

**A STUDY ON THE PEOPLE – PROTECTED AREA  
INTERFACE AT KEIBUL LAMJAO NATIONAL PARK,  
MANIPUR**

**THESIS  
SUBMITTED TO THE  
FOREST RESEARCH INSTITUTE (DEEMED) UNIVERSITY  
DEHRA DUN, UTTARAKHAND  
FOR  
THE AWARD OF THE DEGREE OF  
DOCTOR OF PHILOSOPHY IN FORESTRY  
(FOREST MANAGEMENT)**



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**2014**



## DECLARATION

I hereby declare that the dissertation "A study on the people-protected area interface at Keibul Lamjao National Park, Manipur" is original research conducted by me under the supervision of Dr. Ruchi Badola and co-supervision of Dr. S. A. Hussain of the Wildlife Institute of India. The thesis has been submitted to the Forest Research Institute (Deemed) University for the award of degree of Doctor of Philosophy in Forestry (Forest Management), and has not formed the basis for the award of any other degree. It embodies my own work and observations, and in that respect the investigation appears to advance knowledge on the subject.

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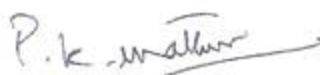
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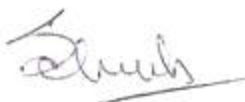


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*The smallest act of kindness is worth more than the grandest intention.*

~Oscar Wilde

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## EXECUTIVE SUMMARY

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It is recognised that protected areas (PAs) should play a role in sustaining the local communities adjacent to them as due to the establishment of PAs, livelihood opportunities for the local communities get limited. Thus, it should be one of the prime objectives of the park managers to allocate the resources in such a way that they meet the needs of the people surrounding the park in a sustainable manner without compromising the long term conservation of biodiversity. However, overutilization of the forest resources by the local communities is one of the main problems and due to competitive exploitation and extraction degradation of the resources is taking place.

Keibul Lamjao National Park (KLNP) is the only natural home of the remnant population of endangered brow-antlered deer or Sangai whose habitat is the *phumdi*- a unique part of the habitat of KLNP. It is a floating mass of entangled vegetation formed by the accumulation of organic debris and biomass with soil particles. It covers approximately two-thirds of the area of the park and the thickness varies from a few centimeters to about two meters. However, due to illegal exploitation of resources from the park in the form of vegetable and fuelwood collection, the park is facing consistent anthropogenic pressures which are posing a threat to the habitat of Sangai. A need arises to understand local people's dependence on the park as well as their perceptions and attitudes in order to devise management strategies to solve park-people conflicts. Thus, the main objectives of the present study were to (a) examine the socio-economic and demographic conditions of the villagers around KLNP, (b) quantify the resources extracted from the park and its contribution to the livelihoods of the local people, (c) assess the impacts of anthropogenic activities on the wildlife habitat, (d) examine the conservation awareness and attitudes of people towards the park and alternative livelihood options and (e) to assess the economic value of the park in terms of recreation for the conservation of Sangai and KLNP.

In order to meet the objectives of the study, the data were collected at two levels, i.e. household level surveys to examine the resource dependency and at the park level to understand the impact of such dependency on the park. On the basis of the reconnaissance of the study area, 36 villages within a 3 km boundary of the park were

selected for the study. The villages were stratified into four clusters: northern cluster with seven villages (542 households), western with ten villages (704 households), southern with nine villages (502 households) and eastern cluster with ten villages (927 households) on the basis of occupations and distinct demarcations like stretches of fields, roads, rivers and streams between the clusters. Out of the total 2675 households, 50 households each in the north and west, 49 households in the south and 90 households in the east were interviewed (n=239). Household surveys during the period from November 2007 to July 2009 by means of structured questionnaires and human foot trail monitoring methods were used to seek information on the social structure, economic conditions, quantities and types of resources extracted from KLNP and their contribution to the household income. In entry point monitoring method, entry points at five specific places at the boundary of the KLNP were monitored. The daily average weight of head loads of fodder; fuelwood; vegetables; daily average fish catch, their species composition and their extraction in different seasons of the year were measured by spring balance and the information so obtained was cross checked with the household questionnaire survey. For studying the anthropogenic impacts on the park, quadrates of 50 cm x 50 cm were placed at a 100 m interval on transects (500 m) laid from the edge towards the interior of the park. To understand the trend in which grass composition might have changed over the years in the park due to human disturbances, permanent plot experiments were conducted for selected four commonly extracted plants from the park. Three harvesting regimes (0%, 50% and 100%) were simulated in permanent enclosures and their regrowths were studied. By means of predesigned questionnaires, attitudes and perceptions of the people living in the vicinity of KLNP towards the park were assessed. The local people were also asked if they were willing to contribute for conservation either in monetary, manual labour or any other ways or not. The local people were also enquired to express if they were willing to accept compensations for foregoing the park benefits. Ecosystem management actions and sustainable alternate livelihood options were identified by household surveys and stakeholders' workshop. The livelihood options identified were examined if they were economically, socially and culturally, environmentally, technologically and politically feasible on the basis of scores they secure for these criteria. Tourists (n=112) visiting the park were also interviewed to obtain information about their education background, occupation and income, expenditure incurred, time spent and this information was used to estimate

