

# CHAPTER I

## INTRODUCTION

### 1.1 Introduction

Since the beginning of civilization, people have used plants as medicine. Perhaps as early as Neanderthal man, plants were believed to have healing powers. A discussion of human life on this planet would not be complete without a look at the role of plants. In the same way, the indigenous people in different parts of Nepal have been utilizing natural resources in various ways since the time immemorial. Ethnobotany is the study of how people of a particular culture and region make use of indigenous plants. Ethnobotanists explore how plants are used for such things as food, shelter, medicine, clothing, hunting, and religious ceremonies. Ethnobotany has its roots in botany, the study of plants. Botany, in turn, originated in part from an interest in finding plants to help fight illness. In fact, medicine and botany have always had close ties. Many of today's drugs have been derived from plant sources (Veilleux and King, 1996). Which reveals the botany and livelihood had close relationship since the human civilization.

Nepal is a land of great altitudinal and ethnic diversity. The altitudinal limit varies from less than 150m to more than 8000m above sea level. Due to this altitudinal variation tropical to alpine vegetation and more than 6000 species of vascular plants as well as many ethnic groups with different customs and languages are found in Nepal (Rajbhandari, 2001).

Wetlands are sites distinguished by the presence of water, which often have unique soils that differ from adjacent uplands and support vegetation adapted to wet conditions. They comprise a wide range of inland, coastal and marine habitats characterized by the presence of flood-tolerant vegetation. The Ramsar Convention defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salty, including areas of marine waters, the depth of which at low tide does not exceed 6 meters", and which may include "riparian and coastal zones adjacent to the

wetlands or island or bodies of marine water deeper than six meters at low tide lying within” ((HMGN/MFSC 2002). Nepal has many types of wetlands with an estimated 382,700 ha in total (about 2.6% of the country’s area). Wetlands range from areas of permanently flowing rivers to areas of seasonal streams, lowland oxbow lakes, high altitude glacial lakes, swamp and marshes, paddy fields, reservoirs and ponds. Wetlands in Nepal are rich in biodiversity supporting habitat for large population of water birds, 172 species of major wetland plants, including threatened plant and animal species (GON/MFSC, 2009).

Nepal’s wetlands support diverse flora and fauna including many threatened species. A wetlands support diverse flora and fauna including many threatened species. A total of 91 globally threatened plants are found in Nepal, of which 11 are dependent on wetlands. Of 862 bird species in Nepal (BCN 2006), 193 (IUCN Nepal 2004a) are known to be dependent on wetlands. IUCN has identified 89 globally threatened and 74 near threatened animal species in Nepal of which at least 59 (66%) and 35 (47%) respectively are dependent of terai wetlands for all or part of the year. Of 20 endemic vertebrate animals found in Nepal, 17 are wetland dependent and 10 of these are present in terai wetlands (Scott 1989, Bhandari 1998a, IUCN Nepal 2004a, WWF Nepal. 2005).

Wetlands are among the most productive ecosystems in the world. They are very important in terms of their ecological, economic, cultural and recreational domains of livelihood. These ecosystems support a wide variety of plants and animals of economic value, which provide a wide range of goods and services as well as income-generating opportunities (MOFSC, 2002). People have a long and intimate association with wetlands. It’s a relationship that’s easy to understand when one considers the benefits, or ecosystem services, that wetlands provide to humanity. Apart from water security wetland contribute to local livelihoods, and especially for the poor (Toit & Perret, 2006). In addition to contributing to their life-support services that sustain us, wetlands also provide many people with a livelihood, or a means of earning a living, often the poor in rural areas, who are most directly dependent on wetlands for their livelihoods.

There is high dependency of local people on wetland resources. More than 125 ethnic communities are found in Nepal, of which about 21 are traditionally dependent either

directly or indirectly on wetland resources. These communities account for more than 17% of the country's population out of which more than 90% are of Tarai origin (WWF Nepal 2005 *cited in* Kafle 2005). As a result, a close interaction takes place between local community and wetland resources and there exists a vital contribution of wetland resources in local livelihood.

## **1.2 Statement of the Problem**

The ecological diversity of the wetland ecosystems of Nepal is very great. However, wetland biodiversity is under threat from encroachment of wetland habitat, unsustainable harvesting of wetland resources, industrial pollution, poisoning, agricultural runoff, siltation and the introduction of exotic and invasive species into wetland ecosystems. Very few researches have been carried out focusing on wetland ecosystem and associated biodiversity. The documentation of wetland issues is also poor (HMGN/MOFSC 2002). Plants are the major source of medicine for the treatment of different diseases in Nepal. Still majority of people, mainly indigenous people who believe traditional treatment method depend on plant rather than sophisticated drugs. In tarai region indigenous people are using plants for different purpose, still some ethnic caste (i.e. Chepang) are in semi wild condition whose livelihood directly depend on wetland resources. Beeshazar lake is also one of the dominant and versatile ecosystems in terai region that harbor precious species of flora, fauna and indigenous people in the vicinity. Indigenous people surrounding the Beeshazar lake have different knowledge, skill, practice and application of the plant resources but these knowledge, skill, practice and application are not sufficiently transferring in new generation and in wide area due to the lack of the documentation and exploration so the ethnobotanical knowledge is in verge of extinction. The government effort is fully apathetic in this context. Very less effort has been done by government and private organizations to trace the indigenous plant species and to explore their impact on local people's livelihood. Hence, there remains a big gap in knowledge and practice of ethnobotanical knowledge and its impact of local livelihood. In this milieu, this study has made an effort to document the major plant species, ethnobotanical use of wetland resources and its role in local livelihood with reference to Beeshazar wetland of Chitwan district.

### **1.3 Objective of the Study**

The general objective of the research study is to assess ethno botanical use of wetland resources and their role in local livelihood.

The specific objectives are:

- Identification and listing of the plant diversities found in the study area.
- Documentation of the ethnobotanical use of the identified (plant) wetland resources.
- Assessing linkage and association of the wetland resources use in contribution to local livelihood.

### **1.4 Importance of the Study**

Wetlands are among the most productive but threatened ecosystems on earth. Wetlands provide many benefits – environmental, economic and social – yet there is a limited assessment of these multiple values and therefore, have little attention in national accounts (Poudel, 2008). Wetlands are crucial for human survival and economic well-being, for ecosystem functions and for earth's life support system and also are of immense socioeconomic importance by providing food, fodder, fuel and water for domestic, irrigation and industrial purposes (Kaul, 2003). They are critical for contributing to poverty reduction if managed and used properly.

The Terai wetlands support several endemic and globally threatened species. There are about 20 indigenous ethnic communities traditionally dependent on wetland products or services. However, these are getting lost or degraded by human activities or by some natural processes. There is an emerging need to promote the wetland conservation in Nepal's Terai to reduce the degradation of wetlands and depletion of native species ( Siwakoti, 2006).

The Government of Nepal has endorsed National Wetland Policy 2003 with the objective of involving the local people in the management of Nepal's wetlands and to conserve wetlands biodiversity with the wise use of wetlands resources. The primary goal as stated in the policy is to conserve and manage wetlands resources wisely and in a sustainable way with local people's participation. Emphasis is given to conserving wetlands by involving the local people, promoting awareness, using

wetland resources wisely, preventing and controlling pollution and invasive species. The policy directed the government – in consultation with concerned stakeholders – to formulate and implement integrated action plans that encourage multi-dimensional model and promote wetland conservation. The policy stated that the legal arrangements to make the wetland management activities effective should be formulated. The need to formulate acts, regulations and guidelines to ensure the jurisdiction and the capabilities of the bodies responsible for wetlands conservation and management is realized from all sides.

Very few researches have been carried out focusing on wetland ecosystem and associated biodiversity. The documentation of wetland issues is also poor (HMGN/MFSC 2002). In this context, this study attempts to provide a comprehensive overview of resources available in the wetlands with reference to Beeshazar lake of Chitwan district.

It is hoped that the result of this study will help to explore the resources available in Beeshazar wetland and its contribution for local livelihood. Moreover, this study helps to expose the value of wetland resources, document socio-economic use of wetland resources and assess the importance and conservation issues of wetland. It is very useful to improve and review the existing policy of wetland management and local people to adjust their management regime toward sustainable management of wetland resources.

## **1.5 Limitation of the Study**

All studies have their own limitation. No study can be free from constraints such as of resources, time, money, etc. This study is especially for academic purpose and the final research report is going to submit in a thesis form for the partial fulfillment in Master degree in Sociology. The study site is confined only to Beeshazar lake of Chitwan district. Wetland resources in this study refer to floral diversity. Thus finding and conclusion drawn from this study may not be generalized in the same manner for other district and the wetland sites.

## 1.6 Operational Definition of the key terms used in the Study

**Ethnobotany** (from ethnology, study of culture, and botany, study of plants) is the scientific study of the relationships that exist between people and plants.

Ethnobotanists aim to document, describe and explain complex relationships between cultures and (uses of) plants, focusing primarily on how plants are used, managed and perceived across human societies. This includes use for food, clothing, currency, ritual, medicine, dye, construction, cosmetics and a lot more.

**Wetlands** are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters.

**Resource** is a source or supply from which benefit is produced. Typically resources are materials, money, services, staff, or other assets that are transformed to produce benefit and in the process may be consumed or made unavailable. From a broader biological or ecological perspective a resource satisfies the needs of a living organism.

A person's **livelihood** refers to their "means of securing the basic necessities -food, water, shelter and clothing- of life". Livelihood is defined as a set of activities, involving securing water, food, fodder, medicine, shelter, clothing and the capacity to acquire above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity.

**Floral** consisting of flowers or associated with flowers or relating to the plant life in a particular region.

**Diversity** or **Biodiversity** may refer to: degree of variation of life forms within a given ecosystem or the effective number of species represented in a data set.

**Plant diversity** is the variance in genetic and phenotypic characteristics of plants.

**Global warming** is a gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, CFCs, and other pollutants.

(Wikipedia; 2013).

## **1.7 Organization of the Study**

This study is divided into five chapters. The first chapter is a general introduction that covers background of the study, problem statement, objectives, significance of the study and limitation of the study. The second chapter provides information on literature review that basically focuses on theoretical, conceptual, empirical review of past researches on ethno botany and also theoretical and conceptual framework adopted in study. Third chapter gives the information on study area and methodology of the study.

Chapter four includes the plant diversity found in the study area and ethnobotanical use of the identified plants (wetland resources). Fifth chapter deals with the contribution of wetland resources in local livelihood. Finally sixth chapter is the summary, conclusion and recommendation.

## CHAPTER II

### LITERATURE REVIEW

#### 2.1 Concept Review

Ethnobotany implicitly embodies the concept of interdisciplinary research. The term “ethnobotany” is derived from ethnology (study of culture) and botany (study of plants); it is the scientific study of the relationships that exist between people and plants. Historically, ethnobotanists documented, described and explained the complex relationships between cultures and their utility of plants. This often included how plants are used, managed and perceived across human societies as foods, medicines, cosmetics, dyes, textiles, building materials, tools, clothing or within cultural divination, rituals and religion. Much of this research assumes that traditional knowledge (TK) can be imposed upon a scientific knowledge (SK) classification of living things (Newmaster and Ragupathy; 2010).

Though the term "ethnobotany" was not coined until 1895 by the US botanist John William Harshberger, the history of the field begins long before that. In AD 77, the Greek surgeon Dioscorides published "De Materia Medica", which was a catalog of about 600 plants in the Mediterranean. It also included information on how the Greeks used the plants, especially for medicinal purposes. This illustrated herbal contained information on how and when each plant was gathered, whether or not it was poisonous, its actual use, and whether or not it was edible (it even provided recipes). Dioscorides stressed the economic potential of plants. For generations, scholars learned from this herbal, but did not actually venture into the field until after the middle Ages (Wikipedia; 2013).

Ethnobotany deals with the study of the relationship between people and plants and most commonly refers to the study of how people of a particular culture and region make use of indigenous plants. The term ‘ethnobotany’ was first used by Harsberger (1896) who defined it as the study of plants used by primitive and aboriginal people. Schultes (1962) defined ethnobotany as the study of relationship that exists between people of primitive societies and their plant environment. Ethnobotany, in totality, is



virtually a new field of research if this field is investigated thoroughly and systematically, it will yield result of great value to the ethnologist, archaeologists, anthropologists, plant-geographers, ethnobotanists, botanists, linguists and ultimately to phramocologists and phytochemists (Shah, 1981). The main aim of ethnobotany is to document the knowledge about plants that had come through generations and use the knowledge for the benefit of the society. Its importance has been realized that it brings to light numerous less known or unknown uses of plants, some of which have potential wider usage (Chaudhary, 1998). Historically plants used in traditional medicine by the indigenous populations across the world have produced some of the most useful modern day pharmaceuticals. It is, therefore, very important that studies in Ethnobotany and Ethnopharmacology continue if the preservation of traditional knowledge is the goal (R.S. Medora, 2001, Forewords in Joshi & Joshi, 2001). The science of ethnobotany has recently received much attention in certain parts of the world, particularly in the underdeveloped and/or developing countries, where small or large proportion of populations still depend on natural resources in practically indigenous condition and the impact of modern systems of medicine has not reached them (Jain, 1981).

Ethnobotany is the study of the interactions and relationships between plants and people over time and space. If plants did not exist, human life would not be possible. All members of the human family depend on plants for their survival in myriad different ways; today we also depend on them for many of our opportunities to improve the quality of human life in the future. Plants are fundamental to the functioning of all human societies and to the operation of all ecosystems. Along with the photosynthetic bacteria and algae, plants are responsible for the formation of almost all of the energy that we consume. In terms of the energy from biomass that we are so actively seeking to develop now, they also provide the hope for energy supplies in the future. Yet despite their central importance, plants are often poorly appreciated. Ethnobotany along with the related disciplines of ethnobiology and ethnoecology are of central importance for understanding and improving the sustainability of our relationships with the living world. The greatest resource that people have is their ability to innovate, and that ability is shared with all groups of humans who live or have lived on the Earth. The strong links between biological and cultural diversity uniquely position ethnobotany to help us craft effective local

solutions to many of the global issues that confront us as a species. Some of the most challenging of these issues are food security, deforestation, pollution, the maintenance of human health, the quality of human life, and resource depletion of all kinds. The concepts and practices of ethnobotany accord well with the “land ethic” of the great conservationist Aldo Leopold, which he describes as changing “the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it.”

Ethnobotany can strengthen our links to the natural world. It is of central importance for understanding the collective experience of humankind in a series of exceedingly diverse environments and using those experiences to meet the challenges that we face. It makes it possible for us to learn from the past and from the diverse approaches to plants represented by the different human cultures that exist today. Ethnobotany is at once a vital key to preserving the diversity of plants as well as to understanding and interpreting the knowledge by which we are, and will be, enabled to deal with them effectively and sustainably throughout the world. Thus ethnobotany is the science of survival (National Tropical Botanical Garden; 2007).

The definition of wetlands included in the Ramsar Convention is deliberately broad, encompassing "areas of marshes, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is flowing or static, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six metres". Wetlands can generally be classified into five basic systems, namely: Lacustrine, Riverine, Palustrine, Marine and Estuarine (Frazier, 1996).

"Wetlands are useful for meeting many of our direct and indirect needs. We use the marshes for dry seasonal grazing, and extract reeds to weave our sleeping mats and baskets. Mangroves provide us with fuelwood and timber for building our houses, and rivers are our source of life for provision of drinking water and as a food source. Rivers and lakes are also recreation areas for our children. Wetlands are therefore vital to our lives and we must continue to use them in such a way as to ensure their continued existence and reliability to meet the needs of our grandchildren and great grandchildren". The Wise Use of wetlands is defined as 'their sustainable use for the benefit of mankind in a way compatible with the maintenance of the natural properties of the ecosystem', and 'sustainable use' of a wetland, refers to the 'human use of a wetland so that it may yield the greatest continuous benefit to the present generation

while maintaining its potential to meet the needs and aspirations of future generations'. This concept is particularly relevant and popular in Africa due to its recognition of wetland values to local communities for meeting various of their needs.

It is important that use of any wetland classification for human development actions such as agriculture or others should take into account the ecological dependence of various species on these ecosystems and as far as possible employ a level of precautionary approach in assigning uses to wetlands. Likewise, it is imperative that the net gain to society and sustainability of proposed uses of wetlands be clearly outlined. The Ramsar Convention does not advocate a "no-use, strict protection" approach, but instead calls for a more informed and cautious approach to assigning uses to wetlands and for greater attention to integrated planning in the watershed areas. This may be achieved through involvement of wetland conservation experts in discussions and implementation of proposed projects and by strengthening studies and research in wetlands in order to gain better understanding of their potentials and limitations. Implementation of this approach requires a holistic approach to planning which involves all stakeholders in and around wetland areas, and preferably within the watershed (Davis, 1994).

Wetlands are among the most productive ecosystems in the world. They are very important in terms of their ecological, economic, cultural and recreational domains of livelihood. These ecosystems support a wide variety of plants and animals of economic value, which provide a wide range of goods and services as well as income-generating opportunities (MOFSC, 2002). People have a long and intimate association with wetlands. It's a relationship that's easy to understand when one considers the benefits, or ecosystem services, that wetlands provide to humanity. Apart from water security wetland contribute to local livelihoods, and especially for the poor (Toit & Perret, 2006). In addition to contributing to their life-support services that sustain us, wetlands also provide many people with a livelihood, or a means of earning a living. Often poor in rural areas, who are most directly dependent on wetlands for their livelihoods (WI, 2006). Wetland are the most valuable terrestrial biomes on earth. They are diverse ecosystems that serve a variety of essential biological functions, such as: water filtration, flood protection, and providing plant

and animal habitats. Not only are wetlands biologically important, they also hold immense cultural value.

## 2.2 Theoretical Review

Natural Resource Theory is the economic theory of exhaustible and renewable resources. These resources last for more than one period of time and so function as a type of capital. They are also used for food, fiber and energy and so function as ordinary goods. What is the impact of international trade on open access natural resources? To illustrate the principles at work, imagine two countries that have equal amounts of a natural resource, the same technologies and identical tastes, but differ with respect to property rights. Access to the stock of the natural resource is perfectly controlled in the first country, but there is open access to the natural resource in the second country. In autarky, it can be supposed that the second country will harvest a larger quantity of the natural resource – and at a relatively lower price – than the first country. When trade is opened up, the second country will then export the natural resource to the first country. In standard trade theory, countries that have identical tastes, endowments and technologies have no reason to trade. However, introducing differences in the strength of each country's property rights creates the basis for trade despite the countries being identical in all other respects. This means that a property rights regime can serve as a *de facto* basis of comparative advantage – a conclusion that is supported by the economic literature on the subject .

“open access” – a situation where common ownership of, and access to, a natural resource can lead to its overexploitation and eventual exhaustion. It examines how this affects the pattern of international trade, factor prices and the gains from trade. Under certain conditions, the existence of poorly defined property rights can result in the natural resource exporting country losing from free trade since, compared with autarky, free trade leads to a permanent reduction in its stock of natural resources. This apparently overturns the standard welfare result from international trade theory which predicts that countries gain from freer trade. While this is possible, it is not the only probable outcome even if there is open access to the natural resource. The reason for this is that a lot of other things come into play. The structure of demand, population pressure, the technological capacity to harvest the resource and the strength of the property rights regime interact in a complex way to determine the final

outcome. In particular, property rights are neither binary nor exogenous. Rather than being completely perfect or completely absent, the strength of property rights in a country falls along a continuum. Property rights to natural resources may be strengthened with more open trade, depending on how other elements that determine the definition and enforcement of property rights are affected. Ostrom (1990) has documented the variety of institutional arrangements by which local communities have successfully managed common resources. These arrangements do not involve the extremes of complete privatization nor full government control (Cited in WTO; 2008).

