439.7	1123.4	1236.4	
Net returns to water/kattha	**478.9**	**491.5**	**762.9**	**349.5**	**499.8**	
Total irrigated area (Kattha)	7040	109300	134200	10000		
Total irrig water value (m Rs.)						

Value of water in irrigated wheat cultivation (Rs/Kattha)

	Chanju Bagdwar	Jaladh	Banaganga	Kandra	Average	% of Tot cost
Material inputs, water costs	166.8	227.2	217.2	241.7	230.3	31.6
Labor costs	217.3	213.1	171.7	188.8	190.8	26.2
Animal & machineries costs	353.3	247.0	218.2	212.8	225.1	30.9
Subtotal	737.4	687.3	607.1	643.3	646.2	
Operating interest	36.9	34.4	30.4	32.2	32.3	4.4
Returns to management	46.8	48.8	46.6	52.5	49.3	6.8
Total costs of production	**821.0**	**770.5**	**684.1**	**728.0**	**727.8**	**100.0**
Yield (Av. kg/kattha)	56.7	58.8	70.1	74.0	68.0	
Product price/kg	16.5	16.6	13.3	14.2	14.5	
Total product value	935.6	976.1	932.3	1050.8	986.0	
Net returns to water/kattha	**114.5**	**205.6**	**248.3**	**322.8**	**258.2**	
Total irrigated area (Kattha)	4600	109300	134200	10000		
Total irrig water value (m Rs.)						

Annex 3: Average amount and value of Churia resources collected by a HH across study sites

		Quantity of goods			Estimated value of collected goods ('000 NRs.)				
Study Site	Physio-region	Fodder (MT)	Firewood (MT)	Timber (ft3)	Fodder	Firewood	Timber	Herbs & others	Total
Chanju Bagdwar	Up hills	10.20	1.86	0.00	5.25	4.88	0.00	0.78	10.9
	Foot hills	2.85	1.18	32.08	3.55	3.10	5.40	0.20	12.3
	Bhabar	0.33	1.68	9.00	0.64	4.42	1.49	0.00	6.5
	Terai	1.21	1.51	0.00	1.45	3.96	0.00	0.00	5.4
	Total	2.52	1.42	18.47	2.59	3.73	3.10	0.16	9.6
Jaladh	Foot hills	5.52	2.45	0.00	12.20	6.72	0.00	0.59	19.5
	Bhabar	1.76	0.79	28.50	5.21	2.16	5.52	0.68	13.6
	Terai	0.33	0.61	14.42	0.52	1.66	2.33	0.20	4.7
	Total	0.62	0.69	14.59	1.25	1.89	2.41	0.24	5.8
Banaganga	Up hills	5.77	1.47	2.61	6.03	3.15	0.44	0.14	9.8
	Foot hills	1.92	2.10	0.00	6.78	4.50	0.00	0.00	11.3
	Bhabar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	Terai	0.20	0.57	0.52	0.39	1.23	0.09	0.12	1.8
	Total	1.52	0.80	0.96	1.86	1.71	0.16	0.12	3.8
Kandra	Foot hills	1.72	1.42	0.00	1.58	2.11	0.00	0.25	4.0
	Bhabar	4.68	3.76	25.00	12.26	5.58	4.20	0.05	22.1
	Terai	3.05	3.48	74.61	7.12	5.18	12.63	0.16	25.1
	Total	3.23	3.34	58.31	7.56	4.97	9.86	0.15	22.5
Total	Up hills	6.68	1.55	2.07	5.87	3.51	0.35	0.27	10.0
	Foot hills	2.76	1.35	22.82	3.89	3.22	3.84	0.22	11.2
	Bhabar	2.08	2.22	15.83	5.41	4.20	2.72	0.08	12.4
	Terai	1.20	1.56	28.47	2.63	2.76	4.79	0.15	10.3
	Total	2.02	1.62	23.67	3.48	3.09	3.99	0.16	10.7

Annex 4: Average annual amount and value of Churia resources collected by a HH across economic classes