the recreational value of the KLNP by using the Travel Cost method (TCM). They were about their attitudes towards conservation of the park and Sangai All the data was subjected to descriptive analysis, ANOVA, t-test, and Chi-square test wherever applicable. The important findings of the study may be summarised as below.

1. In the villages around KLNP, agriculture was the main source of livelihood of the people. However, due to the submergence of the agricultural lands after the commissioning of Loktak Hydro Electric Power Project (LHEP) in 1983, people had become more dependent on fishery. The villages in the eastern cluster had the highest area of total land holdings with 0.98 ha household<sup>-1</sup> whereas the villages of northern cluster had the least land holdings of 0.47 ha household<sup>-1</sup>. Thus, the people of the eastern cluster had agriculture based economy with 37% having agriculture as their primary source of income while on the other hand, people of the northern cluster had fishery (48%) and government jobs (16%) as their main source of income.
2. The people of the eastern villages have highest household area (0.28 ha household<sup>-1</sup>), which enabled them to rear more cattle (0.31 cattle household<sup>-1</sup>), whereas the villages of the northern villages, having the least household area (0.06 ha household<sup>-1</sup>), own least number of cattle (0.08 cattle household<sup>-1</sup>). Maximum numbers (33%) of fish farms were observed in the southern villages due to conversion of submerged fields into farms for pisciculture, followed by the western (30%), eastern (29%) and the northern villages (16%).
3. The annual income of the villages of the northern cluster was found to be the highest (₹84,300 ± 10,462 household<sup>-1</sup>) followed by the western (₹72,186 ± 6,837 household<sup>-1</sup>), southern (₹67,317 ± 8,820 household<sup>-1</sup>) and the eastern villages (₹60,252 ± 4,419 household<sup>-1</sup>). The main secondary sources of income of all the village clusters were vegetable collection (except in north) followed by fishing, pisciculture and agriculture. Since most of the land had been submerged, the people had converted their fields to fish farms. *Athaphum*, a type of pisciculture system using floating meadow, were widely practiced in the open waters of the park by people of the northern villages. Higher dependency of the people on resources of KLNP and income generation from vegetable collection and pisciculture had created heavy anthropogenic pressure on the KLNP. It also makes the livelihood of the people vulnerable to environmental change.

4. Maximum fuelwood collection from the park premises was observed in the western villages (36%) owing to close proximity to park which was followed by the eastern (18%), northern (18%) and the southern villages (2%). Lesser quantity of vegetable collection was recorded in the southern villages and northern villages as compared to western (44%) and eastern (18%) villages as villages in the former directions were distantly located from *phumdi*.
5. Quantity of fish feed/fodder extraction was highest in the southern villages (43%) followed by the western (40%) and the eastern villages (39%). Fishing and fish feed/fodder collection was done throughout the year; vegetable collection was done during October to May, peak months being March to April; fuelwood extraction was done in the winter season i.e. November to March. Stems, young shoots, rhizomes, whole plants and dry leaves of different plants were collected to be used as fuel wood, vegetable, fodder, fish feed or as thatch.
6. Maximum extraction of plant resources was recorded in the eastern villages ( $12,033.8 \pm 2,645.5$  ton year<sup>-1</sup>) and lowest in the north ( $750 \pm 541.8$  ton year<sup>-1</sup>) with a total estimate of about  $32,627.6 \pm 7,121.1$  ton year<sup>-1</sup>. *Zizania latifolia* was collected in highest quantity (42%) as fish feed and fodder for cattle which was followed by *Leersia hexandra* (39%) and *Hydrilla* sp. (7%).
7. A total of  $304.9 \pm 45.1$  ton of fish was estimated to be extracted every year from KLNK. Common carp (*Cyprinus carpio*) was dominant in eastern villages while *Amblypharyngodon mola* and *Puntius chola* were more commonly caught in the northern villages. Fish catch increased from March to November, i.e. during the rainy season when production of fish was highest and gradually decreased during the winter season. *Monopterus albus* and *Cyprinus carpio* were caught in maximum quantity (about 16% each).
8. The households in the western villages (62%) were more dependent on the park for their livelihood than the southern (41%), the northern (38%) and the eastern households (32%). More than 65% of the local people depended on the park resources in some way or the other and 42.8% of the people derived direct income from the sale of the resources contributing up to about 59.5% of the total annual family income. Thus, the anthropogenic pressure was found to be higher on the western side as dependency and extraction rates were higher.