The **tragedy of the commons** is an economics theory by Garrett Hardin, according to which the depletion of a shared resource by individuals, acting independently and rationally according to each one's self-interest, despite their understanding that depleting the common resource is contrary to the group's long-term best interests. The concept is often cited in connection with sustainable development, meshing economic growth and environmental protection, as well as in the debate over global warming. "Commons" can include the atmosphere, oceans, rivers, fish stocks, national parks, advertising, and even parking meters. The tragedy of the commons has particular relevance in analyzing behavior in the fields of economics, evolutionary psychology, anthropology, game theory, politics, taxation, and sociology. Some also see the "tragedy" as an example of emergent behavior, the outcome of individual interactions in a complex system (Hardin, G. 1968).

Vegetation has been frequently used as an indicator of wetland restoration success. The types of plant species growing in a wetland are often a gauge of the wetland's biological status. A wetland's ability to support its natural vegetation can be a positive indicator of its capability to sustain natural functions and biological processes that once existed before degradation. It is important to note that the establishment of certain vegetation criteria is only one step towards understanding a wetland's functions. Vegetation is often used to measure restoration progress because it is generally easy to identify and sample.

Wetland plant communities have been one of the major criteria of measuring the "success" of wetland restoration projects for many reasons. The vegetation of a wetland is effected by the overall physical, chemical, and biological condition of the

wetland ecosystem. Plant communities are usually one of the first components in a wetland to respond to an alteration or disturbance in land use or hydrology. Because plant species have different life history strategies and ecological tolerances, plant communities can be used to assess the health of the wetland ecosystem.

"Design" theory of wetland restoration, is a wetland restoration approach that favors direct intervention through means of landscape engineering as well as actively replanting wetland vegetation. Whereas, "self-design" theory of wetland restoration believe that overtime, under adequate environmental conditions, a wetland will revegetate through natural processes. In this case no planting efforts will be made. The restoration site will be allowed to naturally revegetate and colonize wetland plants (*Middleton ; 1999*).

### **2.3 Review of Past Literature on Ethnobotany and Wetland**

The use of plants as medicine is widespread throughout the world. The plant and plant products have augmented human culture since time immemorial. But few people realize that plant species are an important part of our environment (Singh, 1993). Traditional medicine practices and ethnobotanical information play an important role in the scientific research, particularly when the literature and fieldwork data have been properly evaluated. The documentation of indigenous knowledge on the utilization of local plant resources by different ethnic groups or communities is one of the main objectives of ethnobotanical research (Shrestha, 1998). In general, ethnobotanical studies focus on the indigenous people and the minorities. Indigenous people are the ones who were the original inhabitants of any place and live a life of their own which is of self-sufficient type with no foreign involvement. Indigenous knowledge systems are not only for the cultures from which they evolve, but also for scientists and planners striving to improve conditions in rural societies (Shengji, 1999). The rural people have developed unique indigenous knowledge related to the uses of plant resources due to constant association with the forests. This existing valuable information is needed to be documented before lost or disappeared. As there is lack of the documentation system, priority should be given to develop a system for the systematic recording of the information related to the ethnobotanical uses and indigenous knowledge of the medicinal plant species. Ethnic people have immense

plantlore, folklore which they pass on from generation to generation just through oral conservation (Rao & Shanpru, 1981 & Chhetri, 1994).

Wetland support high levels of biological diversity. They are, after tropical rainforests, amongst the richest ecosystem on this planet, providing essential life support for much of humanity, as well as to millions of both migratory and sedentary water birds. It has been estimated that freshwater wetlands, though covering only 1% of the Earth's surface, hold more than 40% of the entire world's species and 12% of all animal species (Schuyt 2004, Ramsar Convention Secretariat 1996). An extensive typical oxbow lake system inside the buffer zone of Chitwan National Park, Beeshazar and its Associated Lakes is a World Heritage site and has been supporting diversities of floral and faunal populations (GoN, 2007). There are many ethnic communities residing in and surrounding this lake, the livelihood of which is dependent on the use of the wetland resources either for medicinal purpose or for household consumption. The survival of individual human cultures important in and of itself, since we have so much more to learn from these cultures as living societies rather than from descriptions and images of those societies that might be left behind once they have disappeared forever. Further, we believe that cultures have a right to exist that we should respect and facilitate to the extent that is feasible. This capacity to innovate has been expressed in creative ways by different groups of people faced with varied environmental and social challenges; we must attempt to understand those ways for our individual and common benefit. Combining concepts derived from the disciplines of sociology, anthropology, agriculture, biochemistry, horticulture, ecology, conservation biology, and botany, the field of ethnobotany holds extraordinary promise for helping us build a better future.

Nepal hosts great wetlands diversity, including floodplains, high altitude glacial lakes, marshes, hot springs, ponds, ox-bow lakes, seasonally flooded forests and grasslands, rice fields and swamps. Nepal's wetlands cover a total of 7, 43,756 ha, which represents 2.6 percent of the total land mass of the country. Nepal became party to Ramsar Convention in 1988 and now has registered nine wetlands as Ramsar sites: Koshi-tappu, Ghodaghodi Lake, Jagadishpur reservoir, Bishazar Lake, Gokyo, Gosainkunda, Phoksundo, Rara and Maipokhari (HMGN/MOFSC, 2010).

The multiple functions and benefits of Beeshazar wetland is not well studied and is often under-estimated in assigning alternative uses of its resources. Losing our cultural value at a rate that will seriously diminish our opportunities to achieve sustainability in the future. To reverse these trends, we need to respect the wisdom of the diverse approaches to nature that exist in every society. This knowledge is central to the preservation of the integrity of the cultures that possess it, and important for us all to understand, record, and, when appropriate and helpful, apply in other situations. The capacity to innovate and to share lessons learned is a quintessential human characteristic, and one that we have a special need to exercise well in the challenging times that face us now. Guided by these past literatures, the present study, aims to identify the wetland resources in Beeshazar lake and also investigates and document the oral heritage of ethnobotanical knowledge of the ethnic people around Beeshazar lake. This thesis also discusses the economic uses of plant resources of the Beeshazar lake.

#### **2.4 Review of Past Wetland and Ethnobotanical exploration and Studies in Nepal**

Nepal is one of the rich mega-biodiversity countries of the world having wide variety of plants with medicinal value. Herbal medicines have good values in treating many diseases including infectious diseases, hypertension, that they can save lives of many, particularly in the developing countries, is undisputable. Ethnobotany is a relatively new field of study in Nepal, as it is in many other developing countries. It has taken its own way of development, depending on local traditions. It is known that the way of administration to cure diseases using a particular plant widely differs among the indigenous people and also Healers, Jhakarīs and Amchīs (Manandhar, 2002, Shrestha & Dhillon, 2003). Concurrently, the diversity of human cultures is being eroded rapidly everywhere. For example, every week one of the remaining 7,000 languages is being lost (WTO; 2008).

The history on the utilization of the plant resources in Nepal dates back to the work of Banerji (1955). In this study, he documented the various food and medicinal plants of eastern Nepal. After his work, some workers continued the ethnobotanical study in the 60's and 70's (Dobremez, 1976; Pandey, 1964; Singh, 1968). The reports on uses of plants by different Nepalese ethnic groups have been recorded only onwards 80's



(Coburn, 1984; Bhattarai, 1989, 1990, 1991, 1992, 1993; Joshi and Edington, 1990; Manandhar 1989ab, 1990, 1992, 1993ab, 1995, 1996ab, 1997; Mueller-Boeker, 1993; Pohle, 1990; Shrestha, 1985; Shrestha and Pradhan, 1986). These reports documented information of uses of plant resources. The investigators reported the uses of plant resources from six districts of the west, eighteen districts of the central Nepal, and two districts of the east. Among the useful plants reported by the Nepalese people, 800 species were recorded as medicinal plants, 440 species as wild food plants, 100 species as fodder and for animal bedding, 71 species as fiber bearing plants, and 30 species as spices (Manandhar, 1997). Manandhar (1997) concluded that, if systematic surveys are undertaken regularly in different regions and among different tribes, many more useful plants from Nepal will be documented. Shrestha (1997) compiled more than 300 publications on ethnobotanical researches related to Nepal. Some studies on economic uses of plant resources in the Chitwan district have already been reported (Dangol and Gurung, 72 Dangol 1991; Dangol and Gurung, 1995; Manandhar, 1990; Mueller-Boeker, 1993; Shakya et al., 1995; Pant et al., 1995).

Nepal's wetland is characterized by the floral diversity more than the faunal diversity. Twenty-five percent of the 7,000 species of plants recorded in Nepal are aquatic. Of the 700 species of endemic plants, 27 are rare, seven are threatened, and nine are endangered species of endemic plants (Bastola, 2008). Beeshazar Lake is an intricate ecological system with a variety of physical, hydrological and vegetative characteristics. The main habitats within the lake system include: permanent and seasonal fresh water lakes, permanent and seasonal freshwater marshes, permanent and seasonal rivers and streams, freshwater swamp forests, seasonally flooded forests, grassland, terrestrial forest, seasonally flooded rice fields and irrigation canal (GEF, 2008).

It is nearly a two-century-old history since the recorded botanical exploration and study started by foreign scientists in Nepal. It was also the start of the ethnobotanical exploration in Nepal. It was Francis Buchanan, a Scottish medical man, who first collected plant specimens in Nepal in 1802-3, and that was followed by Nathaniel Wallich in 1820-21, who collected plant samples in and around Kathmandu valley (Rajbhandari, 1976). Their collections of plants with ethnobotanical notes are recorded by Don (1825) and Wallich (1824-1826). Nepali people still do not have

access to the modern medicinal facilities, and entirely depend on the plant resources. It is estimated that various communities in Nepal use approximately 1000 species of wild plants in traditional medicinal practice and majority of which await proper documentation (Chaudhary, 1998).

A good information on the ethnobotanical and medicinal uses of the Nepalese plants can be found in the Chandra Nighantu, a herbal pharmacopoeia of medicinal value of plants, the manuscript of which was initiated by the then Prime Minister Bir Samsher Jung Bahadur Rana in the late 19<sup>th</sup> century to use and develop traditional medicine system based mainly on Ayurveda in Nepal. Late pandit kaviraj Shree Ghana Nath Devkota was assigned to prepare this Nighantu which was named as Bir Nighantu (Malla, 1999). This interesting and valuable document could not be completed during the regime of Bir Samsher. Later, Chandra Samsher, who succeeded him as Prime Minister, wanted to change its name into Chandra Nighantu after completion (Devkota, 1968). This is a hand-written herbal encyclopedia including about 840 colour plates, 750 of plants and 90 of animals, and over one thousand pages of their explanations. It consists of 10 volumes, of which 8 volumes are botanical, 1 zoological and another mineralogical (Kanai, 1971). Explanations, mainly of medicinal usage written in Sanskrit and Newar, are quoted from various classics, Vernacular names of Nepali, Newar, many languages of Indian tribes, Persian and Arabic, and sometimes of Tibetan, English and Latin are mentioned. This immense work shows the high level of Nepalese herbal science and is useful as excellent icons of Nepalese plants as well as a reference book of Ayurvedic science (kanai, 1971).

Wild food plants play a very important role in the livelihoods of rural communities as an integral part of the subsistence strategy of people in Nepal. Under community forestry programmes, many local forest user groups (FUGs) in Nepal have drawn up management plans, which ignore edible plants and other non-timber forest products. As a consequence, there is a lack of information about the diversity of species actually used locally. Furthermore the management plans fail to regulate the use of this important resource. Such ignorance results in over-exploitation of commercially demanded species, random harvesting, a lack of equitable sharing of benefits from the use of resources from a community-managed forest, and deprives the poorest groups in the community of the resource (Dhillion and Shrestha, 2006). Several ethnic groups

of people are dependent on wetland resources for their livelihoods in Nepal. They are Sunaha, Khanwas, Mallahs, Bote, Mushahars, Bantar, Gongi, Mukhia (also called Bihin), Dushad, Sahani, Kewat, Danuwars, Darai, Kumal, Barhamus, Dhangar, Pode, Kushars, and Majhi of Terai districts who depend primarily on fishing and aquatic resources for their livelihoods (IUCN-Nepal, 1996). Nepal's wetlands are mostly used for fishing (94%) then for grazing, irrigation, plant harvest, domestic use, fuel wood, wild life and religious use (IUCN, 1996).

Recently, information on ethnobotanical studies of various tribes and regions of Nepal is gradually accumulating. The importance of ethnobotany has been increasing considerably and even international organization such as World Wide Fund for Nature (WWF) Programme has considered this to be an essential part of the programme (Cunningham, 2001; Martin, 1995). In Nepal also since June 1997, an applied ethnobotanical project has been undertaken by the People and Plants Initiative of the WWF in collaboration with WWF Nepal Programme in Shey Phoksundo National park and its buffer zone. The ethnobotanical surveys revealed a rich local knowledge about the medicinal plant resources and their management (Ghimire et al., 2000). Implemented within the larger framework of the People and Plants' Initiative, UNESCO and ICIMOD (International Centre for Integrated Mountain Development), as a joint operation, launched an applied ethnobotany project from 1995 to 1998 in the Hindu Kush- Himalayan region aimed to build up capacities of and capabilities in institutions, improve the skills of young ethnobotanists, and bring ethnobotany into the mainstream in integrated conservation and development research (Rastogi, 1999). All the initiatives and the past literatures are prone to prove extremely valuable, pioneering and giving a direction to the current study on Beeshazar lake of Chitwan district.

## **2.5 Conceptual Framework adopted in Study**

The study began with identification of existing issues in the problem area. In this study, key focus was ethnobotanical use of wetland resources and its impact on local livelihood. To find ethnobotanical use, plants are identified in study area by field survey and assessed the ethnobotanical use of plant resources from key informant and focus group discussion. Major focus of ethnobotanical use were on food, vegetable, spices, medicine, fodder, crop management, pesticide, construction material and

household implements timber and fuelwood. Subsequently, assessed the contribution of ethnobotanical use on local livelihood by considering human capital, social capital, natural capital, financial capital and physical capital. Conceptual framework adopted in study is presented in the following figure.

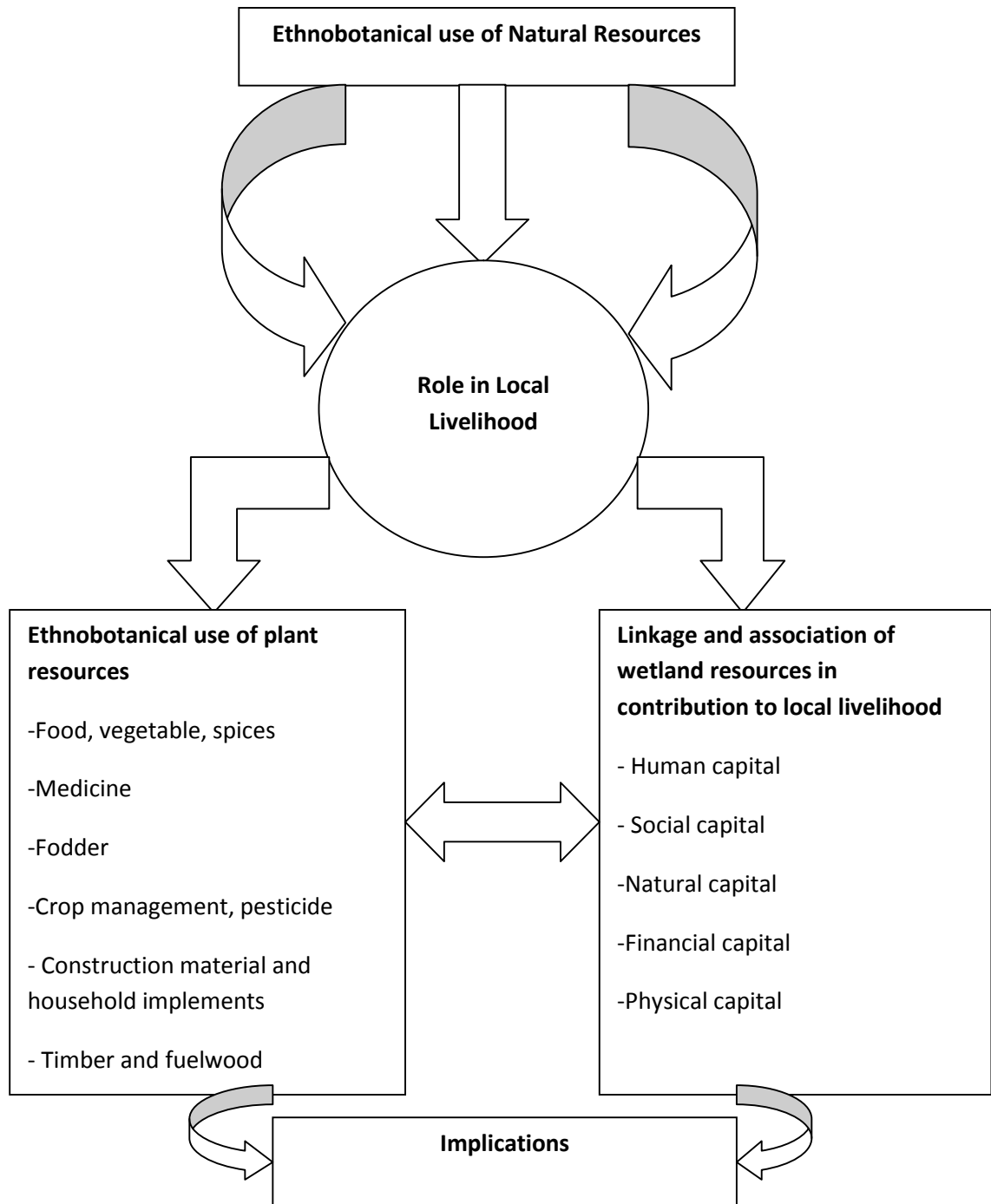


Figure no: 2.1 Conceptual Framework adopted in Study

## **CHAPTER III**

### **METHODOLOGY**

This chapter deals with the methodology applied for conducting the research. This chapter covers the methods of research and materials of data collection, its analyzing techniques and dissemination.

#### **3.1 Introduction**

Success of research is dependent upon the selection of appropriate methods. Considering this truth various methods and techniques have been used for the collection of data and information required for this study.

#### **3.2 Rationale for the Selection of Study Site**

Beeshazar lake lies in Chitwan district which is situated in lowland of inner Terai valley (doon) of central region of Nepal. The area is very rich in terms of natural resources i.e. flora, fauna, etc. The lake has been declared as the Ramsar site hence it has international importance and also located in the buffer zone of Chitwan National Park which is included in the World Heritage Site in 1984. The lake is also one of the dominant and versatile ecosystems that harbor precious species of flora, fauna and indigenous people in the vicinity. Indigenous people surrounding the Beeshazar lake have different ethnobotanical knowledge, skill, practice and application of the wetland resources but these knowledge, skill, practice and application are not sufficiently transferring in new generation and in wide area due to the lack of the documentation and exploration so the ethnobotanical knowledge is in verge of extinction and also this wetland is the life supporting system for the local indigenous people however to date researches on ethnobotanical use of wetland resources and their importance in local livelihood has not been conducted. Hence Beeshazar lake and its surrounding community was selected for the study which endeavors to assess and explore the ethnobotanical use of wetland resources and its role on local livelihood.

Research advisor, wetland professionals, staff from the Department of National Park and Wildlife Conservation and District Forest Office are consulted before the final selection of the study site.

### **3.3 Research Design**

Exploratory as well as descriptive research design has been performed for this research. For the purpose of identification of wetland resources (plant species) precise investigation was the main agenda of this research. The research is somewhat qualitative where the ethnobotanical use and contribution of wetland resources in local livelihood has been assessed in a descriptive way.

### **3.4 Universe, Sample Population and Sampling**

Primary users of the Beeshazar Lake were considered as the target community for study. Altogether 208 household were identified in the study area; which are located in different site surrounding the Beeshazar Lake, only 65 households were randomly selected for the study. The household respondents were 30 female and 35 male hence making a randomly selected 65 households as the sample which represents 30% of the total population.