		Quantity of goods			Estimated value of collected goods ('000 NRs.)				
		Fodder (MT)	Firewood (MT)	Timber (ft3)	Fodder	Firewood	Timber	Herbs &	Total
Chanju Bag..	EC1	1.95	1.55	4.27	1.58	4.07	0.72	0.27	6.7
	EC2	3.65	1.38	15.79	4.41	3.63	2.62	0.00	10.7
	EC3	2.97	0.90	87.48	3.64	2.37	14.73	0.00	20.7
	Total	2.52	1.42	18.47	2.59	3.73	3.10	0.16	9.6
Jaladh	EC1	0.97	0.75	7.00	2.01	2.05	1.16	0.57	5.8
	EC2	0.30	0.62	11.79	0.49	1.71	1.93	0.24	4.4
	EC3	0.73	0.73	22.67	1.56	1.99	3.76	0.03	7.3
	Total	0.62	0.69	14.59	1.25	1.89	2.41	0.24	5.8
Banaganga	EC1	1.07	0.67	0.00	0.84	1.44	0.00	0.03	2.3
	EC2	1.02	0.84	0.00	1.56	1.80	0.00	0.20	3.6
	EC3	3.20	0.95	4.36	4.28	2.05	0.74	0.15	7.2
	Total	1.52	0.80	0.96	1.86	1.71	0.16	0.12	3.8
Kandra	EC1	0.91	1.62	15.18	1.64	2.41	2.52	0.00	6.6
	EC2	4.75	3.91	55.54	11.30	5.81	9.47	0.22	26.8
	EC3	4.21	4.77	116.22	10.17	7.08	19.63	0.24	37.1
	Total	3.23	3.34	58.31	7.56	4.97	9.86	0.15	22.5
Total	EC1	1.30	1.20	6.04	1.43	2.62	1.01	0.17	5.2
	EC2	2.35	1.77	21.55	4.60	3.24	3.64	0.18	11.7
	EC3	2.71	2.07	54.89	5.20	3.65	9.24	0.12	18.2
	Total	2.02	1.62	23.67	3.48	3.09	3.99	0.16	10.7

Annex 5: Average annual amount and value of Churia resources collected by a HH across physio-zones

	Economic Class	Quantity of goods			Estimated value of collected goods ('000 NRs.)				
		Fodder (MT)	Firewood (MT)	Timber (ft3)	Fodder	Firewood	Timber	Herbs & others	Total
Up hills	EC1	5.98	1.49	0.00	2.11	3.52	0.00	0.36	6.0
	EC2	5.76	1.43	0.00	7.35	3.16	0.00	0.00	10.5
	EC3	9.75	1.89	10.00	11.54	4.05	1.70	0.54	17.8
	Total	6.68	1.55	2.07	5.87	3.51	0.35	0.27	10.0
Foot hills	EC1	2.52	1.36	7.11	3.53	3.40	1.21	0.30	8.4
	EC2	2.83	1.42	6.67	4.18	3.16	1.11	0.19	8.6
	EC3	3.47	1.11	124.97	4.55	2.68	21.04	0.00	28.3
	Total	2.76	1.35	22.82	3.89	3.22	3.84	0.22	11.2
Bhabar	EC1	0.54	1.84	0.00	0.85	3.91	0.00	0.00	4.8
	EC2	0.96	2.07	40.15	2.99	3.98	6.98	0.21	14.2
	EC3	6.64	3.19	20.18	17.80	5.07	3.35	0.08	26.3
	Total	2.08	2.22	15.83	5.41	4.20	2.72	0.08	12.4
Terai	EC1	0.29	0.90	8.56	0.74	1.78	1.42	0.14	4.1
	EC2	2.04	1.84	24.61	4.61	3.14	4.13	0.20	12.1
	EC3	1.25	2.00	57.48	2.42	3.47	9.69	0.10	15.7
	Total	1.20	1.56	28.47	2.63	2.76	4.79	0.15	10.3
Total	EC1	1.30	1.20	6.04	1.43	2.62	1.01	0.17	5.2
	EC2	2.35	1.77	21.55	4.60	3.24	3.64	0.18	11.7
	EC3	2.71	2.07	54.89	5.20	3.65	9.24	0.12	18.2
	Total	2.02	1.62	23.67	3.48	3.09	3.99	0.16	10.7

Annex 6: Contribution of different sectors to livelihoods

					Values in (Rs. '000)
Study Site	Churia goods	Agriculture	Livestock	Job & Others	Total
Chanju Bagdwar	9.6	18.3	6.9	20.0	54.8
Jaladh	5.8	27.2	6.4	76.7	116.1
Banaganga	3.8	23.9	6.4	39.4	73.5
Kandra	22.5	33.4	7.7	32.1	95.7
Up hills	10.0	21.1	1.1	34.0	66.2
Foot hills	11.2	21.6	6.4	22.0	61.2
Bhabar	12.4	19.8	6.4	34.0	72.5
Terai	10.3	29.1	7.9	48.4	95.7
EC1	5.2	13.5	3.0	15.0	36.8
EC2	11.7	25.7	6.2	36.1	79.6
EC3	18.2	46.7	14.0	90.4	169.3
Average	10.7	26.1	6.9	41.2	84.8
Values in percentage of total contribution:					
Chanju Bagdwar	17.5	33.4	12.7	36.5	100.0
Jaladh	5.0	23.4	5.5	66.1	100.0
Banaganga	5.2	32.5	8.7	53.6	100.0
Kandra	23.6	34.9	8.0	33.5	100.0
Up hills	15.1	31.9	1.6	51.3	100.0
Foot hills	18.3	35.3	10.4	36.0	100.0
Bhabar	17.1	27.2	8.8	46.9	100.0
Terai	10.8	30.5	8.2	50.5	100.0
EC1	14.2	36.8	8.2	40.7	100.0
EC2	14.7	32.3	7.7	45.4	100.0
EC3	10.8	27.6	8.3	53.4	100.0
Average	12.6	30.7	8.1	48.6	100.0