9. The diversity of plants significantly varied spatially across different disturbance regimes and also from the grassland periphery towards the interior. Shannon Weiner's index ( $H'$ ) of diversity was greater for interior areas ( $H'=2.861$ ) than peripheral areas ( $H'=2.467$ ). The two indices were found to be significantly different ( $t=4.699$ ,  $df=46$ ,  $p<0.01$ ).
10. Different types of responses to different treatments were observed in the four study species subjected to simulated harvesting experiment which indicated the causative reason behind the grassland composition change. The present findings of species composition as inferred from the percentage frequency of occurrence revealed that there has been drastic change in the composition of grassland in KLNP over the years. Occurrence of food plants has further decreased over the years and the food plants: shelter plant ratio now stood at 37 : 27 which was earlier reported to be 60 : 40. This showed that availability of food has also decreased along with loss in shelter plants probably due to invasive species as a result of repeated overharvesting and fire.
11. There has been a high degree of change in the plant composition in the grassland when the present findings were compared with data of 1960s, 1980s and 1990s, which was in the direction not favourable for Sangai. Policies for proper maintenance of the grassland composition were suggested for controlled/regulated harvesting and moderate cutting/harvesting of the plant resources to provide optimum food plants and shelter plants for Sangai.
12. About 90% of households surveyed agreed that wildlife conservation was necessary for the future generations. The percentage of the people who agreed that 'Sangai is important' varied across different directions i.e. ( $\chi^2 =10.7$ ,  $p=0.013$ ), maximum being in the eastern villages (94%) and minimum in the western (78%). Most of the local residents (94%) agreed that Ithai barrage (LHEP) has caused damage to the park and its vicinity.
13. KLNP was considered to be important for the villagers in the western villages (48%) as majority of them derived their income from the park. Less people were in favour for fencing the park (19% in east; 17% in south; 12% in north and 8% in the west), or for complete restriction on resource extraction from the park (24% in east; 16% in south; 14% in north and 3% in the west).

14. Majority of the southern villages (88%) and eastern villages (84%) agreed to control the over extraction of resources. The reason maybe that 55% in southern villges and 60% in eastern villages were aware that extraction of plants was depleting Sangai's food plants and shelter plants whereas it was least (39%) acknowledged in the western villages. Those local residents who derived resources from the park and who derived income from those park resources were significantly ( $p<0.01$ ) related to whether they gave a negative opinion to the complete restriction of entry to the park or not.
15. More than 93% of the local respondents around the park were willing to contribute for conservation of Sangai and the park in the form of money or as manual labour. The mean amount willing to contribute was estimated to be ₹283.15 ± 30.17 household<sup>-1</sup> for one time. More than 55% of the respondents who were willing to contribute for the park were not willing to receive any monetary compensation for conservation of the park. Seventy three percent of the respondents who were not willing to contribute wanted to receive onetime monetary compensation of a mean amount of ₹36,481.48 ± 2,544.43. The total amount willing to contribute by the local people for the conservation of Sangai in KLNP was estimated to be ₹7,38,917. Total landholdings and total annual income influenced the respondent's willingness to contribute.
16. The feasibility analysis of alternative livelihood options revealed that handloom was the most feasible livelihood option (score 2.81/3), followed by businesses such as small shops or service providers and poultry (score 1.88/3), and fishery (score 1.75/3). Although the local people revealed their preference for tourism as the most preferred livelihood option, the prevailing dismal law and order situation and the lack of proper infrastructure in the tourism sector did not give it a high score on feasibility.
17. The annual flow of tourist to KLNP was estimated to be about 5,780 (92% local tourists) in which 50% of the visits were recorded in the months of June and July and 23% in December to February. Travel Cost Method (TCM) was used to derive the recreational value of the park by using the data from the survey. The recreational value of the park was estimated to be ₹375.35 visit<sup>-1</sup> and the total economic benefit from recreation use was estimated to be ₹21,69,523 annum<sup>-1</sup>.