In the selection of household for interview prior notice was served informing the respondents of the household interview. The researcher himself visited the research areas with research assistant and representatives from the concerned community forest. Then the researcher searched for key persons who have an idea about the ethnobotany and served as local doctor, vaidya, dhama (traditional wizards) and gurau (tharu doctor).

### **3.5 Nature and Source of Data Collection**

On the basis of nature, both qualitative and quantitative data has been agglomerated. The sex, education status, land holding size, etc. was quantitative while why and how they are dependent in wetland was the qualitative information. On the basis of sources, both primary and secondary data was collected during the entire research process.

- i. Primary Data: The interview, observation, schedule etc agglomerated during the field work are the primary data for this study.
- ii. Secondary Data: The information about wetland, livelihood on them from hard or soft copy of scholarly journals, books, reports from varied sources, operational plan of surrounding community forest are the source of secondary data for the study.

### **3.6 Tools and Techniques of Data Collection**

The selections of appropriate methods are the most important part of any types of research. Methods depend on the required data and objectives of the study so to accomplish this study primary and secondary data were collected by different methods according to the objectives of the study.

#### **3.6.1 Secondary data collection**

Some secondary data has been used according to the nature of information required in this study. Information on the biophysical, demographic and socioeconomic condition of people, recorded wetland resource and its collection mechanism were collected through the review of government records, records from NGOs, research papers, journals, buffer zone community forest operational plan and other published and unpublished sources. It also gave the idea on condition of wetland resources and its contribution on local livelihood.

#### **3.6.2 Primary data collection**

##### **(i) Designing the interview script**

An interview script was developed in order to guide the interview and obtain reliable data from the respondents in a structured way. The types of questions were selected according to the research objectives. The interview script comprise of both open-ended and close-ended questions. In open-ended questions, respondents were asked to provide their own answer whilst in close-ended questions; respondents were asked to select the answer from the list provided by the researcher. Close-ended questions are very popular in survey research because they provide a greater uniformity of responses and are more easily processed than open-ended ones (Babbie, 2002). Therefore, some questions were framed in a closed form. Some open-ended questions were asked to the respondents to allow them to express their reasons and impression according to their attitude and personal belief.

## **(ii) Questionnaire survey**

Survey research is undoubtedly the most common research method in social science (Baker, 1999). It is probably the best method available to the social researcher who is interested in collecting original data to describing a large population to be observed directly. Careful probability sampling provides a group of respondents whose characters may be taken to reflect those of a large population. The interviewer can also observe the surrounding and can use non-verbal communication and visual aids and it permit a long questionnaire (Neuman, 2000). With these face to face interviews, it was easier for the interviewer to probe for additional information.

In total, 30% households from all the study sites were randomly selected for the questionnaire survey. Among the selected household; gender balance was also consider for the respondents. Thus face to face interviews were undertaken with 30 female and 35 male respondents of the study site among 208 house hold. Most of the interviews occurred in their respective houses, whereas some of others occurred in respondent's work place. Informal discussion and cross questioning during the face to face interviews gave opportunity for the interviewer to explore additional information.

## **(iii) Key informant survey**

Key informants are those persons who can give major information about the study area and other required information in a very short time. In this study, key informants were selected from the persons (as indicated by at least three people) who were knowledgeable about the wetland resources, use wetland most and directly involving for the management of wetland. It was carried out by considering the indigenous well experienced people, gurau (Tharu doctor), Vaidya (an ayurvedic physician, Dhami (Diviner) and committee member of local buffer zone community forest user group (Bandevi BZCFUG) as key informant. Key informants were asked to present their views on the current and past wetland resource use pattern, their contribution on local livelihood and their views on wetland resources protection and management activities.

## **(iv) Focus group discussion**

Focus Group Discussion (FGD) is a fairly inexpensive but effective way to get the reaction of a small group of people to a focused issue (Baker, 1999). The purpose of FGD in this research was to provide an opportunity to explore the wetland resources found in the study area, to assess the linkage of wetland resources in local livelihood



and to understand the diversity of perception and opinion. Focus group discussion was conducted with various levels of stakeholders separately in the study area. Different caste, sex, professional, economic class, dalits /disadvantage group was included in the focus group discussion. The Focus group discussion gives opportunity to indigenous people, disadvantage people and women to express and share their ideas and views more freely in a homogenous group. It also gave an opportunity to familiarize with field situation. The discussion was based on checklist. Chepang community, Tharu/Chaudhary community, male group, female group and forest staffs were considered as focus group in this study.

**(v) Direct Field Observation**

Rapid field assessment was used during the study period, which is one of the methods for gathering quick information about wetland resources. Field observation, in sample was carried out to gather the general information and apprise the existing resource condition. Before starting the work, operational plan of surrounding community Forest of Beeshazar Lake (i.e. Bandevi Buffer Zone Community Forest ) was thoroughly studied as secondary information. The primary purpose of field observation was to check the validity of the wetland resources and its collection trend as expressed by the community in questionnaire survey and prescribed in the operational plan and also explore the more wetland resources which were not identified by the community.

For field observation, focus was given to assess the wetland resources, collection trend and human impact on wetland resources. Researcher conducted field walks in wetland sites and adjoining forest of wetland. The buffer zone community forest user group (BZCFUG) members have given the accompany in the walk. Transect lines were drawn arbitrarily around the wetlands passing the core of the wetland surrounding from one boundary to another. Major wetland resources, their associates and most collected wetland resources were noted. Major threats for wetland resources and management initiative were also observed and noted during field observation.

### 3.7 Data Analysis and Interpretation

Data analysis followed both qualitative and quantitative method. Simple statistical tools, such as mean, percentage, etc. were also used for the analysis. Computer software such as Microsoft word, Excel, etc was used for data processing and analyzing and also interpreted in the form of tables, graphs and charts. Local uses of identified plants are interpreted in descriptive way. Similarly different stationary materials were also used for different purposes during the study period.

#### 3.7.1 Assessment of indicators of livelihood

Contribution of wetland resources to local livelihood was analyzed by following Sustainable Livelihood Framework; developed by DFID-1999, in which qualitative and quantitative assessment of the indicators of five livelihood-assets was carried out.

- a) **Natural Capital:** The participatory resource assessment was carried out to find out the natural stock of the Non Timber Forest Products (NTFPs) available in the forest estate. How is the growing stock quality changing from time to time (trend of qualitative change in the growing stock) was assessed by interview with NTFPs collectors, local community forest committee member (i.e. Bandevi BZCFUG), staffs of Forest Office, etc. Next, the access over the resources of the NTFPs was analyzed about whether the resource is easily accessible to the poor or not.
- b) **Financial capital:** How much contribution is made by different wetland resources to the annual household income was studied to understand the financial contribution made by the potential resources. What could the opportunities to maximize the existing financial contribution from the wetland resources was also rigorously studied.
- c) **Social capital:** Are the potential wetland resources creating social cohesion in the community or not was qualitatively analyzed by conducting participant observation in the community. Are there any conflicts regarding the possession of wetland resources in the community were also analyzed.
- d) **Physical Capital:** For this, it was probed by the following questions:
  - a. Whether the wetland resources have contributed to the physical infrastructural development and production durables or not was analyzed by questionnaire and observation methods.

- b. Will the promotion of the potential resources be contributing to the formation of the physical capital?
- e) **Human Capital:** For finding the contribution of the NTFPs to the human capital, answer to the following questions were sought:
  - a. Are the potential resources helpful to skill development of the local people?
  - b. Is the resources been helpful to knowledge systems of the community?
  - c. Is the resources been useful for the health-condition improvement by their medicinal values?

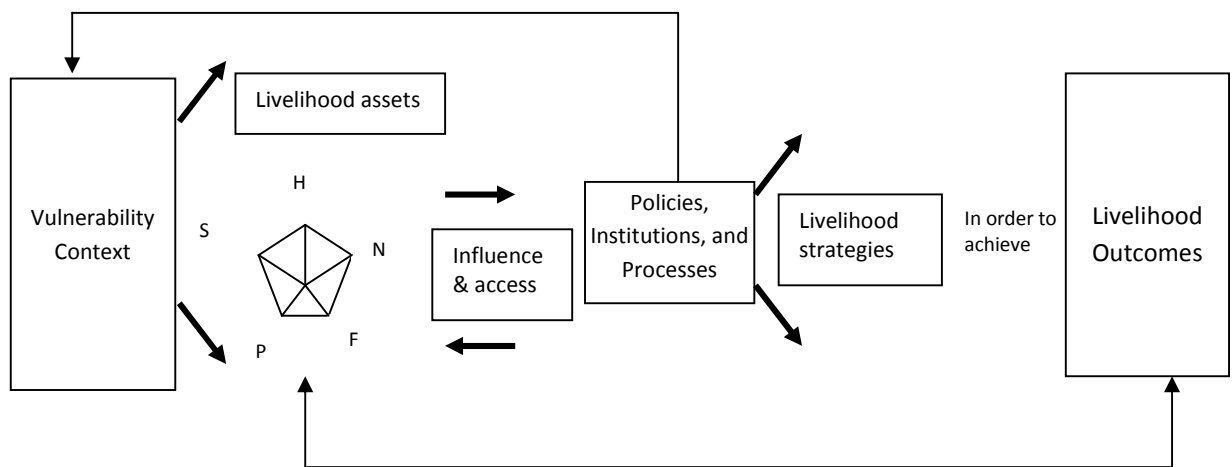


Figure 3.1: Sustainable Livelihood Framework (DFID; 1999).

Data analysis followed both qualitative and quantitative assessments besides using the following methodologies. Simple statistical tools, such as mean, percentage, charts, graphs, ANOVA, etc. was also used for the analysis.

### 3.7.2 Index of Relative Ranking (IRR)

Scales (from one to five, i.e., strongly agree to strongly disagree) was developed to find out the perception of local people about the matters to be analyzed in the different livelihood assets. From the scales, the IRR was calculated. Its use in the social sciences is common, and they “are significant because they provide quantitative measures that are amenable to greater precision, statistical manipulation, and explicit interpretation” (Miller, 1983 cited in Tiwari, 1998).

The Index of Relative Ranking (IRR) was calculated as follows:

$$\text{IRR} = (R_1 S_1 + R_2 S_2 + \dots + R_n S_n) / nr$$

Where, IRR = Index of Relative Ranking.

R<sub>1</sub> = Rank of the first order

S<sub>1</sub> = Score of the highest order

R<sub>n</sub> = Rank of the last order

S<sub>n</sub> = Score of the last order, i.e., 1.

n = Number of observations

r = Total ranks given to the particular attribute.

The scales of perception gave value from 1 to 5 indicating strongly-agree to strongly disagree.

## CHAPTER IV

### PROFILE OF THE STUDY AREA

This chapter deals with the study area and Demographic Features of Targeted Community. It includes description of the study area. i.e. Chitwan district and Beeshazar lake and its surrounding community.

#### 4.1 Brief Introduction of Chitwan District

The study area is situated in Chitwan District which is located in the Narayani zone of central development region, Nepal. The district is in the western part of Narayani Zone with Bharatpur, the Fifth largest city of Nepal, as its district headquarters. It covers an area of 2,218 km<sup>2</sup> (856 sq mi) between 27<sup>0</sup>21'45" to 27<sup>0</sup>52'30" northern latitude and 83<sup>0</sup>54'45" to 84<sup>0</sup> 48'15" eastern longitude, the elevation of the district varies from 141 m to 1,945 m from Mean Sea level and in 2011 had a population of 579,984 (279,087 male & 300,897 female) people. Major ethnicities of this district are Brahmin, Chhetri, Tharu, Newar, Gurung, Magars, Tamang, Chepang etc. (CBS, 2011).

There are several predication on the origin of the name Chitwan. Some of the most satisfactory predications on the origin of its name are: The name *Chitwan* is a composite of the Sanskrit words "chitta" meaning *heart* and "Van" meaning *jungle* or *forest*. Thus, the meaning of Chitwan is *Heart of the Jungle*. Another predication on the origin of its name is - Chitwan, a land of aborigines "Tharus", were very rich in their art & drawings, & are still renowned for it. Their houses are decorated by religious drawings denoting different phases of history, culture and environment along that time. Since their homes in the forest were decorated with their drawings, locally called "Chitra", the land was called "Ban", and in combined form "Chitraban" which was transliterated into *Chitwan*.

The district takes its name from the Chitwan Valley, one of Nepal's Inner Terai valleys between the Mahabharat and Siwalik ranges, both considered foothills of the Himalayas. Bharatpur, on the bank of Narayani River, is the main town with

numerous shopping zones where people come from all over the district and neighbouring districts.

Now there are about 40 Village Development Committees (each of which has nine wards or villages) and two municipality- Bharatpur and Ratnanagar; each of which has more than nine wards or urban areas. Chitwan is one of the few remaining undisturbed vestiges of the Terai region, which formerly extended over the foothills of Nepal (Wikipedia, 2013)

## 4.2 Beeshazar Lake

The study site, Beeshazar lake is a surface and ground water fed natural fresh water lake located in Chitwan district of central Nepal which is included in the Ramsar site

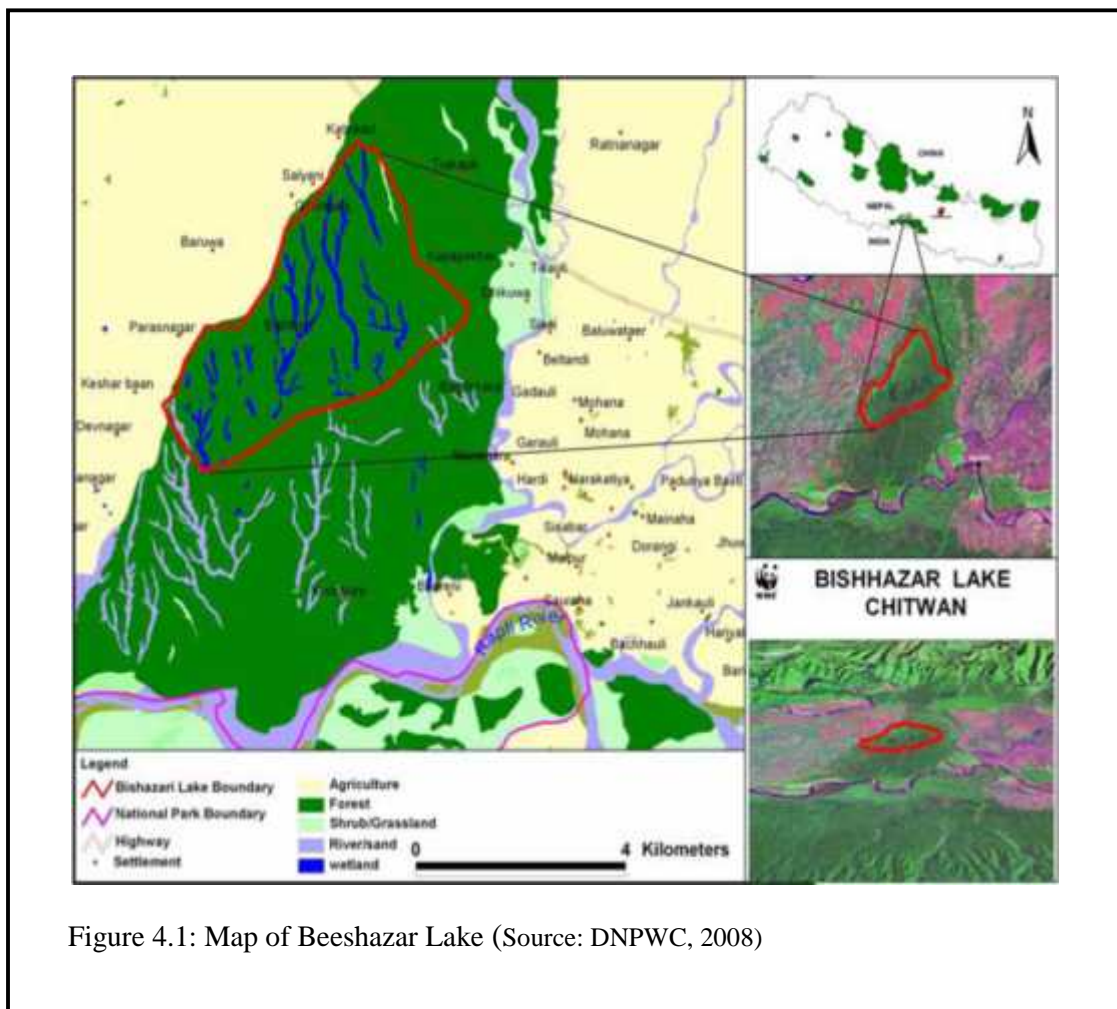


Figure 4.1: Map of Beeshazar Lake (Source: DNPWC, 2008)

in 2004. It is situated in lowland of inner Terai valley (doon) of central region of Nepal in between Mahabharat Mountain Range to the north and the Siwalik Range to the south.

It covers an area of 3,200 ha and lies in 27°37'04.6"N, 084°26'11.3"E and 286 m altitude from sea level. An extensive, typical oxbow lake system consists of 30% open forest, 40% dense forest, 15% grassland and 15% pasture and bed is situated on the laterite soil. The oligotrophic state of the lake is shown by the low content of Chlorophyll "A" due to the rich growth of macrophytes which prevents the penetration of sunlight needed for photosynthesis. However, with respect to nutrient content and based on one-time analysis during the summer season, the lakes can be considered to be eutrophic to hypertrophic. (HMGN/MOFSC, 2010).

It is an extension of the buffer zone of Chitwan National Park (a World Heritage Site) supporting an appreciable assemblage of rare, vulnerable and endangered flora and fauna including white-rumped vulture (*Gyps bengalensis*), Royal Bengal tiger (*Panthera tigris*), onehorned rhinoceros (*Rhinoceros unicornis*), Asiatic elephant (*Elephas maximus*), barking deer, ghariyal (*Gavialis gangeticus*), smooth-coated otter (*Lutra peripiscillata*), sloth bear (*Melalurus ursinus*), marsh crocodile (*Crocodylus palustris*), lesser adjutant stork (*Leptoptilos javanicus*), ferruginous duck (*Athyra nyroca*), band-tailed fish eagle (*Haliaeetus leucoryphus*), and several species of migratory birds (Jha S.N. 2007).

**Flora:** The terrestrial vegetation is dominated by Sal (*Shorea robusta*) forest. The prominent associated species include Myrobalan (*Terminalia alata*) Silk cotton (*Bombax ceiba*) and Bot Dhainyaro (*Lagerstroemia parviflora*). The wetland vegetation consist of Sedge (*Cyperus* spp.), Common Reed (*Phragmites karka*), Morning Glory (*Ipomea carnea* ssp. *fistulosa*) and Mikania (*Mikania micrantha*). The aquatic vegetation is represented by extensive coverage of floating leafed species mainly water hyacinth (*Eichhornia crassipes*), Water Chestnut (*Trapa bispinosa*) followed by Evening Primrose (*Ludwigia adscendens*). The free floating species include Water Velvet (*Azolla imbricata*) and Duckweed (*Lemna* spp.). The abundant submerged species include Hornwort (*Ceratophyllum demersum*), Hydrilla (*Hydrilla verticillata*) and Water Nymph (*Najas minor*). In general, the vegetation is in floating leafed succession stage. Reed swamp formations are found in backwaters in finger like projections, characteristic of an ox-bow lake system.

**Sociocultural and Religious Value:** The current use by local population includes fishing, grazing, fuel wood and fodder collection, domestic use and supply of water for irrigation in surrounding cultivated land.

**Threats:** Major threats of this lake are unsustainable use of water resources, invasion of exotic species, leaching of inorganic fertilizer and pesticide from farmlands, development of major development projects and industries, development/expansion of settlements, pollution and weak earthen embankment of the reservoir.

**Conservation Measures:** Invasive species are manually removed by local communities with the help of Local NGOs, Buffer zone user committees/Management committee and Chitwan National Park. Due to the recent designation as buffer zone for the National Park, the management responsibility has been given to the Buffer Zone Management Committee. Armed Forest Guards control poaching and land encroachment (DNPWC 2008).