18. All the tourists agreed that the park was important for the protection of Sangai (100%) and encouragement to tourism (93%) will also help to conserve it. Thirty seven percent of the tourists agreed on fencing the park for the protection of Sangai. However, 61% of the tourists also supported habitat improvement for better conservation of Sangai, while 56% of the tourists were satisfied with the present management of the park by the Forest Department.

Conserving the habitat of the KLNP is crucial for the long term survival of the critically endangered Sangai. Majority of the local people are also aware about the destruction to the habitat of Sangai, but since they were dependent on the resources from the park they gave preference to fulfilling their needs (livelihoods). A complete ban on resource extraction from the KLNP (by virtue of it being a protected area) will lead to a hostile attitude among the local communities and a repeat of the incident of 1979 cannot be ruled out. A proper solution is needed for harnessing the positive attitudes of people towards Sangai conservation. Therefore, along with the protected area conservation and protection to the habitat of the Sangai, the park management also needs to focus on developing sustainable livelihoods for the local people and involve them in protected area conservation. It has also been observed that the political situation in Manipur does not permit proper protection to the park. Thus, with no clear policy on alternative source of livelihood and no direct conservation-development linkages, the park protection faces a bleak future. The study revealed that people were willing to improve the condition of the park and help in conservation of Sangai provided they are given adequate compensation for forgoing their dependence on the park. The existing protected area system in India allows for involvement of local communities in resource management. The conservation initiatives in KLNP should try to address the socio-economic conditions of the local villagers, specifically unemployment and poverty, by increasing output from their existing assets, by facilitating the provision of other assets through alternative livelihood options (or income diversification) and by developing the stakes of local people in conservation of Sangai. Thus, by continuous participation and involvement of local people and other stakeholders in conservation activities, the anthropogenic pressures on the park can be reduced and the habitat secured for long term conservation of the Sangai.

# CHAPTER 1

## INTRODUCTION

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### 1.1 Historical background of protected areas

The natural history of wildlife is much older than the history of man himself. Men have learned the art of living from wildlife, wandering from place to place searching plants and hunting animals for food and shelter. This culture of nomadic life was gradually replaced by that of settlements into villages and hamlets. The gatherings of plants were replaced by organized farming and cultivation of crops and hunting for animals were taken over to some extent by domestication of animals. With the invention of new tools and equipments there had been mass destruction of forest and its natural resources to give way to expansion of villages, agriculture and other developmental activities (Singh, 1992a).

The ancient Indians have areas that were specifically set aside for the protection of natural resources over two millennia ago (Holdgate, 1999). There are many mythological stories in India where references of love and regards for wild animals are made. Protection of special places occurs among many traditions of communities as ‘tapu’ areas in the Pacific and as ‘sacred groves’ in parts of Africa.

While many areas were set aside for cultural importance and resources, protected areas were reserved as royal hunting grounds by kings and other national rulers in Europe during early part of Renaissance. The turning of the 18<sup>th</sup> century saw vast destruction of natural forest and extinction of many wild animals. In 1864, the US Congress gave a significant part of the present Yosemite National Park to the State of California for ‘public use, resort and recreation’. The first true national park of Yellowstone of United States was established in 1872 ‘as a public park or pleasuring ground for the benefit and enjoyment of the people’. According to the IUCN (1994), definition of ‘protected area’ is ‘an area of land and/sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.’

In the nineteenth century, the modern protected area movement which originated in the 'new' nations of Australia, Canada, New Zealand, South Africa and the United States of America had spread around the world and since, then there has been an expansion in the number of protected areas. By the year 2002, some 44,000 sites which met the IUCN definition of protected area covering around 10% of the land surface were established (Eagles et al., 2002).

Parks were established to protect scenic and recreation resources or for viewing wildlife. The idea of protecting entire ecosystems to preserve biological diversity developed later (Dixon and Sherman, 1990). Gradually protected areas have become the cornerstones of biological conservation (Walpole and Goodwin, 2001) and protection of nature became the primary objective of national parks. Large numbers of national parks have been established worldwide to protect nature from destruction and degradation (Fortin and Gagnon, 1999). With similar objectives in mind, India also established in 1936, the Hailey National Park, currently known as Jim Corbett National Park, as the first national park in India, in the erstwhile United Province, in Nainital district of Uttarakhand. In India, protected areas cover about 5% of the total land area (Kothari et al., 1989) comprising of 18 biosphere reserves, 102 national parks and 526 wildlife sanctuaries.