### **4.3 History of Beeshazar Lake**

There are several predications on the origin of the name this lake as Beeshazar Lake. The lake area covers 3200 hectare with numerous waterholes. Some old age key informants predict that there were 20000 waterholes / pockets. Embankment (dam) was constructed in southern part to trap water in summer with aim of irrigation in the winter and drought period. Because of this dam, these small pockets water were converted into one large lake and other few pockets. And people named the largest waterhole as Beeshazar Lake and others as associaed lake of this Beeshazar lake.

To irrigate the downward crop field, one canal was constructed along lake site from Khageri river at east west Mahendra Highway in Tikauli. Because of the dam of canal, the several pockets were combined and form a large waterhole which is 20000 feet from the starting point of canal named Khageri irrigation barrage. So, people strated to indicate this large lake as 20000 (Beeshazari Lake) and later on the lake was named as Beeshazar Lake while proposing as Ramsar Site.

The Khageri Irrigation Canal, which was constructed during mid sixties with both sides embankment to streamline the water flow through the canal for irrigation has



acted as barrier to the depressed lands north of the embankment obstructing the southerly drainage of the area. Location of swarms of water bodies just north of the Khageri Irrigation Canal embankment amply indicate its present day conditions related to the man made structure. And this man made structure (embankment) has been instrumental in maintaining round the year wetland character of the Beeshazar Lake.

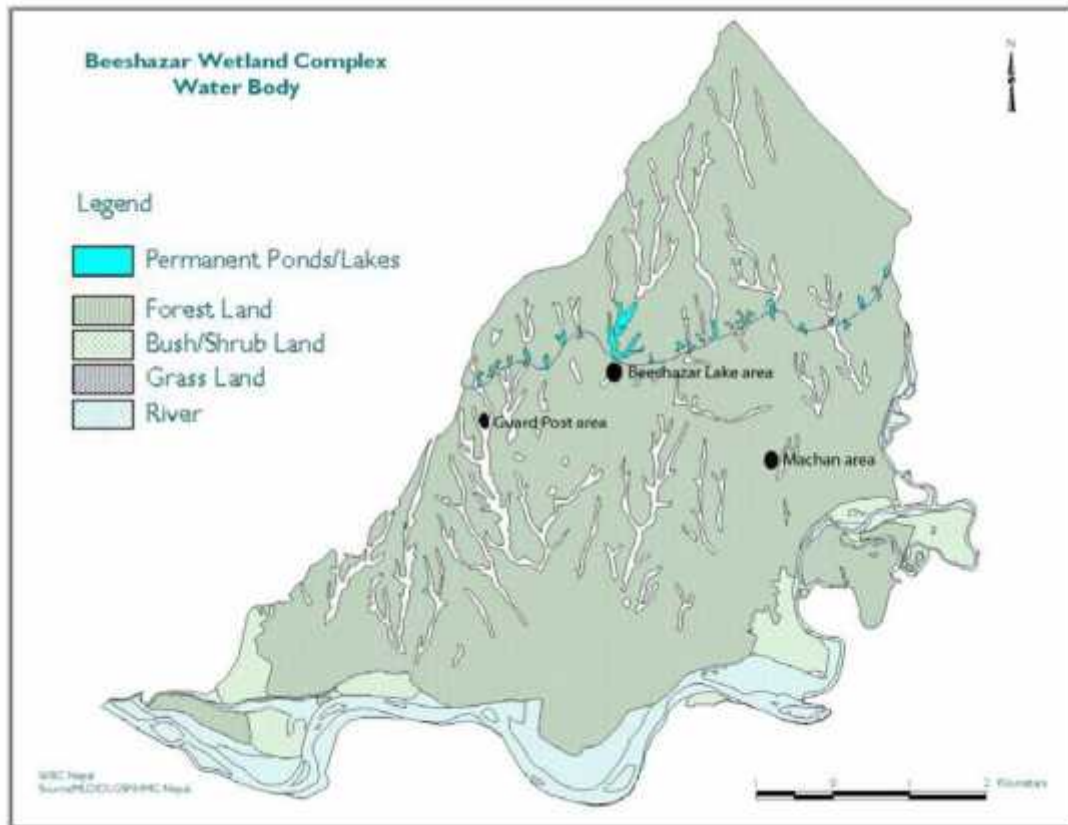


Figure 4.2: Map of Beeshazar and associate Lake

Source: Jha. S.N., 2007

#### 4.4 Demographic Features of Targeted Community

Primary users of the Beeshazar Lake were considered as the target community for study. The targeted community lies in Bharatpur municipality ward no- 8, 9 and Ratnanagar municipality ward no-7. Altogether 208 household were identified in the study area; which are located in different site surrounding the Beeshazar Lake.

The ethnic composition and total house hold no of the targeted community is shown in following table:

**Table 3.1 Demographic Features of the targeted community**

S.N	Location	Tole	Ethnicity	HH
1	Bharatpur - 9	Bandevi	Gurung, Brahmin, Tamang, Newar	18
2	Bharatpur - 8	Sukumbasi	Gurung, Damai, Kami, Chepang, Kshetri, Sarki, Tharu/Chaudhari, Darai, Newar	41
3	Bharatpur - 8	Salyani	Magar, Kami, Kshetri, Brahmin, Gurung	30
4	Bharatpur - 8	Sansari	Chepang, Brahmin, Kami, Newar, Kshetri	30
5	Bharatpur - 8	Pachas begha	Tamang, Brahmin, Kami	7
6	Bharatpur - 8	Baruwa	Tharu/Chaudhari, Magar, Kshetri, Brahmin, Gurung,	16
7	Ratnanagar - 7	Chauki tole	Tharu/Chaudhari, Darai, Brahmin, Kshetri, Newar, Gurung	29
8	Bharatpur - 8	Nawajagriti	Tharu/Chaudhari, Magar, Darai, Tamang, Brahmin, Kshetri, Chepang	37
Total				208

\*HH- Household

Source: Field Survey, 2012

Table 3.1 shows the highest no of households are in Sukumbasi tole and lowest no of households are in Pachas begha tole. Major ethnicity in study area are Brahmin, Gurung, Kshetri, Tharu/ Chaudhari, Kami, Newar, Chepang, Magar, Darai, Tamang, damai and Sarki.

## CHAPTER V

### SOCIO-ECONOMIC CHARACTERISTIC OF RESPONDENT

This chapter highlights the socio-economic dynamics of the respondents. The ethnicity, age group, family size, education and occupation of the respondents are analyzed and presented below.

#### 5.1 Caste/ Ethnicity

Study area has diverse ethnicity, which is significant attribute for the ethnobotanical study. The caste of the respondent has been grouped on the basis of Nepal Living Standard Survey (NLSS), 2004.

**Table 5.1: Respondent by Caste/ Ethnicity**

S.N	Caste/ Ethnic Group	No. Of Respondent	Percentage
1	Brahmin	10	15.38
2	Khsetri	8	12.31
3	Janajati (Gurung, Tamang, Newar, Chepang, Tharu/Chaudhari, Darai, Magar)	35	53.85
4	Dalit (Damai, Kami, Sarki)	12	18.46
Total		65	100

Source: Field survey, 2012

Above table shows that the majority of the respondents belongs to Janajati (53.85%) and rest of the respondents were Dalits (18.46%), Brahmin (15.38%) and Khsetri (12.31%). Male and female respondents were considered from every ethnic group with proportionately.

## 5.2 Age of the Respondents

It is apparent that older people have more knowledge, practice and idea about the ethnobotanical use of the wetland resources so older people were the targeted respondent for this study.

**Table 5.2: Respondent by Age Group**

S.N	Age Group	No. Of Respondent	Percentage
1	21 - 30	3	4.62
2	31 - 40	10	15.38
3	41 - 50	11	16.92
4	51 - 60	20	30.77
5	61 - 70	16	24.62
6	> 70	5	7.69
Total		65	100

Source: Field survey, 2012

Among 65 respondents more than 63 percent respondents were above 50 years aged category and less than 37 percent respondents were lower than 50 years aged category. Among them respondents mainly 61–70 age category shows very much interest and idea on ethnobotanical use of wetland resources where as respondents having age more than 70 age have higher knowledge on ethnobotany and age category of 31-40 and 41-50 are more dependable on wetland resources for the income generation.

## 5.3 Family Size

Family is one of the important social institutions that has vital role in the process of socialization and performing collective works for wetland resource conservation and utilization. Family size of local people determine the requirements, dependent and consumption of wetland resources. Following table shows the family size of the respondents.

**Table 5.3: Family Size of the Respondents**

S.N	Family members	No. Of Respondent	Percentage
1	Up to 3	7	10.76
2	4 - 6	47	72.31
3	> 6	11	16.93
Total		65	100

Source: Field survey, 2012

The majority of the respondents were in the category of 4-6 family members (72.31%). This figure indicates that the family size of the surveyed population is around the national average which is 4.88 (CBS, 2011).

#### 5.4 Education Status of Respondents

Education plays crucial role to determine the capacity of individuals for carrying out different activities related on wetland resources. Generally it is perceived that a person with higher educational status has low dependency on wetland resources because they have additional opportunity for their livelihood. On the contrary, person with lower educational status has higher dependency and more knowledge on ethnobotanical use of wetland resources because their livelihood is more reliant on natural resources and low opportunity for exterior profession. Following table shows the educational status of the respondents.

**Table 5.4: Educational Status of the Respondents**

S.N	Level of Education	No. Of Respondent	Percentage
1	Illiterate	15	23.07
2	Literate	41	63.09
3	Up to SLC	6	9.23
4	Above SLC	3	4.61
Total		65	100

Source: Field survey, 2012

Here, the level of respondents was broadly classified into four categories such as illiterate, literate, up to SLC and above SLC. The average literacy rate of the respondent was 66.93 % . The average literacy rate of the respondent higher than the national average which is 65.9% (CBS, 2011).

## 5.5 Occupational Status of Respondents

Nepalese people adopted many occupation for their livelihood. Most of the people have been involved in agriculture activities including livestock farming. For the purpose of the study, the occupation of the respondents has been divided into agriculture, government service, business, wages and household. Following figure shows the occupational status of respondents.

**Table 5.5: Occupational Status of the Respondents**

S.N	Level of Education	No. Of Respondent	Percentage
1	Agriculture	15	23.07
2	Government service	3	4.61
3	Business	7	10.77
4	Daily wages	21	32.32
5	Housework	19	29.23
Total		65	100

Source: Field survey, 2012

Table 5.5 shows that 32.23 percent respondent were involved in daily wages, 29.23 percent respondent were involved in housework, 23.07 percent respondent were involved in agriculture, 10.77 percent respondent were involved in business and 4.61 percent involved in government service. Respondent involving in agriculture, daily wages and housework are more dependent on wetland resource because they have donot have regular duty in these occupation so more leisure time to spend on the wetland resource collection.

## CHAPTER VI

### LISTING OF PLANTS, DOCUMENTATION OF ETHNOBOTANICAL USE

This chapter deals with the documentation of field data and its analysis. This chapter covers the identification and listing of the plant diversity in the study area and documentation of ethnobotanical use of the identified wetland resources(plant).

#### 6.1 Identification and Listing of the Plant Diversity in the Study Area

Total 133 species of vascular plants including pteridophytes and angiosperms of different 52 families have been recorded from Beeshazar wetland and its adjoining areas. A random transect walk with the local botanists (knowledgeable by experience) was used to identify different species.

On the basis of habits, out of 133 identified plants, 58 species were trees, 19 species were shrubs and 36 species were herbs, 17 species were climbers and 3 species were grass. Similarly different species have been identified to be of different use value.

Based on site condition, 10 species were dependent on wet regions of the wetland, 96 species on moist land and 27 on dry site condition.

**Table 6.1: Tree species diversity in and around Beeshazar lake**

S.N	Local name	Botanical name	Family	Habit	Site Condition
1.	Kutmiro	Litsea monopetala	Lauraceae	Tree	Moist
2.	Saj	Terminalia temontosa	Combretaceae	Tree	Moist
3.	Kimbu Kaphal	Morus nigra	Moraceae	Tree	Moist
4.	Pindar	Trewia nudiflora	Euphorbiaceae	Tree	Moist
5.	Bhellar	Trewia nudiflora	Euphorbiaceae	Tree	Moist
6.	Karam (Karma)	Adina cordifolia	Rubiaceae	Tree	Moist
7.	Sal	Shorea robusta	Dipterocarpaceae	Tree	Moist
8.	Petare	NA*	NA*	Tree	Moist
9.	Kyamuno	Careya arborea	Lecythidaceae	Tree	Moist

10.	Bhalayo	Semicarpus anacardium	Anacardiaceae	Tree	Moist
11.	Kumbhi	Cochlospermum religiosum	Cochlospermaceae	Tree	Moist
12.	Kali Kath (Gaide; Tharu)	Glochidion velutinum	Euphorbiaceae	Tree	Moist
13.	Jamuno	Syzygium cumini	Myrtaceae	Tree	Moist
14.	Kalo Gendari	Premna integrifolia	Verbenaceae	Tree	Moist
15.	Barkyaule	Stephania glabra	Menispermaceae	Tree	Moist
16.	Archale	Antidasma bunius	Euphorbiaceae	Tree	Moist
17.	Seyal Phosre	Grewia elastica	Tilaceae	Tree	Moist
18.	Areli Kath	Hypericum cordifolium	Hypericaceae	Tree	Moist
19.	Semal	Bombax ceiba	Bombacaceae	Tree	Moist
20.	Madhesi Khirro	Trema orientalis	Ulmaceae	Tree	Moist
21.	Barro	Terminalia bellirica	Combretaceae	Tree	Moist
22.	Kammare (Kammaru)	Drynaria propinqua	Polypodiaceae	Tree	Moist
23.	Asare	Osbeckia stellata	Melastomaceae	Tree	Moist
24.	Syakhenu	Indigofera atropurpurea	Leguminosae	Tree	Moist
25.	Ram Peyari	NA*	NA*	Tree	Moist
26.	Sandan	Tectona Grandis	Verbenaceae	Tree	Moist
27.	Padel	NA*	NA*	Tree	Moist
28.	Sun Kainyo	NA*	NA*	Tree	Moist
29.	Chaichui	NA*	NA*	Tree	Moist
30.	Chille	Ehretia acuminata	Cordiaceae	Tree	Moist
31.	Hadey Ghans	NA*	NA*	Tree	Moist
32.	Amaro	Spondias pinnata	Anacardiaceae	Tree	Moist
33.	Lati Ghans	NA*	NA*	Tree	Moist
34.	Phalame	NA*	NA*	Tree	Moist
35.	Bahun Kath/ Bauni Kath	Hydrangea anomala	Hydrangeaceae	Tree	Moist
36.	Singane	NA*	NA*	Tree	Moist



37.	Amala	<i>Phyllanthus emblica</i>	Euphorbiaceae	Tree	Moist
38.	Bot Dhangero	<i>Lagerstoemia parviflora</i>	Lythraceae	Tree	Moist
39.	Thulo Archal	NA*	NA*	Tree	Moist
40.	Harro	<i>Terminalia chebula</i>	Combretaceae	Tree	Moist
41.	Sissoo	<i>Dalbergia sissoo</i>	Leguminosae	Tree	Dry
42.	Bakino	<i>Melia azadirach</i>	Meliaceae	Tree	Dry
43.	Teak/ Sagwan	<i>Tectona grandis</i>	Verbenaceae	Tree	Dry
44.	Satisal	<i>Dalbergia latifolia</i>	Leguminosae	Tree	Dry
45.	Bel	<i>Aegle marmelos</i>	Rutaceae	Tree	Dry
46.	Rajbriksha	<i>Cassia fistula</i>	Leguminosae	Tree	Dry
47.	Chhatiwan	<i>Alstonia scholaris</i>	Apocynaceae	Tree	Dry
48.	Tanki	<i>Bauhinia purpurea</i>	Leguminosae	Tree	Dry
49.	Pepal	<i>Ficus religiosa</i>	Moraceae	Tree	Dry
50.	Seto Pepal	NA*	Moreaceae	Tree	Dry
51.	Khamari	<i>Gmelina arborea</i>	Verbenaceae	Tree	Dry
52.	Thotne/tote	<i>Ficus hispida</i>	Moraceae	Tree	Dry
53.	Bakhre Ghans (Rato)	<i>Desmodium elegans</i>	Leguminosae	Tree	Dry
54.	Kalo Siris	<i>Albizia lebbeck</i>	Mimosaceae	Tree	Dry
55.	Dumri	<i>Ficus racemosa</i>	Moraceae	Tree	Dry
56.	Bar	<i>Ficus benghalensis</i>	Moraceae	Tree	Dry
57.	Neem	<i>Azadirachta indica</i>	Meliaceae	Tree	Dry
58.	Sepligan	<i>Crateva unilocularis</i>	Capparaceae	Tree	Dry

Among identified tree species Sal, Bhellar, Karma, Kyamuno, Asare, Chaichui, Phalame, Singane, Bot dhangero and Bakhre ghans are found sufficiently. Whereas Harro, Semal, Amaro, Bel and Neem are found very few although they are highly valuable for ethnobotanical use.

**Table 6.2: Shrub species diversity in and around Beeshazar lake**

S.N	Local name	Botanical name	Family	Habit	Site Condition
1	Arbire Saag /Karni Saag/ Pani saag	<i>Ipomoea reptans</i>	Convolvulaceae	Shrub	Wet
2	Gande	<i>Ageratum conyzoides</i>	Compositae	Shrub	Wet
3	Khasreto	<i>Ficus hispida</i>	Moraceae	Shrub	Wet
4	Aank	<i>Calotropis gigantea</i>	Asctepiadaceae	Shrub	Moist
5	Main Kanda (Main Gatta)	<i>Xeromphis spinosa</i>	Rubiaceae	Shrub	Moist
6	Sashra Buti (Bikh Jhar)	<i>Polygonum barbatum</i>	Polygonaceae	Shrub	Moist
7	Chhikota (Kali Gedi)	<i>Solanum americanum</i>	Solanaceae	Shrub	Moist
8	Angeri	<i>Melastoma metabathricum</i>	Melastomaceae	Shrub	Moist
9	Semthi	NA*	NA*	Shrub	Moist
10	Ganaune ghans	<i>Ageratum conyzoides</i>	Compositae	Shrub	Moist
11	Narkatai	<i>Phragmites karka</i>	Gramineae	Shrub	Moist
12	Khar (Dhaddi)	<i>Themeda arundinacea</i>	Gramineae	Shrub	Moist
13	Guyalo	<i>Callicarpa macrophylla</i>	Labiatae	Shrub	Moist
14	Sano Dhangeri	<i>Woodfordia floribunda</i>	Lythraceae	Shrub	Moist
15	Kurilo	<i>Asparagus racemosus</i>	Liliaceae	Shrub	Moist
16	Dattiwan	<i>Achyranthes aspera</i>	Amaranthaceae	Shrub	Dry
17	Amriso	<i>Thysanotaena maxima</i>	Gramineae	Shrub	Dry
18	Aiselu	<i>Rubus ellipticus smith</i>	Rosaceae	Shrub	Dry

19	Dhurseuli /Dhursulo	Ribes takare	Grossulariaceae	Shrub	Dry
20	Tama Bans	Bambusa arundinacea	Gramineae	Grass	Dry
21	Seru	Imperata cylindrica	Gramineae	Perennial grass	Moist
22	Bhata Bans	Bambusa balcooa	Gramineae	Grass	Dry

Among identified shrub species Arbire saag, Gande, Khsreto, Khar, Chhikota and Angeri are frequently observed whereas Aank, Main Kanda, Sashra buti and Kurilo are found very few.

**Table 6.3: Herb Species Diversity in and Around Beeshazar Lake**

S.N	Local name	Botanical name	Family	Habit	Site Condition
1	Jaluko	Eichhornia crassipes (Mar.) Solms	Pontederiaceae	Herb	Wet
2	Jalkumbi	Eichhornia (Mar.) Solms	Pontederiaceae	Herb	Wet
3	Pirle/Pire	Polygonum hydropiper	Polygonaceae	Perennial herb	Wet
4	Pani Jhar	Rotala rotundifolia	Lythraceae	Herb	Wet
5	Mathe Jhar	Cyperus compressus	Cyperaceae	Herb	Wet
6	Singada	Trapa bispinosa	Trapaceae	Herb	Wet
7	Ban Pati	Artemisia indica	Compositae	Herb	Moist
8	Dubo(Ghode Dubo)	Cynodon dactylon	Gramineae	Herb	Moist
9	Seto Banmara/ Banmara	Eupatorium odoratum	Compositae	Herb	Moist
10	Gaide Kuro/Gaide kanda	Caesalpinia bonduc	Leguminocae	Herb	Moist
11	Lahare Ghans	Galium elegans	Rubiaceae	Herb	Moist
12	Kali Gedi (Kali Kumai)	Gaultheria nummularioides	Ericaceae	Herb	Moist
13	Kantakari	Solanum surattense	Solanaceae	Herb	Moist

14	Tapre	Cassia tora	Leguminosae	Annual herb	Moist
15	Neuro	Dryopteris cochleata	Aspidiaceae	Herb	Moist
16	Unyu	Woodwardia unigemmata	Blechnaceae	Herb	Moist
17	Galení	Sambucus hookeri	Caprifoliaceae	Herb	Moist
18	Lazzawati	Mimosa pudica	Leguminosae	Herb	Moist
19	Kans	Saccharum spontaneum	Gramineae	Herb	Moist
20	Kharu Ghans	NA*	NA*	Herb	Moist
21	Bet Lauri	Costus speciosus	Zingiberaceae	Herb	Moist
22	Gayo	Bridelia retusa	Euphorbiaceae	Herb	Moist
23	Pharsa	Grewia sclerophylla	Tiliaceae	Herb	Moist
24	Thakal (Thakale)	Argemone maxicana	Papaveraceae	Herb	Moist/Dry
25	Rani Senka	Cheilanthes albomarginata	Pteridaceae	Herb	Moist
26	Sashra Buti	Blumea hieraciifolia	Compositae	Herb	Moist
27	Pani Ghans	Neanotis ingrata	Rubiaceae	Herb	Wet
28	Kukur Banso	Blumea lacera	Compositae	Herb	Moist
29	Hade Lasun	NA*	NA*	Herb	Moist
30	Twak Twake	NA*	NA*	Herb	Moist
31	Charikhutte	Gentiana pedicellata	Gentianaceae	Herb	Moist
32	Besare (Ban Besar)	Curcuma aromelica	Zingiberaceae	Herb	Moist
33	Kure Ghans	Chrysopogon aciculatus	Gramineae	Herb	Moist
34	Sano Mothe	Cyperus rotundus	Cyperaceae	Herb	Moist
35	Rudilo	Nyctanthes arbor-tristis	Oleaceae	Herb	Dry
36	Lasune Phool	NA*	NA*	Herb	Moist

Among identified herbs species, Jaluko, Jalkumbi, Pirle, Pani jhar, Singada, Ban pati, Seto banmara, Neuro, Lazzawati, Rudilo, Dubo and Thakal are found more dense in the study site.

**Table 6.4: Climber Species Diversity in and around Beeshazar Lake**

S.N	Local name	Botanical name	Family	Habit	Site Condition
1	Gurjo	Tinospora sinensis	Menispermaceae	Climber	Dry
2	Githa	Dioscorea bulbifera	Dioscoreaceae	Climber	Dry
3	Gol Kakri	Mukia scabrella	Cucurbitaceae	Climber	Moist
4	Char Chare Lahara	Cissus repens	Vitaceae	Climber	Moist
5	Lute Gaujo	Dicksonia appendiculata	Dennstaedtiaceae	Climber	Moist
6	Bharlang	NA*	NA*	Climber	Moist
7	Dudhe Lahara	Ichnocarpus frutescens	Apocynaceae	Climber	Moist
8	Janai Lahara/ J. Ghans	Lygodium japonicum	Schizaeaceae	Terrestrial fern/Climber	Moist
9	Ban Tarul	Dioscorea bulbifera	Dioscoreaceae	Climber	Moist
10	Ghar Tarul	Dioscorea alata	Dioscoreaceae	Climber	Moist
11	Hatti Kane	Kalanchoe spathulata	Crassulaceae	Climber	Moist
12	Birale Lahara (Debre Lahara)	Spatholobus parviflorus	Leguminosae	Climber	Moist
13	Dhaturu laharo	NA*	NA*	Climber	Moist
14	Fusro Bagal Pate Lahara	NA*	NA*	Climber	Moist
15	Kukurdaino	Smilax aspera	Lillaceae	Climber	Moist
16	Kobre Lahara	NA*	NA*	Climber	Moist
17	Bire Lahara	Mikania micrantha	Compositae	Climber	Moist

NA\* - Not Available

Source: Field survey, 2012

Among identified climber species Githa, Lute gaujo, Bharlang, Dhaturu laharo, Bire lahara are found frequently. Bire lahara; invasive species is growing rapidly and people feel that this is the major threat for other plant.

## **6.2 Documentation of Ethnobotanical use of the Identified (plant) Wetland Resources**

God did not send down any disease without also sending down a medicine or cure (Bhukari, 1976) With this statement, I again emphasize that each plant species are useful, having a certain characteristics and use value. All the 133 species identified were purely useful and utilized by local communities for various purposes. Many were important for medicinal purpose and most served as part and parcel of their social and religious living.

The local communities have been using these resources from the beginning of their life and culture. In such, Dependency of Tharu, Chepang and Darai/Dalit communities on wetland resources were high with 78.5% followed by Brahmin and Magar communities with only 32.6%. The less dependency of some communities on wetland resources is due to their high exposure to modern world amenities and medicines and also the improvement of their living standard.

Among all the ethnic communities, Tharu's culture is closely associated with wild plants, these plants play very important role from the time of birth of a baby until s/he dies. Being adherents of Hinduism, they use different types of plant species in different socio cultural matters. Different plants in the wetland periphery have also been used for medicinal purpose.

Ten major types of species, having socio-cultural importance, were ranked in focus group discussion. These species are Pipal, Bar, Bel, Sal, Aanp, Dhaturu, Aank, Tulsi, Dubo and Bayar. The analysis revealed that whole of the plant parts were mostly used by the respondents i.e. leaves, flowers and fruits respectively. Green leaves of Sal and Agaiya were used for making dinner plates in marriage, festival and in special occasion meanwhile whole plant of Bel, Tulsi, Piple, Bar, Dubo and Aanp were worshiped as God Narayan. Aank leaves were also used for worshiping. The Sal wood is used to make Jagya (a long pole used to light 101 lamp) when some wishes made comes true. Tharu people plant Bayar near their house because of their opinion that Bayar plant helps to protect their family from ghost and evil spirits. They prefer fruit of Dhaturu in order to serve for God Shiva. Aank is also taken as a symbol of God; women worship Aank when they sense that their husband is making extra

marital affairs and are likely to invite other women as a replacement. Tulsi is also used as a symbol of God and women worship Tulsi as a starter of the day.

The analysis revealed that the respondents were strictly protecting the plant species to maintain their socio-cultural-economic association. Two species namely Sal and Dhaturu were found in diminishing condition. The reason behind being in scarce condition is that, Sal is a multipurpose tree, very useful for timber, fuelwood and other uses such as Sal leaves are used for making plates for dining and used during Puja's and marriages. The leaves of Dhaturu were used to make bidi and for making gaja, and also acts as antispasmodic, anodyne and narcotic agent. Some species like Bar, Piple, Tulsi, Aanp etc were found domesticated condition while other species were found in wild condition. Tharu community also highly collected a snail spp locally called as ghongi for medicinal purpose. In every rainy season when the population of ghongi flourished, tharu children and men went to the wetland areas for collection. They are used as serving for meat purpose and mostly for its medicinal value.

Among other communities interviewed and observed, the Chepang community, the Brahmin community and the darai/dalit communities collected natural resources of economic value. 20% of the local people in the wetland area collected seasonal fruits and vegetables from the forest/wetland for their livelihood. Among the highly collected edible resources, mushrooms (4 Species), *Dryopteris cochleata* (locally called as niuro), Spinach and Bamboo shoots made a good seasonal income to the local people. They are widely consumed as delicious vegetables in most Nepali homes. During rainy season these resources are available in ample, the local people during these season is seen in the forest/wetland area for collection. One in each family goes for collection, thereby contributing to the household income. Local people make as much as NRs 20,000 per season by selling these mushrooms and fern. Five plants were identified as a major contributor to household medicines. Amala, Harro and Barro are used for curing coughs, colds and stomach pains. Asparagus is used as a diet for the pregnant women for enhancing good lactation. Sashra Buti is used as medicine for Typhoid and Making Yeast used in local wines.

### 6.2.1 Plants used as Food, Vegetable, Spices

This study revealed that the fruits of the following wild plants are edible: *Trapa bispinosa*, *Trewia nudiflora*, *Morus nigra*, *Mukia scabrella*, *Solanum surattense*, *Cassia tora*, *Xeromphis spinosa*, *Careya arborea*, *Semicarpus anacardium*, *Syzygium cumini*, *Melastoma metabathricum*, *Premna integrifolia*, *Antidasma bunius*, *Terminalia bellirica*, *Osbeckia stellata*, *Indigofera atropurpurea*, *Argemone maxicana*, *Woodfordia floribunda*, *Dioscorea bulbifera*, *Phyllanthus emblica*, *Dioscorea alata*, *Aegle marmelos*, *Albizia lebeck*, *Rubus ellipticus smith*, *Ficus racemosa*, *Callicarpa macrophylla*, *Lantana camara*. Among them, *Callicarpa macrophylla* is very rare in the common lands, but *Lantana camara* is becoming very invasive mostly on roadsides and forests, especially in Nagarban of the Chitwan district.

During times of scarcity, people of the study area use their knowledge of wild plants to obtain vegetables for sustenance. They collect tender plants and their parts from the common lands. Some of the wild vegetables are as follows: *Eichhornia crassipes* (Mar.) Solms, *Ipomoea reptans*, *Trapa bispinosa*, *Trewia nudiflora*, *Xeromphis spinosa*, *Dryopteris cochleata*, *Smilax aspera*, *Indigofera atropurpurea*, *Asparagus racemosus*, *Bauhinia purpurea*, *Bombax ceiba*, *Solanum nigrum*, and *Xeromphis spinosa*.

Among them, species of *Ipomoea*, *Pistia*, *Monochoria*, *Oenanthe*, *Eclipta*, *Ceratopteris* and *Alternanthera* are harvested from the wetland ghols. *Chenopodium* (Bethe) and edible fern (Neuro) are also sold in the urban as well as rural markets.

Tharu and Darai ethnic people know a number of plants useful for making "marcha" a substrate used to prepare beverages such as "raksi" (local whisky) and "moat" (beers). The plants, alone or along with other ingredients, are first dried, then powdered and mixed with wheat flour to make cake. The Darai people find that the "moat" prepared by packing in the leaves of *Artemisia indica*, *Clerodendrum viscosum* makes the local beer "moat" very tasty. The plants of fermenting value, along with distribution in the study area, are listed.



### 6.2.2 Plants as Medicines

The common land plant resources are used medicinally on both humans and livestock to treat a wide array of health problems. For humans, ailments (such as open wounds, stomach disorder, indigestion, ulcers, sprains, bone fractures, abortion, measles, headache and bodyache, fevers, coughs and colds) are treated with these healing plants. Some common land plants are also used as veterinary medicine. To treat different diseases, the plants as a whole or its parts in the form of juice, decoction, ash, or infusion are prescribed externally or internally. Some important medicinal plants found in the wetland area are *Ageratum conyzoides*, *Calotropis gigantean*, *Eupatorium odoratum*, *Solanum surattense*, *Mikania micrantha*, *Mimosa pudica*, *Saccharum spontaneum*, *Hypericum cordifolium*, *Bombax ceiba*, *Argemone maxicana*, *Woodfordia floribunda*, *Phyllanthus emblica*, *Asparagus racemosus*, *Terminalia chebula*, *Imperata cylindrical*, *Imperata cylindrica*, *Aegle marmelos*, *Cassia fistula*, *Alstonia scholaris*, *Nyctanthes arbor-tristis*, *Ribes takare*, *Thysanotaena maxima*, *Tinospora sinensis*, *Rubus ellipticus smith*, *Ficus racemosa*, *Azadirachta indica*, *Crateva unilocularis*, *Achyranthes aspera*. The Chitwan people use *Achyranthes aspera* medicinally in very small scale, but harvest in mass scale especially for religious purpose in "Rishi Tarpani, *Semicarpus anacardium*, *Careya arborea*.

### 6.2.3 Plants used as Fodder

The common lands are most frequently used for grazing animals, cutting grasses for stall feeding, and other purposes. The plants that have fodder value are comprise of 1 species of Anacardiaceae, 1 spp. Of Asctepiadaceae, 1 spp of Blechnaceae, 1 spp of Blechnaceae, 1 spp of Bombacaceae, 1 spp of Caprifoliaceae, 2 spp of Combretaceae, 3 spp of Compositae, 1 spp of Convolvulaceae, 1 spp of Cordiaceae, 2 spp of Cucurbitaceae, 2 spp of Cyperaceae, 1 spp of Dioscoreaceae, 1 spp of Dipterocarpaceae, 4 spp of Euphorbiaceae, 6 spp of Gramineae, 1 spp of Grossulariaceae, 1 spp of Lauraceae, 9 spp, of Legumes 2 spp of Lillaceae, 2 spp of Lythaceae, 2 spp of Melastomaceae, 2 spp of Meliaceae, 1 spp of Menispermaceae, 7 spp of Moraceae, 1 spp of Papaveraceae, 2 spp of Ploygonaceae, 2 spp of Pontederiaceae, 1 spp of Rocaceae, 4 spp of Rubiaceae, 1 spp of Schizaeaceae, 1 spp of Tilaceae, 1 spp of Trapaceae, 2 spp of Verbenaceae,

1 spp of Vitaceae, 1 spp of Zingerceae. Farmers of Chitwan supply the fodder requirement of their livestock from the common lands and the cultivated fields.

#### **6.2.4 Plants used in Crop Management**

Dried leaves and leftovers of most plants are used as green manure in the fields and gardens. Farmers use *Spondias pinnata* for manuring their fields. The leaves and stem of some plants such as *Azadirachta indica*, *Eupatorium odoratum*, *Lantana camara* and *Melia azedarach* (kernels) are used as botanical insecticide to protect the crops. The dried stems of some plants such as *Phragmites karka* and *Cissus repens* are used to make fence to protect especially fields and kitchen gardens from the domestic fowls and livestock.

#### **6.2.5 Plants used as Pesticide**

In the study area *Polygonum hydropiper* was collected and used by the locals for fish poisoning. The whole plant is crushed and spread in the water which acts as a seduction to the fishes and aerial animals. Among all the fish poisoning plants used by rural communities in Nepal, *P. hydropiper* was found to be most effective in poisoning the fish and dried shoots of Neem and Bhuijn-kadam are mixed with paddy and wheat grains to prevent their damage in storage.

#### **6.2.6 Plants used as Construction Materials and for Making Household Implements**

The common land plants like *Cyperus* spp. are used to prepare mats. Brooms are also made from the *Thysanolaena maxima* and *Argemone maxicana*. *Saccharum spontaneum* (Kans), *Imperata cylindrica* (Siru), and *Chrysopogon aciculatus* are used for thatching and also for making brooms and baskets. Kans and Siru are also used to make ropes for fastening the fodder and forages. These plants *Tectona grandis*, *Callicarpa macrophylla*, *Lagerstoemia parviflora* for making ploughs, wheel of cart and bullocks. Bambusa spp are used for making local crafts such as doko (for carrying goods).

### **6.2.7 Plants Used for Timber and Fuelwood**

*S. robusta*, *T. temontosa*, *S. cumini*, *D. sissoo*, *T. grandis*, *D. latifolia*, *G. arborea*, *L. parviflora*, *Hydrangea anomala*, *B. ceiba*, *Premna integrifolia*, *Syzygium cumini* found in the surrounding of the Beeshazar lake was collected for timber purpose.

*C. arborea*, *S. cumini*, *P. integrifolia*, *H. cordifolium*, *I. atropurpurea*, *O. stellata*, *B. retusa*, *E. acuminata*, *C. macrophylla*, *H. anomala*, *D. sissoo*, *M. azadirach*, *T. grandis*, *D. latifolia*, *B. purpurea*, *G. arborea*, *D. elegans*, *R. takare*, *A. lebbeck*, *T. chebula*, *H. anomala*, *C. macrophylla*, *E. acuminata*, *B. retusa*, *I. atropurpurea*, *O. stellata*, *T. bellirica*, *T. orientalis*, *H. cordifolium* were collected for fuelwood purpose.

### **6.2.8 Plant's Tuber and Root Use for Edible Purpose**

Tuber of Ban tarul (*Dioscorea bulbifera*), Ghar tarul (*Dioscorea alata*), Githa (*Dioscorea spp.*) and root of Kurilo (*Asparagus racemosus*) are highly demandable for edible purpose. Chepang community highly depend on these plants to fulfill their subsistence need.

## CHAPTER VII

### CONTRIBUTION OF WETLAND RESOURCES IN LOCAL LIVELIHOOD

This chapter deals with the contribution of wetland resources in local livelihood. This chapter covers the linkage and association of the wetland resources use in contribution to local livelihood and assess the contribution in Human capital, Social capital, Natural capital, Financial capital and Physical capital of livelihood .

#### 7.1 Assessing linkage and Association of the Wetland Resources use in contribution to local livelihood

##### 7.1.1 Human Capital

Human capital represents the skills, knowledge, ability to labor and good health that together enable people to pursue different livelihood strategies (Carney 1999) and achieve their livelihood objectives. Human capital is increased by investment in education and training as well as by the skills acquired through pursuing one or more occupations (Ellis 2000).

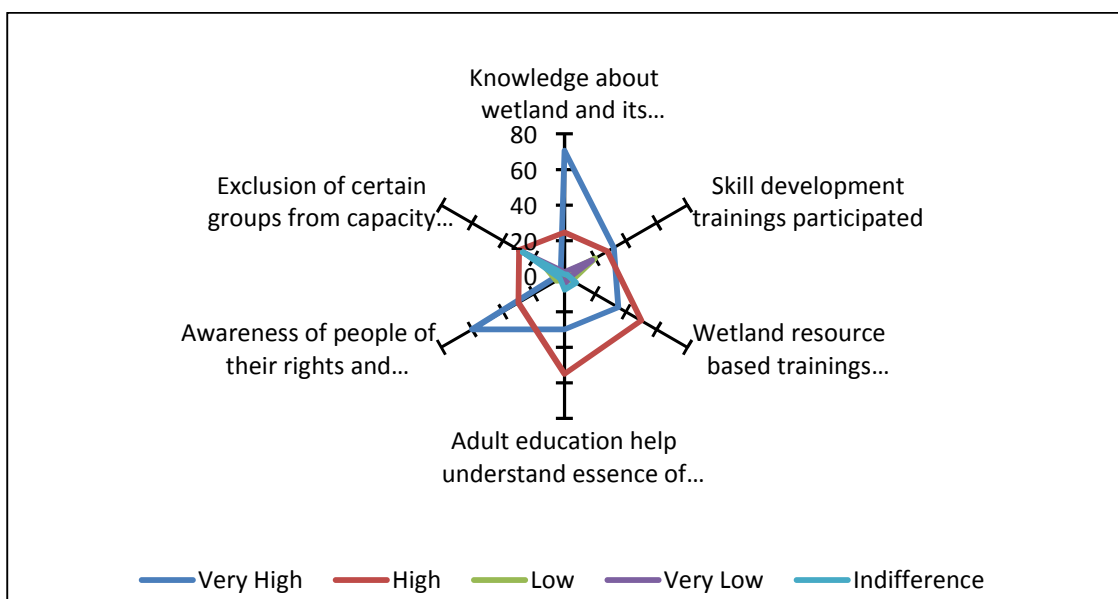


Figure 7.1: Assessment of Human Capital

Knowledge about wetland and its importance, Skill development trainings, Awareness of people of their rights, policies, and legislation related to Natural Resource Management (NRM), Wetland resource based trainings, Exclusion of certain groups from capacity build trainings were six indicators taken for assessing human capital in the study area. Based on the below figure, knowledge about wetland and its importance increased received the higher response with 70% viz: the locals were aware about the importance and significance of wetland, its resources and contribution to livelihood. Similarly people were also aware about their rights and policies, legislation related to NRM, the weighted mean being 1.3 which reveals very high response. Summing up the weighted mean of the human capital indicators which becomes 1.8, the impact of wetland resources on people’s livelihood (Human capital) is high.