## **1.2 Values of protected areas**

Throughout the history of protected areas, the common objective is to provide for life now and into the future by safeguarding the intrinsic values of biodiversity. Protected areas are the critical tool for conservation of biodiversity in the face of the global crisis of species extinction and the loss of the earth's natural capacity to support life and human existence. Various types of benefits are obtained from these protected areas like maintenance and conservation of environmental resources and ecological processes, production of natural resources, recreation services, protection of cultural and historical sites and objects and provision of educational and research opportunities (Dixon and Sherman, 1990). They also act as the buffers of life by serving as sanctuaries and strongholds of species in the face of climate change. Besides maintaining the complete balance of species, diseases and expansion of pests are also kept in check. These protected landscapes provide shelter to humans

from natural calamities like tsunamis, landslides, floods, storms that are subjected to increased intensity brought on by climate change. A well protected, protected area represents a sound natural system which resists damaging erosion, soil loss or water quality loss.

Protected areas also serve as economic engines. They provide livelihood and jobs to the people living in and around them. Protected areas also provide numerous natural resources *viz.*, food, fodder, fuel wood, medicinal plants, etc. which the local people use for sustenance or to earn some extra income for their families. Protected areas are the traditional destination for the global tourism industry. They provide the settings for healthy outdoor living and recreation. Exploring the natural environment helps people to understand and appreciate nature.

Protected areas bring tremendous cultural, ecological, spiritual and scientific benefits to society. Cultural landscapes forged by repetitive human practices often results in a symbiotic relationship of species that are dependent on the practices. The cultural richness and layers of meaning of these areas yield intertwined stories of humans and nature living in harmony. **Figure 1.1** summarises the different values that are derived from protected areas.

### **1.3 Literature review**

#### **1.3.1 Protected area and people relationship**

Surveys have showed that over 65% of the protected areas in India were characterized by human settlements and resource use (Kothari et al., 1989). Household socio-economic background played a role in resource utilization where the poor families depended more on natural products as proved in studies made in South Africa, Tanzania and Zimbabwe (Infield, 1988; Newmark et al., 1993; McGregor, 1995). A similar case was also found in the forest adjacent households of Chittagong Hill Tract in Bangladesh where the poor were relatively more dependent on non-timber forest products (NTFPs) for subsistence and cash income than the better off households and other socio-economic factors such as numbers of household members, total value of household implements and furniture were significantly correlated with the income from NTFPs (Kar and Jacobson, 2012).

Analyzing the household wealth status and natural resource use in the Kat River valley in South Africa, Shackleton and Shackleton (2006) found that there were no differences in the proportions of households in each wealth class using NTFPs nor the total numbers of NTFPs used per household. But with increasing wealth there was more purchase of NTFPs and greater proportion of poor households were involved in the sale of one or more NTFPs and they sold greater number of NTFPs per household as compared to wealthy and intermediate households. They also found that the poorest households used more of fuel wood, wild fruits, edible herbs and grass hand brushes per capita than the other wealth classes. But in a study conducted in Mudumalai Wildlife Sanctuary, Southern India, it was found that higher income groups at the periphery of the reserve used resources more heavily than the lower income groups (Hedge and Enters, 2000). In another study on harvesting forest products in southern Western Ghats in India, distance was the only constraint for sustenance harvesters but not for commercial harvesters, wealth was independent of resource interest except for the poorer lower caste households with low levels of literacy (Davidar et al., 2008) as also observed in the most 'rural' villages of KwaJobe of South Africa where the greatest diversity of resources were used by the highest number (>90%) of people (Shackleton et al., 2002).