### 7.1.2 Social Capital

Social capital in the context of the social livelihood framework is defined as the social resources upon which people draw in pursuit of their livelihood objectives (DFID 1999). Collier (1998) stated that social capital is institutions, relationships, and norms that shape the quality and quantity of society’s social interaction and the glue that holds societies together.

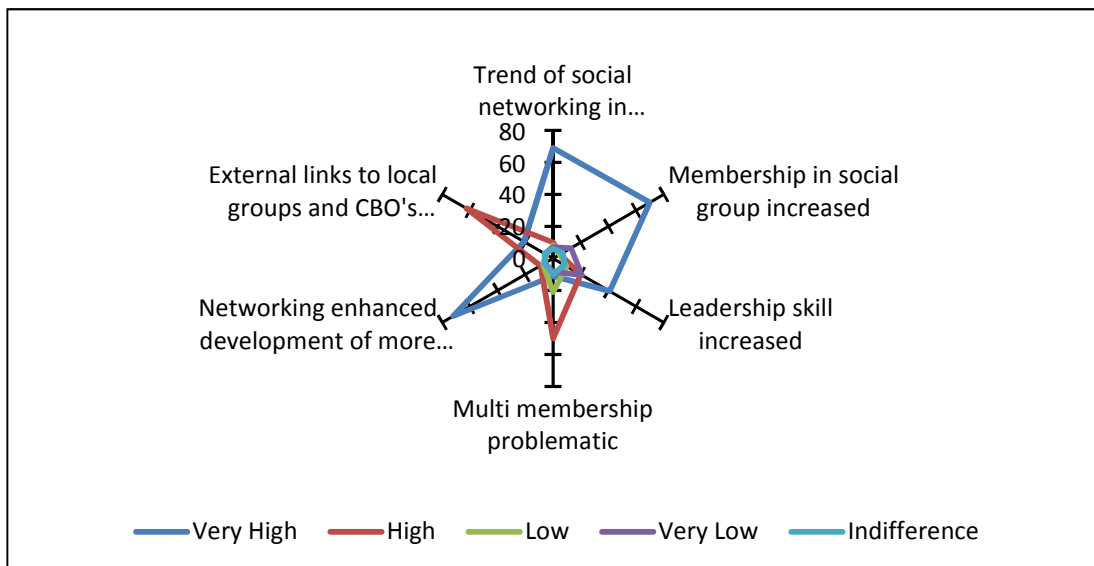


Figure 7.2: Assessment of Social Capital

Trend of social networking in community increased, Membership in social group increased, External links to local groups and CBO’s increased, Networking enhanced development of more open policy environment, Multi membership problematic and

leadership skill increased where six indicators taken to access contribution of wetland resources to social capital in the study area. Of the six indicators accessed, networking enhanced development of more open policy environment received higher response of 72% followed by membership in social group increased with 70%. Summing up the weighted mean of the Social capital indicators which becomes 1.6, the impact of wetland resources on people’s livelihood (Social capital) is high.

### 7.1.3 Natural Capital

Natural capital is the term used for natural resource stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived. There is a wide variation in the resources that make up natural capital, from intangible public good such as the atmosphere and biodiversity to divisible assets used directly for production (DFID 1999).

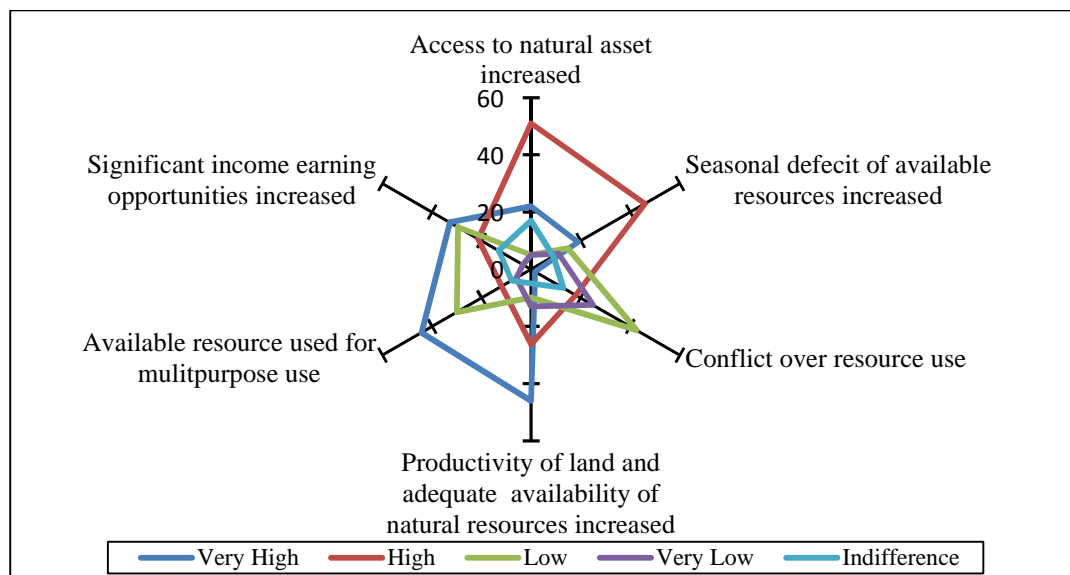


Figure 7.3: Assessment of Natural Capital

In the study area to access natural asset increased, Significant income earning opportunities increased, Seasonal deficit of available resource of available resources increased, Conflict over resource use, Productivity of land and adequate availability of natural resources, Available resources used for multipurpose use were six indicators used for accessing contribution of wetland resources to natural assets of livelihood. Of the indicators accessed, Productivity of land and adequate availability of natural resource increased received very high response of 46% followed by access to natural asset increased receiving high response of 51% compared to other

indicators. This means that every local people had access to the wetland resources. During rainy season, and resource availability periods, one in each household spent their major time in collection and sale of these resources contributing to their annual income. Summing up the weighted mean of the Natural capital indicators which becomes 2.0, the impact of wetland resources on people’s livelihood (Natural capital) is high.

#### 7.1.4 Financial Capital

Financial capital refers to stocks of money to which household has access (Ellis 2000). It denotes the financial resources that people use to achieve their livelihood objectives.

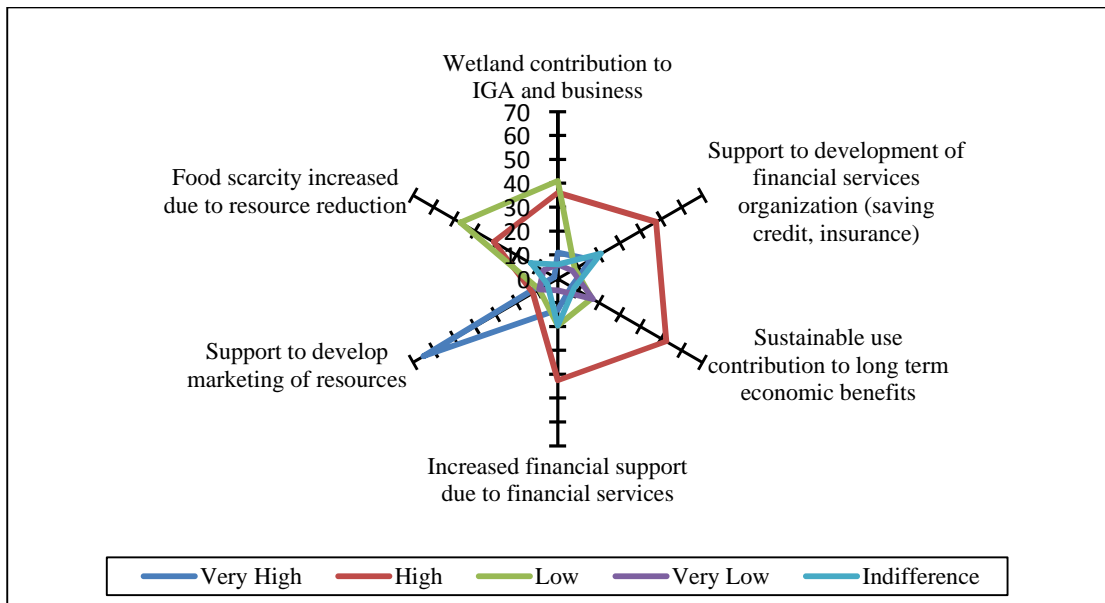


Figure 7.4: Assessment of Financial Capital

Wetland contribution to IGA and business, Support to development of financial services organization, Sustainable use contribution to long term, Increased financial support due to financial services, Support to develop marketing resources and Food scarcity increased due to resource reduction were the six indicators taken to assess contribution of wetland resources to financial asset of livelihood in the study area. Of the indicators assessed, support to develop marketing of resources received very high responses compared to other indicators with 65% of the total responses whereas food scarcity increased due to resource reduction received low response of 47% which reveals that there was no or less scarcity due to resource reduction as the locals had other livelihood options. Summing up the weighted mean of the financial indicators

which becomes 2.1, the impact of wetland resources on people’s livelihood (Financial capital) is high.

### 7.1.5 Physical Capital

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods (DFID 1999). Ellis (2000) defined in economic term, producer good as contrast to consumer good. Building irrigation canals, roads, tools, machines and so on are physical assets.

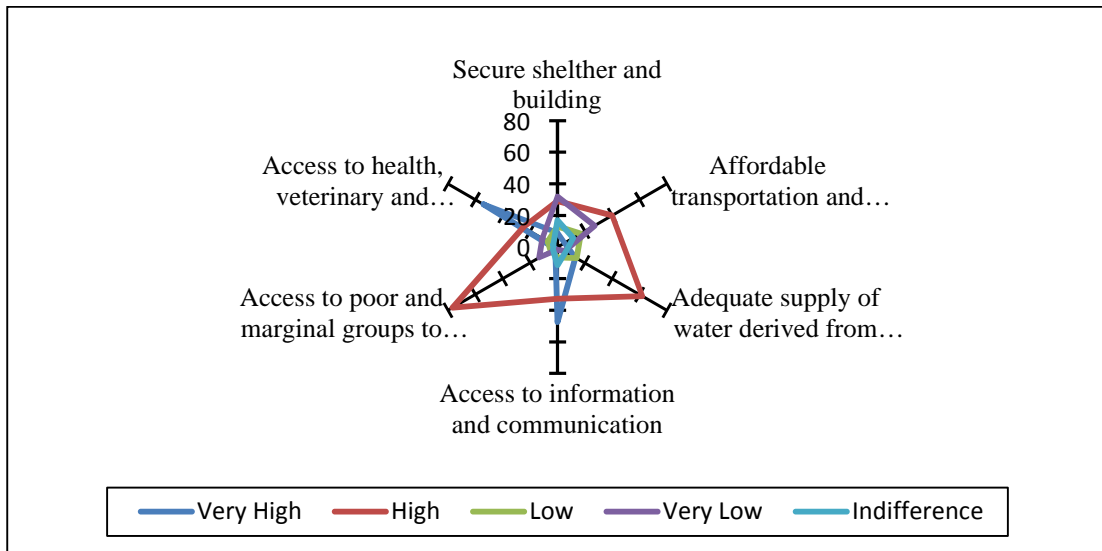


Figure 7.5: Assessment of Physical Capital

In the context of this study, secure shelter and building, Affordable transportation and transport facilities, Access to health, veterinary and irrigation facilities, Adequate supply of water derived, Access to information and communication were six indicators taken for accessing wetland resource contribution to Physical capital of livelihood. Of the indicators accessed, access to health, veterinary and irrigation facilities increased as responded by 54% of the respondents; followed by access to poor and marginal groups to physical facilities with 77% high response. Summing up the weighted mean of the physical asset indicators which becomes 2.1, the impact of wetland resources on people’s livelihood (Physical Capital) is high.

### 7.1.6 Livelihood Assessment

In the study area five capitals of livelihood; social capital, human capital, physical capital, natural capital and financial capital were indicators used for accessing contribution of wetland resources to local livelihood.



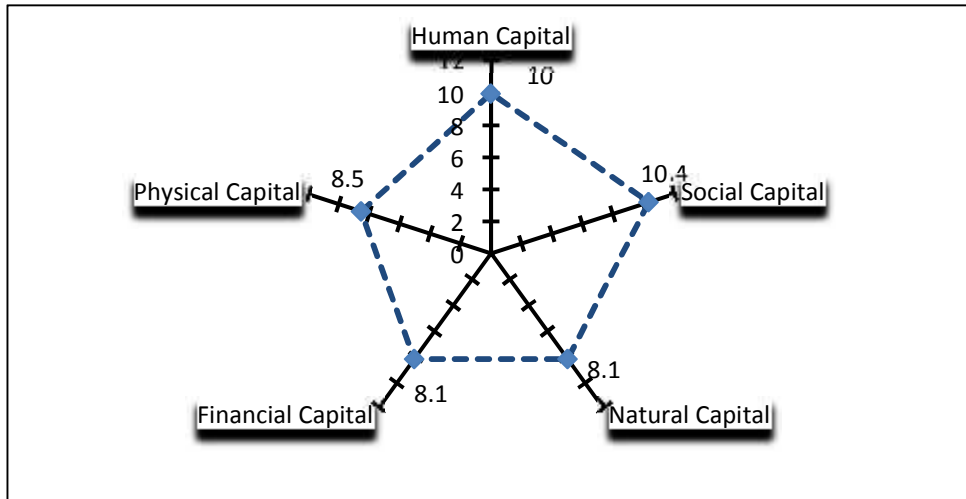


Figure 7.6: Livelihood Assessment

Based on the analysis of Index of relative ranking of the five capitals of livelihood, the social capital had very high impact of 10.4 ranking in the IRR. This is because of social networking in community increased, Membership in social group increased, External links to local groups and CBO's increased, Networking enhanced development of more open policy environment, Multi membership problematic and leadership skill increased. Human capital and physical capital have 10, 8.5 ranking in the IRR respectively. Natural and financial capitals both have low impact of 8.1 ranking in the IRR because of seasonal deficit of available resources increased, Conflict over resource use and food scarcity increased due to resource reduction.

## 7.2 Wetland Resource and Income for Community

This wetland is the major source of timber, fuelwood, fodder, grass and bedding material for the adjoining and distant accessible community. There are 2363 house hold in local community forest user group though adjoining community (primary users) were considered as sample for the study. In local community forest (Bandevis Bufferzone Community Forest User Group - BZCFUG) there are 5910 female and 6136 male so altogether population covered by Bandevi BZCFUG is 12,046. The major wetland resources, harvestable amount and cash income collection provision in Bandevi BZCFUG operational plan is shown in following table.

**Table 7.1: Major wetland resources, harvestable amount and collection cash provision in Bandevi BZCFUG**

S.N	Wetland Resource	Harvestable Amount	Unit Cost (Rs)	Possible Collection Cash/Year	Remarks
1	Timber	2491.56 Cft	750	18,68,670	For community member only
2	Fuelwood	3753.2 Bhari	15	56,298	
3	Fodder, Grass	5868 Bhari	50/month	17,500	
4	Bedding material	7905 hari			
Total				19,42,468	

Source: Bandevi BZCFUG operational plan, 2012

Table no 7.1 shows that major wetland resources collected by the community are timber, fuelwood, fodder, grass and bedding material. Timber is the major source of income for community forest user group. This income is using in local development, skill development of community people, women empowerment, community forest office management, wetland resource conservation and management.

Adjoining community (primary users) depends on this wetland for timber, fuelwood, fodder, grass, bedding material and also other all resources found in this wetland. Where as distant accessible community (secondary users) depends on this wetland for timber, fuelwood and some seasonal vegetable i.e. Neuro, Sepligan, Mushroom and Pani Saag.

## **CHAPTER VIII**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

This chapter deals with the summary of the study, conclusion, suggestions to local community and suggestions to future researches.

#### **8.1 Summary**

The ecological diversity of the wetland ecosystems of Nepal is very great. Wetland Plants are also the major source of medicine for the treatment of different diseases in Nepal. Still majority of people, mainly indigenous people who believe traditional treatment method depend on plant rather than sophisticated drugs. In tarai region indigenous people are using plants for different purpose, still some ethnic caste (i.e. Chepang) are in semi wild condition whose livelihood directly depend on wetland resources. In this way, indigenous people in a particular geographical area have different knowledge, skill, practice and application of the plant resources but these knowledge, skill, practice and application are not sufficiently transferring in new generation and in wide area due to the lack of the documentation and exploration so the ethnobotanical knowledge is in verge of extinction.

Beeshazar lake lies in Chitwan district which is situated in lowland of inner Terai valley (doon) of central region of Nepal. The area is very rich in terms of natural resources i.e. flora, fauna, etc. The lake has been declared as the Ramsar site hence it has international importance and also located in the buffer zone of Chitwan National Park which is included in the World Heritage Site in 1984. The lake is also one of the dominant and versatile ecosystems that harbor precious species of flora, fauna and indigenous people in the vicinity. Although this wetland is the life supporting system in lowland for the local indigenous people and indigenous people around this geographical area have different knowledge, skill, practice and application of the plant resources; very few researches has been conducted on this regard. Hence, this study consider essential in Beeshazar lake with setting the general objective; to assess ethnobotanical use of wetland resources and their role in local livelihood. And the

specific objectives are: identification and listing of the plant diversities found in the study area, documentation of the ethnobotanical use of the identified (plant) wetland resources and assessing linkage and association of the wetland resources use in contribution to local livelihood.

This study has purposively selected and adopted random sampling within in surrounding community of Beeshazar lake, which communities lies in Bharatpur municipality, ward no 8, 9 and Ratnanagar municipality, ward no 7. The household respondents were 30 female and 35 male hence making a randomly selected 65 households as the sample which represents 30% of the total population. Direct observation, structured schedule questionnaire with some Rapid Rural appraisal tools including focus group discussion, key informant interview were used to gather primary and secondary data. The collected data were analysed and interpreted in logical way through some charts, table and figures.

In this study area, total 133 species of 52 families were identified; out of which habit/plant type of 58 species were trees, 19 species were shrubs, 36 species were herbs, 3 species were grass and 17 species were climbers. Based on site condition, 10 species were dependent on wet regions of the wetland, 96 species on moist land and 27 on dry site condition. The local communities have been using wetland resources from the beginning of their life and culture. In such, dependency of Tharu, Chepang, and Darai/Dalit communities on wetland resources were high (78.5%) and Brahmin and Magar communities were low (32.6%). The less dependency of some communities on wetland resources is due to their high exposure to modern world amenities and medicines and the improvement of their living standard. Ten major types of species, having socio-cultural importance, were ranked. These species were Pipal, Bar, Bel, Sal, Aanp, Dhaturu, Aank, Tulsi, Dubo and Bayar. Tharu people plant Bayar near their house because of their belief is that the Bayar plant helps to protect their family from ghost and evil spirits. Five plants were identified as a major contributor to household medicines they are; Amala, Harro, Barro, Kurilo and Sashra Buti. They are used for different medicinal purpose by local people esp, the guraus (local tharu healer) used them in healing some common diseases in the communities. For example: the Guraus (local tharu healer) used Sashra Buti as medicine for Typhoid and Making Yeast used in local wines.

Among the highly collected edible resources; mushrooms (4 Species), *Dryopteris cochleata* (locally called as neuro), Spinach and Bamboo shoots make a good seasonal income to the local people. Local people make as much as NRs 20,000 per season by selling these mushrooms and neuro. They are widely consumed as delicious vegetables in most Nepali homes. Major wetland resources collected by the local community forest user group are timber, fuelwood, fodder, grass and bedding material. Local community forest user group is generating more than Rs. 19,42,468/year by selling wetland resources from the study site and using this cash for local development, skill development of community people, women empowerment, community forest office management, wetland resource conservation and management.

## **8.2 Conclusions**

Total 133 species of 52 families were identified in and around the Beeshazar lake out of which habit/plant type of 68 species were trees, 16 species were shrubs, 34 species were herbs and 15 species were climbers. Dependency of Tharu, Chepang and Dalit communities on wetland resources were high compared to Brahmin, Chhetri and Magar communities. The less dependency of some communities on wetland resources is due to their high exposure to modern world amenities and medicines and the improvement of their living standard.

Major wetland resources collected by the local community forest user group are timber, fuelwood, fodder, grass and bedding material. Local community forest user group is generating more than Rs. 19,42,468/year by selling wetland resources from the study site and using this cash for local development, skill development of community people, women empowerment, community forest office management, wetland resource conservation and management. Wetland resources is one of the important sources of household income in the study area. Mushroom and Neuro is the major source of income for local household among collected wetland resources. Local people make as much as NRs 20,000 per season by selling mushrooms and Neuro. Based on the analysis of Index of relative ranking of livelihood, the social capital had very high impact, this is because of social networking in community, membership in social group, external links to local groups and CBO's and leadership skill increased. Human capital and physical capital have medium impact. Natural and financial

capitals both have low impact because of seasonal deficit of available resources increased, conflict over resource use and food scarcity increased due to resource depletion.

### **8.3 Suggestions to Local Community**

- Important and protected floral and faunal species in the wetland area should be prohibited from collection and sale.
- Conservation, sustainable use and management should be done in planned way to avoid pressure on these resources thereby posing threat to wetland biodiversity.
- Traditional indigenous knowledge of the use of resources should be documented locally.

### **6.4 Suggestions to Future Researches**

- This study shows the seasonal deficit of available resource increased and conflict over resource use and this may be due to climate change so further study on - impact of climate change on wetland resources and its consequence on local livelihood is highly recommended.

## References

- Bhattarai, N. K. (1989). *Traditional phytotherapy among the Sherpas of Helambu, Central Nepal*. Journal of Ethnopharmacology, Kathmandu, Nepal 27:45-54.
- Bhattarai, N. K. (1990). *Herbal folk medicines of Kabhrepalanchok district, central Nepal*. Int. J. Crude Drug Res. 28(3):225-231.
- Bhattarai, N. K. (1991). *Folk herbal medicines of Makawanpur district, Nepal*. Int. J. Pharmacognosy 29(4):284-295.
- Bhattarai, N. K. (1992). *Medical ethnobotany in the Karnali zone, Nepal*. Economic Botany 46(3):257-261.
- Bhattarai, N. K. (1993). *Folk herbal medicines of Dolkha district, Nepal*. Fitoterapia LXIV(5):387-395.
- Bhukhari, S. (1976). *Interpretation of the meanings of the noble Qur'an*. [www.sahin-bukhari.com/pages/Bukhari\\_7\\_71.php](http://www.sahin-bukhari.com/pages/Bukhari_7_71.php).
- CBS, (2011). *Population monograph of Nepal*, Central bureau of statics, Kathmandu, Nepal.
- Coburn, B. (1984). *Some native medicinal plants of the western Gurung*. Kailash XI(1-2):55-88.
- Coburn, B. (1984). *Some native medicinal plants of the western Gurung*. Kailash XI(1-2):55-88.
- Dangol, D. R. (1998-99). *An inventory of plant biodiversity of Rampur, Chitwan, Nepal*. J. Inst. Agric.
- Dangol, D. R. and S. B. Gurung. (1988). *Preliminary survey of major weeds and farmers' weed management practices in Chitwan, Nepal*. A report submitted to Royal Nepal Academy of Science and Technology, Kathmandu, Nepal.
- Dangol, D. R. and S. B. Gurung. (1991). *Ethnobotany of the Tharu tribe of Chitwan district, Nepal*. Int. J. Pharmacognosy 29(3):203-209.
- Davis, T.J. (Editor). (1994). *The Ramsar Convention Manual: A guide for the Convention on Wetlands of International Importance especially as waterfowl habitat*. Ramsar Convention Bureau, Gland, Switzerland. 207 p.
- Dhillion S.S and Shrestha P.M, (2006). *Diversity and Traditional Knowledge Concerning Wild Food Species in a Locally Managed Forest in Nepal*, Agroforestry Systems, Volume 66, Issue 1, January
- DNPWC/WWF (2005). *Fact Sheet: Wetlands of Nepal*. Kathmandu: World Wildlife Fund and Department of National Park and Wildlife Conservation

- Dobremez, J. F. (1976). *Exploitation and prospects of medicinal plants in eastern Nepal*. In: *Mountain Environment and Development*. Swiss Association for Technical Assistance in Nepal, Kathmandu.
- EPA (2006a). Wetlands. Retrieved April 25, 2009, from <http://www.epa.gov/emap/html/data/wetlands/>
- EPA (2006b). *Economic Benefits of Wetlands*. Retrieved April 29, 2008, from [www.epa.gov/owow/wetlands](http://www.epa.gov/owow/wetlands)
- Ghimire, S.K., Shrestha, A.K., Shrestha, K.K. & Jha, P.K. 2000. *Plant resources use and human impact around Royal Bardia National Park, Nepal*. J. Nat. His. Mus. 19: 3-26.
- GON/MOFSC, (2009). *Nepal Fourth National Report to the Convention on Biological Diversity*. MOFSC, Kathmandu, Nepal
- Hardin, G. (1968-12-13). "The Tragedy of the Commons". *Science* (AAAS) **162** (3859): 1243–1248. doi:10.1126/science.162.3859.1243. PMID 5699198. Retrieved 22 October 2013.
- HMGN/MOFSC, (2002). *Nepal Biodiversity Strategy*. GEF/UNDP/MOFSC, Kathmandu, Nepal
- IUCN-Nepal. (1996). *An Inventory of Nepal's Wetlands*. IUCN-Nepal, Kathmandu.
- Joshi, K.K. & Joshi, S.D. 2001. *Genetic Heritage of Medicinal and Aromatic Plants of Nepal Himalayas*. Kathmandu: Buddha Academic Publishers and Distributors Pvt. Ltd.
- Jha, S.N., (2007). *Phytodiversity in Beeshazar Lake and Surrounding Landscape System*, Chitwan, Nepal. *Our Nature* (2007)5: 41-51
- Joshi, A. R. and J. M. Edington. (1990). The use of medicinal plants by two village communities in the Central Development Region on Nepal. Kathmandu, *Economic Botany* 44(1):71-83.
- Kaphley H., (2005). *A Survey of Herpetofaunal Diversity in SPNP*, Dolpa. Report Submitted to WWF Nepal Program, Kathmandu.
- Kunwar, R. M., Uprety, Y., Burlakoti, C., Chowdhary, C. L. & Bussmann, R.W. (2009). Indigenous use and Ethnopharmacology of Medicinal plants in far-west Nepal. Kathmandu, *ethnobotany Research & Applications* 7: 5-28.
- Mahato, R.B. & Chaudhary, R.P. (2005). *Ethnomedicinal plants of Palpa district*, Kathmandu, *Nepal Ethnobotany* 17: 152-163.
- Manandhar, N. P. (1987). *An ethnobotanical profile of Manang Valley*, Kathmandu, *Nepal. J. Econ. Tax. Bot.* 10:207- 213.
- Manandhar, N. P. (1989a). *Ethnobotanical notes on some pesticidal plants of Nepal*. Kathmandu, *Ethnobotany* 1:57-59.



- Manandhar, N. P. (1989b). *Useful plants of Nepal*. Frank Steiner verlag Wiesbaden GMBH, Stuttgart.
- Manandhar, N. P. (1990a). *Folk-lore medicine of Chitwan district, Nepal*. Kathmandu, *Ethnobotany* 2:31-38.
- Manandhar, N. P. (1990b). *Some additional note on wild food plants of Nepal*. *J. Nat. Hist. Mus.* 12(1-4):19- 32.
- Manandhar, N. P. (1991). *Some additional note on wild food plants of Nepal*. *J. Nat. Hist. Mus.* 12(1-4):19- 32.
- Manandhar, N. P. (1992). *Ethnobotanical observations on fiber bearing wild plants of Nepal*. *J. Econ. Tax. Bot. Addl. Ser.* 10: 117-122.
- Manandhar, N. P. (1993a). *Ethnobotanical claim on less known food plants of Nepal*. *J. Econ. Tax. Bot.* 17(2):373-383.
- Manandhar, N. P. (1993b). *Herbal remedies of Surkhet district, Nepal*. Kathmandu, *Fitoterapia* 64(3):265-272.
- Manandhar, N. P. (1995). *Ethnobotanical notes on unexploited wild food plants of Nepal*. *Ethnobotany* 7(1- 7):95-101.
- Manandhar, N. P. (1996a). *Ethnobotanical observations on ferns and fern allies of Nepal*. *J. Econ. Tax. Bot. (Add. Series)* 12:414-422.
- Manandhar, N. P. (1996b). *Traditional practice for oral health care in Nepal*. *J. Econ. Tax. Bot. (Add. Series)* 12:408-413.
- Manandhar, N. P. (1997). *Role of ethnobotany in the context of Nepal*. Paper presented on National Training Workshop on "Application of ethnobotany to community development" held in Sauraha, Chitwan from January 6-13, 1997.
- Manandhar, N. P. (1997). *Role of ethnobotany in the context of Nepal*. Paper presented on National Training.
- Manandhar, N. P. (2002). *Plants and People of Nepal*. Timber Press Portland, Oregon, USA: 63- 487.
- Manandhar, N.P. (1985). *Ethnobotanical notes on certain medicinal plants used by Tharus of Dang-Deukhuri district, Nepal*. *Int. J. Crude Drug Res.* 23 (4): 153-259.
- Mueller-Boeker, U. (1993). *Ethnobotanical studies among the Chitwan Tharus*. *Journal of Nepal Research Centre* 9:17-56.
- National Tropical Botanical Garden; (2007). *Ethnobotany, the science of survival; The Bulletin Volume XXIV No. 4 , Kaua‘i.*

- Newmaster and Ragupathy (2010). Ethnobotany genomics - discovery and innovation in a new era of exploratory research. *Journal of Ethnobiology and Ethnomedicine* 2010 6:2.
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Pandey, P.R. (1964). Distribution of Medicinal Plants in Nepal. Symposium on Medicinal Plants (Ceylon): 15-18.
- Pohle, P. (1990). Useful plants of Manang district. Franz Steiner Verlag Wiesbaden GMBH, Stuttgart.
- Poudel, S. & Gautam, C.M. 2008. *Studies on Ethnomedicine of Magar community in Dhading district*, central Nepal. *Bull. Dept. Pl. Res.* 30: 80-86.
- Rajbhandari, K.R, (2001). *Ethnobotany of Nepal*. Ethnobotanical Society of Nepal, Kathmandu, Nepal
- Ramsar. (2007). *Economic Valuation of Wetlands: A Guide for Policy*. Retrieved April 29, 2009, from [www.ramsar.org](http://www.ramsar.org)
- Rao, M.K.V. & Shanpru, R.(1981). *Some plants in the life of Garos of Meghalaya: 153-160*. In S.K.Jain (ed.) *Glimpses of Indian Ethnobotany*. Oxford & IBH Publishing Co., New Delhi .
- Resource Book, FAO, ICIMOD, PWMTA. 35-38.
- Sacherer, J. (1979). *The high altitude ethnobotany of the Rolwaling Sherpas*. *Contribution to Nepalese Studies* 4 (2): 45-64.
- Schuyt, (2004). *A Short History of Waterbird Convention. Ramsar convention Secretariat 1996*. URL <http://www.fern.org.np/publications/ramsar.htm> accessed on 23rd March 2010
- Shakya, M.R., Bajracharya, D.M., Joshi, G.P. & Shakya, J. (1999). *Ethnobotany and plant diversity of Royal Shukla Phanta Wildlife Reserve, Nepal*. In Proc. III Conf. Sci. & Tech. Kathmandu, RONAST: 288-295.
- Shakya, S. M., D. R. Dangol and A. Srivastava. (1995). *Exploration of underexploited vegetables of Chitwan district, Nepal*. Pp. 69-92. A final report submitted to NEMP-IUCN, Nepal.
- Shengji, P. (1999). Ethnobotany for biodiversity conservation. In Bhatta, B.R., Chalise, S.R., Myint, A.K. & Sharma P.N. (eds.). *Recent concepts, knowledge, practices and new skill in participatory integrated watershed management trainers*,
- Shrestha, I. & Pradhan, N. (1993). Medicinal plants of the Lele Village of Lalitpur, Nepal. *Int. J. Pharmacog* 31 (2): 130-134.

- Shrestha, I. and N. Pradhan. (1986). *Medicinal plants of Chobhar village of Kathmandu district, Nepal*. Journal of Natural History Museum (Kathmandu) 10(1-4):65-72.
- Shrestha, K.K. (1998). *Ethnobotanical inventory and plant taxonomy: basic approaches for ethnobotanical research*. In: Shrestha, K.K. et al. (eds.) *Ethnobotany for Conservation and Community Development*. Ethnobotanical Society of Nepal, Kathmandu, Nepal: 58-65.
- Shrestha, P. (1985). *Contribution to the ethnobotany of the Palpa areas*. Contribution to Nepalese Studies 12(23):63-74.
- Shrestha, P. (1997). *Selected bibliography of ethnobotanical literatures of Nepal*. Pp. 121-144. In: K. K.
- Shrestha, P. K. Jha, Pei Shengji, A. Rastogi, S. Rajbhandary, M. Joshi (eds.), *Ethnobotany for conservation and community development. Proceedings of the National Training Workshop in Nepal (January 6-13, 1997)*, Ethnobotanical Society of Nepal (ESON), Kathmandu, Nepal.
- Shrestha, P.M. & Dhillon S.S. (2003). Medicinal plant diversity and use in the highlands of Dolakha district, Nepal. *Journal of ethnopharmacology* 86: 81-96.
- Singh, L.M. (1999). Medicinal plants of Nepal. An overview, In: Shrestha, R. and B. Shrestha 1999. (eds.) *Wild relatives of cultivated plants in Nepal. Proceedings of National Conference on Wild relatives of cultivated plants in Nepal*, Kathmandu: The Green Energy Mission /Nepal.
- Singh, P.B.(1993). Medicinal plants of Ayurvedic importance from Mandi district of Himanchal Pradesh. *Bull. Medico-ethnobot. Res.* 14 (3-4):126-136.
- Singh, S. C. (1968). Some wild plants of food value in Nepal. *J. Tribhuvan Univ.* 4(1):50-60.
- Taylor, R. S. L., Shahi, S., & Chaudhary, R. P. 2002. Ethnobotanical research in the proposed Tinjure-Milke-Jaljale Rhododendron conservation area, Nepal. *Vegetation and society, their interaction in Himalayas.* 26-37.
- Veilleux C. and Steven R. K, 1996. *An Introduction to Ethnobotany*. Shaman Pharmaceuticals, Inc. work interdisciplinary to discover new drugs.
- Wikipedia (2013). Chitwan District, Wikipedia-The Free Encyclopedia, URL [http://en.wikipedia.org/wiki/Chitwan\\_district](http://en.wikipedia.org/wiki/Chitwan_district) retrived on December 6, 2013
- WTO; 2010. Trade theory and natural resources; II – Trade in natural resources, world Trade Organization report 2010

**Annex 1: Livelihood analysis**

<b>Human Capital</b>	Very High	High	Low	Very Low	Indifference	Weighted mean
Knowledge about wetland and its importance increased	70	25	2	2	1	1.4
Skill development trainings participated	32	28	20	18	2	1.8
Wetland resource based trainings increased awareness	35	50	5	3	8	1.5
Adult education help understand essence of NRM	30	55	2	5	8	1.6
Awareness of people of their rights and policies, legislation related to NRM	60	30	5	2	3	1.3
Exclusion of certain groups from capacity build trainings	3	30	15	26	27	3.6

<b>Social Capital</b>	Very High	High	Low	Very Low	Indifference	Weighted mean
Trend of social networking in community increased	69	10	8	7	6	1.4
Membership in social group increased	70	5	5	13	7	1.2
Leadership skill increased	41	20	10	21	8	1.9
Multi membership problematic	11	50	21	8	10	2.5
Networking enhanced development of more open policy environment	72	9	7	6	6	1.1
External links to local groups and CBO's increased	21	62	5	6	6	1.7

<b>Natural Asset</b>	Very High	High	Low	Very Low	Indifference	Weighted mean
Access to natural asset increased	22	51	5	5	17	1.7
Seasonal deficit of available resources increased	19	46	15	11	9	1.8
Conflict over resource use	2	18	43	25	13	3.2
Productivity of land and adequate availability of natural resources increased	46	26	10	13	5	1.5
Available resource used for multipurpose use	44	12	30	6	8	1.9
Significant income earning opportunities increased	33	21	30	3	13	2.4

<b>Physical Capital</b>	Very High	High	Low	Very Low	Indifference	Weighted mean
Secure shelter and building	9	29	13	32	17	2.6
Affordable transportation and transport facilities	5	40	17	27	11	2.6
Adequate supply of water derived from wetland	13	62	14	5	6	2.0
Access to information and communication	48	33	7	2	11	2.0
Access to poor and marginal groups to physical facilities	2	77	5	13	3	2.4
Access to health, veterinary and irrigation facilities increased	54	25	7	11	3	1.3

<b>Financial Capital</b>	Very High	High	Low	Very Low	Indifference	Weighted mean
Wetland contribution to IGA and business	11	36	41	6	6	2.3
Support to development of financial services organization (saving credit, insurance)	16	48	8	7	21	1.6
Sustainable use contribution to long term economic benefits	7	52	16	17	8	2.6
Increased financial support due to financial services	13	43	20	5	20	2.8
Support to develop marketing of resources	65	12	9	9	5	1.2
Food scarcity increased due to resource reduction	2	31	47	7	13	2.6

**Annex 2: Ethnobotanical use of wetland flora**

S.N	Local name	Botanical name	Use
	Jaluko	Eichhornia crassipes (Mar.) Solms	Vegetable
	Jalkumbi	Eichhornia (Mar.) Solms	Bio gas
	Pirle/Pire	Polygonum hydropiper	Used as poison for fishing
	Pani Jhar	Rotala rotundifolia	Grass for animals
	Arbire Saag/Pani saag	Ipomoea reptans	Used as vegetable and fodder for goats
	Gande	Ageratum conyzoides	Wound healer
	Khasreto	Ficus hispida	Fodder for animals
	Mathe Jhar	Cyperus compressus	Grass for animals, straws used for mat preparation
	Singada	Trapa bispinosa	Fruit used as Vegetable
	Kure Ghans	Chrysopogon aciculatus	Fodder for animals
	Ban Pati	Artemisia indica	Used for making yeast (Marcha), Fodder for animals
	Ghode Dubo	Cynodon dactylon	Fodder
	Sal	Shorea robusta	Incense powder, coloring purpose, resin, timber, fodder
	Aank	Calotropis gigantea	Healing fractures, curing ligament stretch, worshipped during marriage rituals, latex used in snake, crab bite, low back pain, sinusitis, constipation. Flowers used in dog bite. Fibre from fruit pod used in filling pillows and mattress
	Kimbu Kaphal	Morus nigra	Producing silk when fed to silk worms, fruits edible, Fodder
	Pindar	Trewia nudiflora	Fruit, vegetable, fodder
	Seto Banmara	Eupatorium odoratum	Medicine for healing fresh wounds, fodder
	Kutmiro	Litsea monopetala	Good fodder
	Saj	Terminilia temontosa	Timber, fuelwood, Grass