The lack of formal education besides distance from markets prevented the Tagbanua of Palawan Island in the Philippines, from receiving more favourable income from the sale of NTFPs (Richman, 2004). Though, with increase in education level and opportunities in non-forestry vocations, people's reliance on forests have declined, forests still were very important for the indigenous communities of Mudumalai Wildlife Sanctuary of Southern India both in terms of food security and cash income (Hedge and Enters, 2000; Shackleton et al., 2002; Senaratne et al., 2003). Timko et al. (2010) identified five broad socioeconomic factors - wealth status, gender, location, education, and seasonality affecting levels of dependency on NTFPs by rural households while examining the socio-economic contribution of NTFPs to rural livelihoods in Sub-Saharan Africa. The NTFPs that the local communities collect from protected areas play important role in the livelihoods of the local population (Delang, 2006). In the rural economy of Sikkim Himalaya, income from 140 ton per annum estimated from 44 plant species was an important source of income and subsistence for farm families (Sundriyal and Sundriyal, 2004). In another study in the

markets of Xishuangbanna in southwest China, it was reported that the wild vegetables accounted for 20.6% (in weight) of total vegetable sales (You-Kai et al., 2004). A study in the Royal Chitwan National Park in Nepal reported that as much as 50,000 ton of biomass were removed in just 10 days of open access to the park amounting to more than US\$ 1 million (Streade and Helles, 2000). Murray et al. (2005) examined the abundance and aboriginal use of botanical NTFPs in the Gwich'in people in the Mackenzie River Delta Region of Northwest Territories, Canada. It was revealed that 16000 L wild berries collected by 450 households for consumption was an important factor in culture and traditional land use which was much higher than that gathered by northern aboriginal people in North America. A study conducted to examine the forest income among the rural dwellers in Malawi's most populated districts of Chiradzulu showed that forest income contributed about 15% of total income with the rest coming from non-farm income and agriculture (Kamanga et al., 2009). In Nilgiri Biosphere Reserve, southern India, 50% to 75% of rural households derived ₹134 to ₹4,955 as mean annual per capita household income from diverse NTFPs (Narendran et al., 2001). Another study undertaken to evaluate the flow of NTFPs in Uttara Kannada district, Western Ghats in Karnataka by Murthy et al. (2005) showed communities collected 50% of available species in evergreen zone, 40% in semi-evergreen and dry deciduous zone and only 13% in moist deciduous zone from which per household realized NTFPs values ranging between ₹1,233 in dry deciduous zone to ₹3,445 in evergreen zone. A detailed accounting of commercially valuable forest products from dry deciduous forests of Eastern India highlighted the value of revenue from NTFPs to be \$1,016 ha<sup>-1</sup> in the coastal area and \$1,348 ha<sup>-1</sup> in the inland area, which proved to be significantly higher than the returns from alternative land use (Mahapatra and Tewari, 2005).

Examining the heterogeneity of NTFPs used by tribal communities by Saha and Sundriyal (2012) in northeast India, it was observed that a total of 343 NTFPs were recorded for diverse purposes; 163 species for medicinal purposes, 75 species as edible fruits and 65 species as vegetables. The study also revealed that community was totally dependent on forest for firewood and house construction material while 76 species were sold in three local markets and 22 species were traded outside the state contributing 19% - 32% of total household income for different tribal communities.

**Figure 1.1:** Ecological, social and socio-economic values of protected areas

<b>VALUES OF PROTECTED AREAS</b>					
<b>Ecological value</b>		<b>Social and cultural value</b>		<b>Socio-economic value</b>	
<b>Services provided by ecosystem</b> Water quantity and quality, ecosystem-based mitigation and adaptation to climate change,	<b>Natural hazards mitigation</b> Protection against coastal erosion, floods, landslides	<b>Heritage value</b> Regional and national identity and inspirational value for arts; landscape characters and	<b>Recreational value</b> Wilderness, fishing and spawning, hunting, trekking	<b>Employment</b> Managers of PAs, rural tourism and ecotourism, regional marketing	<b>Production</b> Genetic material, non-wood timber products, medical resources, products from sustainable
<b>Services provided by species</b> Pollination, soil structure and stabilisation, pest control, balances and in food webs	<b>Biodiversity, genetic resources</b> Refuges and habitats for species, reservoirs for genetic resources and evolutionary processes	<b>Scientific and educational value</b> Environmental education, inspiration for scientific innovation (bio-mimicry), opportunities for research and monitoring	<b>Health and quality of life</b> Quietness, well-being; very much linked to recreational and ecological values	<b>Expertise</b> Regarding biodiversity conservation but also testing sustainable practices in agriculture, forestry, fishing, hunting, tourism, transport	<b>Governance</b> Testing sustainable practices in agriculture, forestry, fishing, hunting, tourism and transport, and sustainable development of rural areas

PAs=Protected areas

Adapted from CREDOC, 2008; and Stolton, 2009

Harvesting of papyrus from the wetlands of Uganda supplement the household income by as much as \$200 (Ministry of Waters, Lands and the Environment, 2001) while the mangrove forests of Kosrae, Federated States of Micronesia in the Eastern Caroline Islands provided the Kosaereans with the equivalent of nearly \$1 million or approximately 14% of median household income from the harvest of fish, fuel wood and mangroves crabs (Naylor and Drew, 1998). Valuation of six major groups of NTFPs in the Mediterranean region by Croitoru (2007) showed that NTFPs provided an annual benefit of about €39 ha<sup>-1</sup> of forests accounting for about a fourth of the total economic value of forests. The study estimated the average benefits as €54 ha<sup>-1</sup> for southern countries, €41 ha<sup>-1</sup> for northern countries and €20 ha<sup>-1</sup> for eastern countries. Plant resources from Maputo Elephant Reserve in Mozambique used by 71% of the households were more highly valued than the animal and fish resources hunted by 21% (de Boer and Baquete, 1998).

A research conducted to study the local use and economic value of products showed that contribution of many of the herbaceous species to NTFPs used and harvested during the dry season in Cinzana, Mali was negligible but trees species played a significant role in the region during the long seasonal dry periods (Gustad et al., 2004). For the people in two Pwo Karen villages in Thung Yai Naresuan Wildlife Sanctuary in Western Thailand, wild food plants were a preferred alternative to commercial food crops since gathering wild food plants was more efficient use of time than engaging in the market economy in order to purchase commercial food crops (Delang, 2006).

It is obvious that if the resources harvested are more than the production capacity, the growing stock as well as the biodiversity will be lost. Greater the harvest rate over the production rate, smaller the time taken in ecosystem conversion (Sarin, 1994). Over harvesting or continued extraction may alter population size, growth rates and reproduction capacity of harvested species, leading to a reduction in the quantities of non-timber forest products or NTFPs (Hall and Bawa, 1993). The impact may vary with the intensity of extraction and the plant part extracted (flower, fruit, seed, leaf, stem, root, tuber or entire plant). There had been some studies which showed depletion due to overharvesting or over exploitation of target species (Browder, 1992; Homma, 1992; Nepstad et al., 1992; Peters, 1992; Offen, 1993). Most of the threats to protected areas came from small scale activities of local communities (Rao et al.,

2002) like deforestation (Leimgruber et al., 2005), hunting (Rao et al., 2002; Lynam, 2003) and agricultural purposes (Aung et al., 2004; Leimgruber et al., 2005) which have caused significant declines in wildlife populations and loss of natural habitats and in many countries, park managers neither have the human capacity nor technical and financial resources to manage the areas without the cooperation of local communities (Allendorf et al., 2006).

Though many studies have been conducted to estimate the amount of NTFPs extracted from protected areas and forests elsewhere but little work had been done on the studies related to impact of harvesting NTFPs on the regeneration and composition of species. Murali et al. (1996) studied the impact of NTFPs extraction on regeneration, population structure and species composition in Biligiri Rangaswamy Temple Sanctuary in Karnataka, India and reported that according to the frequency of size classes in the sampled sites, overall regeneration of trees were poor in the area. The species richness, basal area and tree mortality in two different sites close to and far away from settlements indicated different results and also observed that NTFPs species showed a greater deficit of small size classes than the timber forest species. Konsala et al. (2012) conducted a long term ecological impact of harvesting NTFPs in Mbam and Djerem National Park, Cameroon and reported that Shannon diversity index were highest in undisturbed sites and lower in disturbed sites. Kryszak et al. (2012) studied the effect of utilisation on the floristic composition of meadow communities in Poland and found out that regular sward utilization of plant communities exert a positive impact on the biodiversity index as well as the fodder value score of meadows and pastures. The negative influence on the floristics composition of the meadow communities were the sporadic, incorrect utilization as it favoured taking over of green area by expansive grass species and development of communities of low natural and use values.