	Gol Kakri	Mukia scabrella	Fruit, Fodder for animals
	Gaide Kuro/Gaide kanda	Caesalpinia bonduc	Grass for animals
	Lahare Ghans	Galium elegans	Grass for goat, buffalo
	Kali Gedi (Kali Kumai)	Gaultheria nummularioides	Fruit, vegetable, Grass for animals
	Bire Lahara	Mikania micrantha	Fruit used for toothache, preparing mats
	Kantakari	Solanum surattense	Tooth ache, Used in preparation of soap, Grass, Fruit preferred by rhinoceros
	Tapre	Cassia tora	Fruit, fodder for goat
	Main Kanda (Main Gatta)	Xeromphis spinosa	Fruit, vegetable, pickle, grass
	Sashra Buti (Bikh Jhar)	Polygonum barbatum	Fuelwood, Medicine for Typhoid
	Bhellar	Trewia nudiflora	Grass, fuelwood, Major diet for rhinoceros
	Neuro	Dryopteris cochleata	Vegetable, grass
	Unyu	Woodwardia unigemmata	Thatch/shed and bedding material for animals
	Galeni	Sambucus hookeri	Grass
	Lazzawati	Mimosa pudica	Root used for curing Gastric, grass for animals
	Karam (Karma)	Adina cordifolia	Grass, fodder, timber
	Kans	Saccharum spontaneum	Grass, thatch, Root used for worm problem,
	Petare	NA*	Grass, fuelwood
	Fusro Bagal Pate Lahara	NA*	Grass
	Kukurdaino	Smilax aspera	Vegetables, Put in door, windows to drive bad spirit, witches
	Kobre Lahara	NA*	Bedding material
	Kharu Ghans	NA*	Fodder
	Kyamuno	Careya arborea	Used as medicine for curing Cynus, Fruit edible, Grass, Fuelwood



	Bhalayo	<i>Semicarpus anacardium</i>	Fruit edible, Bamboo, Used as medicine for curing Cynus
	Kumbhi	<i>Cochlospermum religiosum</i>	Bedding material
	Chhikota (Kali Gedi)	<i>Solanum americanum</i>	Fuelwood, Bedding material
	Birale Lahara (Debre Lahara)	<i>Spatholobus parviflorus</i>	Grass, Used as rope for binding
	Kali Kath (Gaide; Tharu)	<i>Glochidion velutinum</i>	Stick, Grass, Small wood
	Jamuno	<i>Syzygium cumini</i>	Fruit edible, Fuelwood, Wood, Bamboo
	Angeri	<i>Melastoma metabathricum</i>	Fruit edible, Grass
	Kalo Gendari	<i>Premna integrifolia</i>	Fruit edible, Wood, Bamboo, Fuelwood
	Barkyaule	<i>Stephania glabra</i>	Wood, Fuelwood, Grass
	Archale	<i>Antidasma bunius</i>	Fruit edible, Grass for animals
	Seyal Phosre	<i>Grewia elastica</i>	Grass
	Dhaturu laharo	NA*	Used in Cosmetics
	Areli Kath	<i>Hypericum cordifolium</i>	Used for making gun powder, Fuelwood, Root used for cutting fractures,
	Semal	<i>Bombax ceiba</i>	Wood, Bark/roots used for making local breads, Tubers used against rheumatism
	Madhesi Khirro	<i>Trema orientalis</i>	Wood, Grass for goats
	Barro	<i>Terminalia bellirica</i>	Fruit used for cough, used for making Grass, wood
	Kammare(Kammaru)	<i>Prynaria propinqua</i>	Healing wrist pain, Grass
	Asare	<i>Osbeckia stellata</i>	Fruit edible, Fuelwood
	Syakhenu	<i>Indigofera atropurpurea</i>	Fruit used as Vegetable, Pickle , Grass, Fuelwood
	Ram Peyari	NA*	Grass, Fuelwood
	Bet Lauri	<i>Costus speciosus</i>	Fruit used as vegetable, pickle, Grass, Wood
	Gayo	<i>Bridelia retusa</i>	Fuelwood

	Lute Gaujo	Dicksonia appendiculata	Leaves paste is used as Scabies treatment in animals, Grass
	Sandan	Tectona grandis	Wood used for preparing ploughs, Wooden vessels, Timber, Grass
	Bharlang	NA*	Tarul Khane, Making liquor, Used as Grass
	Semthi	NA*	Used in making ropes (damlo and namlo)
	Padel	NA*	Fruits edible, Fuelwood, Timber, Grass
	Dudhe Lahara	Ichnocarpus frutescens	Grass
	Pharsa	Grewia sclerophylla	Grass, Fruits edible
	Sun Kainyo	NA*	Grass, Fuelwood, Timber
	Ganaune	Ageratum conyzoides	Grass, Fuelwood, Timber, Fruits edible
	Chaichui	NA*	Grass, Fuelwood, Timber
	Thakal (Thakale)	Argemone maxicana	Fruits edible, Thatch grass (Khar), Used as Broomstick, Root, seeds and latex used to treat pox, skin diseases, gonorrhoea and rabies
	Rani Senka	Cheilanthes albomarginata	Used in ear and nose holes
	Sashra Buti	Blumea hieraciifolia	Used as medicine for Typhoid, Making Yeast (Marcha garanue),
	Narkat	Phragmites karka	Grass, Used for fencing purpose
	Khar (Dhaddi)	Themeda arundinacea	Thatching purpose, Grass, Fodder for Horse
	Pani Ghans	Neanotis ingrata	Grass used for feeding livestock
	Kukur Banso	Blumea lacera	Grass used for feeding livestock
	Hade Lasun	NA*	Used as medicine for curing wounds and itches
	Lati Ghans	NA*	Grass and fuelwood
	Twak Twake	NA*	Grass
	Janai Lahara/ J. Ghans	Lygodium japonicum	Grass
	Chille	Ehretia acuminata	Grass, Fuelwood

	Hadey Ghans	NA*	Grass, Fuelwood
	Amaro	Spondias pinnata	Used for making pickles, Grass, Manure
	Guyalo	Callicarpa macrophylla	Wood used for making ploughs, Fuelwood
	Sano Dhangeri	Woodfordia floribunda	Fruits edible, Grass, Flowers used as medicine for dysentery
	Phalame	NA*	Grass, Fuelwood
	Bahun Kath/ Bauni Kath	Hydrangea anomala	Fuelwood, Timber
	Singane	NA*	Fuelwood, Timber
	Ban Tarul	Dioscorea bulbifera	Fruits edible, Grass for feeding livestock
	Amala	Phyllanthus emblica	Fruits edible, Grass, used for curing Gastrics and stomach pain, Herbal product
	Ghar Tarul	Dioscorea alata	Fruits edible, Grass
	Hatti Kane	Kalanchoe spathulata	Grass
	Char Chare Lahara	Cissus repens	Grass, Used for fencing
	Bot Dhangero	Lagerstoemia parviflora	Grass, Timber, Railway league, Making wheel of cart and bullocks
	Charikhutte	Gentiana pedicellata	Vegetable, Grass for feeding livestock
	Kurilo	Asparagus racemosus	Vegetable, Roots used to treat internal haemorrhage, diarrhoea, piles, hoarseness of voice, cough, and gout, defects of vision, poisoning and disorders of female genital tract.
	Thulo Archal	NA*	Fruits edible, making pickles, Grass, Fuelwood
	Harro	Terminalia chebula	Used for curing cough and colds, and Fuelwood
	Besare (Ban Besar)	Curcuma aromelica	Grass
	Seru	Imperata cylindrica	Khar, Grass, Roots used for curing worms
	Sano Mothe	Cyperus rotundus	Grass
	Sissoo	Dalbergia sissoo	Fuelwood, Timber
	Bakaino	Melia azadirach	Fuelwood, Grass used for curing tapeworm

			infection in livestock
	Teak/ Sagwan	<i>Tectona grandis</i>	Pole, Dying, Fuelwood, Timber
	Satisal	<i>Dalbergia latifolia</i>	Fuelwood, Timber
	Dattiwan	<i>Imperata cylindrica</i>	Root, seed and leaves used in form of juice and powder to treat excessive hunger, piles, skin disease, wounds, difficult labor, eye disease, tooth ache, Gum bleeding (Harsha)
	Bel	<i>Aegle marmelos</i>	Used for religious purpose, Grass, Fuelwood, Symbol of God, Fruit for Juice, Used for dyspepsia. Unripe fruits useful in diarrhoea, dysentery and stomachalgia. Roots useful in case of seminal weakness, uropathy, swellings, intermittent fever and gastric irritability in infants. Root bark used in hypochondriasis, melancholia and palpitation of heart and stomach pain.
	Rajbriksha	<i>Cassia fistula</i>	Used for dysentery (Jhada Pakhala), used in constipation
	Chhatiwan	<i>Alstonia scholaris</i>	Bark used for abortion purpose,
	Tanki	<i>Bauhinia purpurea</i>	Grass, Vegetable, Fuelwood
	Pepal	<i>Ficus religiosa</i>	Religious purpose, Symbol of God
	Seto Pepal		Grass, Climber, Leaves used (Patko use)
	Rudilo	<i>Nyctanthes arbor-tristis</i>	Used as medicine for dry cough in infants,
	Khamari	<i>Gmelina arborea</i>	Grass, Fuelwood, Timber
	Thotne/tote	<i>Ficus hispida</i>	Fuelwood, during birth of calf used in storing milk for seven days
	Lasune Phool		Interior plant
	Bakhre Ghans (Rato)	<i>Desmodium elegans</i>	Grass, Fuelwood
	Dhurseuli /Dhursulo	<i>Ribes takare</i>	Fuelwood, Used to ripen bananas, Root used as medicine
	Kalo Siris	<i>Albizia lebbeck</i>	Leaf, flower, fruits and pods are used. Used for treating skin disease and also to treat cough and asthma, skin eruptions. Used as Grass, Fuelwood

	Githa	<i>Dioscorea bulbifera</i>	Tuber edible, Grass, Climber used
	Amriso	<i>Thysanotaena maxima</i>	Broomstick, leave paste used in healing fractures and ruptures
	Tama Bans	<i>Bambusa arundinacea</i>	Bamboo shoots edible, Grass, Bata, choya,
	Bhata Bans	<i>Bambusa balcooa</i>	Bhata, Choya, Doko, , Grass
	Gurjo	<i>Tinospora sinensis</i>	Curing heat, used for healing cancer
	Aiselu	<i>Rubus ellipticus smith</i>	Fruits edible, roots used for reducing/healing body heat
	Dumri	<i>Ficus racemosa</i>	Religious importance, Grass, Fuelwood, Fruits edible, Ellergies, skin cracks, leaves paste used in itches
	Bar	<i>Ficus benghalensis</i>	Religious importance, Symbol of God
	Neem	<i>Azadirachta indica</i>	Insecticide, Curing prickles and skin allergies, Whole plant used to treat fever, bleeding piles, wound, gout, skin diseases, diabetes and jaundice, intestinal worms, scabies, chronic malarial fever.
	Sepligan	<i>Crateva unilocularis</i>	Used as pickles, Curing heat and malaria, curing blood pressure, used for treating body heat, used as blood pressure medicine

**NA\* - Not available**

### *Annex 3: Questionnaire*

Name of the respondent: \_\_\_\_\_ Date: \_\_\_\_\_

Name of the wetland/study site: \_\_\_\_\_

Respondent sex: \_\_\_\_\_ Age: \_\_\_\_\_

**Household information**

Ethnicity: \_\_\_\_\_ Occupation: \_\_\_\_\_

Education status: Illiterate  Literate  Below S.L.C  Above S.L.C

HH members: \_\_\_\_\_ Male: \_\_\_\_\_ Female: \_\_\_\_\_

Land holding size:

Khet (kathha): <5  5-10  10-15  15-20  >20

Bari (kathha): <5  5-10  10-15  15-20  >20

Dependency on wetland resources: High  Medium  Low

**(A) Socio-economic value and local level use of wetland resources:**

- In your judgment, are local people benefiting from wetland resources?
- Do you collect any resources from Beeshazar Lake and its periphery? If yes then what types of resources do you collect and explain their use and value?

S.N	Name of resources	House hold use(purpose)	Marketing (Income/year)	Remarks (Cultural/social)
1				
2				
3				
4				
5				
6				
7				
...				
...				

What are the plants which are mostly collected?

SN	Local name	Reason for collection	Condition of plant (abundance/scarce)	Contribution to income %
1				
2				
3				
...				
...				

### Human Capital:

1. Main source of income

SN	Types	Income	
1.	Agriculture		
2.	Employment		
3.	Business		
4	Household worker		
5.	Others		
6.	Contribution from wetland		

2. Main Source of income/ Livelihood Strategies

SN	Source	Income	Contribution in % or part
1	Crops		
2	Vegetables/Fruits		
3	Livestock		
3	NTFPs		
4	Service within Nepal		
5	Service outside Nepal		
6	Business		
7	Daily wage		
8	Fishing		
9	Wetland based IGA		

Have you participated in any kind of training before?

<b>Training</b>	<b>Yes</b>	<b>No</b>	<b>If Yes, Time</b>
Skill development/ Income generation			
Agriculture			
Forestry/ Biodiversity			
Wetland based			
Office management/ Administrative			
Leadership			
Gender Equity			
Adult Literacy			
Responsibility			
Village Skill training			
Orientation			
Others			

**Financial Capital:**

Does wetland contribute to your income?

Yes \_\_\_\_\_ No \_\_\_\_\_

What kind of wetland based business/IGA activities are you doing?

3. Have you taken loan to initiate these activities?

Yes \_\_\_\_\_ No \_\_\_\_\_

Have you taken loan for other purpose, for what purpose?

Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, for what following purposes?

- a. Agriculture
- b. Livestock
- c. IGA related
- d. Poultry
- e. Education
- f. Purchase of food
- g. Household health( Domestic)
- h. Business/ Small industry
- i. Alternative energy

3. Types of Domestic animals and their number

What kind of feeding system do you apply for the livestock you have?

Grazing                      Stall fed                      Semi grazing and stall fed

4. Category of land ownership/tenure:

- a. Landless
- b. Owner operator/ cultivator



c. Owner cum rented-in

d. Owner cum rented-out

e. Share cropper

Have you own/rented any piece of land for initiating wetland based IGA?

Yes

No

5. Land type and area

Type of Land	Area	Land Tenure Status
Khet (Lowland)		
Bari (Upland)		
Others		

Note: Land tenure status: **1-** Own **2-** Share in **3-** Share out **4-** Rented in **5-** Rented out  
**6-**Others

6. Crop type

Crops	Area	Yield	Remarks

Reason for increasing for increasing crop yield in: Example- Fertility, Irrigation, wildlife damage etc.

7. Is your production from the land sufficient for the family consumption throughout the year?

Yes

No

If not, for how many months is the consumption sufficient?

Less than 3 months

3 months

6 months

8. How do you cope up with the situation? Rank 1, 2, 3, ----- in order of importance

a. Loan \_\_\_\_\_ b. Sale of other household production \_\_\_\_\_ c. Labor \_\_\_\_\_

d. Part time business \_\_\_\_\_ e. Others \_\_\_\_\_

9. In which month do you experience the food scarcity? Rank **months** in order of importance

**Physical Capital:**

10. Do you have your own house?

Yes: \_\_\_\_

No:

11. Type of house:

Wall			Roof			Storey		
Mud	Wooden	Cement	Kacchi	Semi pakki	Pakki	One	Two	More

12. If house is of wooden, from where do you bring timber?

Past: \_\_\_\_\_

Present: \_\_\_\_\_

13. Do your family have access to the following facilities?

Facilities	Types	Present	
		Distance	Duration
Water supply	Tap/Hand Pipe		
School	Primary		
	Lower secondary		
	Secondary		
Health	Health Post		
	Health Center		
Irrigation	Canal		
	Pumpset/Boring		
Veterinary			
Electricity			
Bank			
Motor Road			
Others			

**Natural Capital:**

14. State the number of timber materials you are using for following purposes.

Purpose	Types of materials Number
Housing	
Cattleshed	
Furniture	
Agricultural implements	
Bullcart	
Sell	
Others	

15. From where do you bring the timber?

Sources	Distance		%
	Past	Present	
Buffer Zone			
Private forest			
Reserve			
Other			

16. Do you feel any difficulties to get timber?

Time	Difficulties
Past	
Present	

17. How do you collect fuelwood?

Past: \_\_\_\_\_ Present: \_\_\_\_\_

18. Do you have any alternative energy source? If yes then what?

20. Did wild life cause damage when you were inside the reserve?

Wildlife type	Damage			Compensation	Remarks
	Crop	Cattle	Human		

21. Did you kill any wildlife before? If yes, why?

22. Is the felling of trees increasing or decreasing?

Past: \_\_\_\_\_ Present: \_\_\_\_\_

### Social Capital

23. Do you have membership in any type of group? Yes: \_\_\_\_\_ No: \_\_\_\_\_

If yes, which type of group?

- |                     |                     |
|---------------------|---------------------|
| BZ user group       | Youth Group         |
| CF user group       | Religious Group     |
| Agriculture Group   | Cooperative         |
| Fishery group       | NonGovernment Group |
| Drinking watergroup | Ethnic based Group  |
| Female group        |                     |

p

23. Do you think protection and conservation of NR is good? Yes: \_\_\_\_\_ No: \_\_\_\_\_

24. If yes, what do you do to help to conserve the NR?

Reporting

Protection of NTFP

Protection of trees and their seedling

Protection from fire

Protection from Illegal felling of trees

Others

## Checklist for key informants

1. What types of flora and fauna are found in Beeshazar Lake?
2. Do you have some idea of general and specific (distinctive) use of these resources?
3. What is its status? Do these resources increasing or decreasing?
4. Are these resources contributing in the livelihood of local people?
5. If yes which caste and level (Poor, women, DAGs, others) are most benefited?
6. Does this wetland have some cultural value? If yes what types? Other typical value.....?
7. What is the mechanism of wetland resources use? Open access or controlled by some institution/organization?
8. Are they using these resources on sustainable way? If yes what mechanism do they follow for its sustainability?
9. Are there any programmes to identify and protect important wetland resources?
10. If yes what types of change you found after that programmes?
11. Wetland resources status? Are they increasing or some are disappearing in comparison to the past?
12. Are local people conserving the wetland? What are the motivational factors for protection?
13. What types of activities and role are needed to conserve the wetland resources in this wetland by local people?
14. Who are the most benefited by wetland resources? (Poor, women, DAGs, others)
15. Are there some religious and cultural important sites in this wetland? If yes then what types of provision are made in that site? (Protection/use)
16. What types of potentiality have you been observed from this wetland?
17. For focus group discussion, the most benefited group (tharu, chaudhari, tamang or Dalit/darai from field information) was targeted. Focus group discussion was conducted with the small group of people (7-9 people) in four places with the group of community forest user group, women group, ethnic people and dalit group.

***Annex 4: Some Glimpses of the work (Photo Gallery)***



**Photo 1: Researcher collecting information from ethnic groups**



**Photo 2: Local women collection sal leaves and mushrooms**



**Photo 3: Research assistant with respondents**



**Photo 4: Local botanist identifying plant species**



**Photo 5: Local healer showing use of plant for medicinal purpose**



**Photo 4: Children collected vegetable from Wetland**



**Photo 5: Wetland resources collected for sale**



**Photo 6: Interaction with local healer**



1: Women collecting sal leaves for making sal plates 2: Tharu women collecting mushrooms for vegetables 3: Local people collecting ferns and mushrooms for sale

*Annex 5: Photos of Some Important Plant Species Found in Study Area*



Jaluko

Pirle/Pire

Singada



Sal

Ban tarul

Amala



Ghar tarul

Sashra buti

Kurilo







Githha



Tama Bans



Bhata Bans



Bar



Neem



Sepligan



Main kanda



Neuro



Aank