### **1.3.2 Attitudes and perceptions towards conservation**

The classical approach considered the forest dependent as ‘threats’ to the forest ecosystem (Hedge and Enters, 2000) and the species and habitats are guarded by ‘fortress and fine’ model (Baral and Heinen, 2007). Up to the end of the 1970s, a centralized regulatory control and separation of local people and their sustenance forest-based activities from conservation areas were widely advocated in the name of biodiversity conservation (Colchester, 1996; Mehta and Kellert, 1998). Though

this exclusion policy helped in the protection and conservation of some endangered species from extinction (Harmon, 1987), it had put the local people through economic hardships by wildlife depredation and resource access deprivation (Hulme and Murphree, 2001; Vedeld, 2002; Weladji and Tchamba, 2003; Heinen and Shrestha, 2006). Exclusion of local people from the management of protected areas left them deprived and hostile to government and local politicians (Weladji et al., 2003) and conflicts between reserve managers and local people are thus exacerbated (Quyung et al., 2002). Widespread and escalating park-people conflicts, have caused damage to valuable habitats, ecosystems, flora and fauna that were supposed to be protected (Coggins, 2000; Han, 2000).

In recent years, the need was felt to include local people in protecting and conserving the nature. Needs arise to study the perceptions and attitudes of the local people for the better management of protected areas which will offer much promise and help to identify the problems and recognize potential solutions for developing appropriate strategies (Sewell, 1973). A number of studies have been conducted worldwide to examine the issue of local attitudes towards conservation and development (Heinen, 1993; Newmark et al., 1993; Mkanda and Munthali, 1994; Fiallo and Jacobson, 1995; Nepal and Weber, 1995; Ite, 1996; de Boer and Baquete, 1998; Mehta and Kellert, 1998, Xu et al., 2006). The outcome of decision making is considerably affected by the perceptions and attitudes of participants in the process (White, 1966).

There is growing empirical evidence indicating that assessment of local responses towards protected areas is a crucial step in gathering information that can be incorporated into decision – making processes and lead to people – park conflict mitigation (Newmark et al., 1993; Fiallo and Jacobson, 1995; Badola, 1998; Gillingham and Lee, 1999; Trakolis, 2001; Jim et al., 2002; Rao et al., 2003). On the other hand, local people’s perceptions are determined by their value and frame of reference (ecological, economic and culture) which lead to differences in needs, perceptions and attitudes along the lines of their personal attributes.

It has been recognized that many demographical factors such as age, education, residence location, affluence and ethnic origin can significantly shape the attitudes of local people (Jim et al., 2002; Bandara and Tisdell, 2003). The local people’s perceptions and attitudes of protected areas are also influenced by the benefits they

acquire from the protected areas and by the negative consequences of its conservation status (Newmark et al., 1993; Fiallo and Jacobson, 1995; Studsrød and Wegge, 1995).

A questionnaire survey of conservation attitudes of people living adjacent to Arusha, Tarangire, Lake Manyara and Mikumi National Parks and the Selous Game Reserve, Tanzania showed that over 71% were opposed to the suggested abolishment of the adjacent protected area, 47% reported they received 'nothing' good from the park, however combining this figure with those who did not answer the question over 71% also held negative or neutral attitudes towards protected area employees (Newmark et al., 1993). In Ecuador, local residents living either within or adjacent to Machalilla National Park held a variety of negative attitudes towards the park, however, positive attitudes were affected by respondents' level of education and knowledge about conservation issues as revealed in the study conducted by Fiallo and Jacobson (1995). De Boer and Baquete (1998) tried to improve the understanding of the local people's use of natural resources and perception of Maputo Elephant Reserve's impact in Mozambique where 88% respondents answered positively about the reserve and the attitudes of respondents were inversely related to the number of species invading their agricultural fields. In India, Badola (1998) examined the attitudes of local people living in and around the forest corridor linking the Rajaji and Corbett National Parks and found that the concept of conservation of forests was well supported but people were ready to agitate against rules which will make the resources unavailable to them. In Ghodaghodi Lake Area in Nepal, attitudes showed a positive relationship by educated males of higher caste while people using resources and women showed a negative relationship (Sah and Heinen, 2001).

Trakolis (2001) conducted a survey among the local people of Prespes Lakes National Park in northwestern Greece to know local people's perception of planning and management issues and he found that 65% knew the park's aims, with their main source of information about the aims being environmental societies (36%) and a high percentage (49.5%) responded that there was no influence of the national park on their economic status, 27% opined that it had worsened and 15% agreed that their economic situation improved after designation of the park. Results of a questionnaire survey done to examine the local attitudes towards conservation and tourism around Komodo National Park in Indonesia revealed that there were positive attitudes

towards tourism and conservation by 93.7% of the local communities but matters concerning the local inflation and the tourists' dress code prevailed (Walpole and Goodwin, 2001).

Opinions on perceptions towards protected area also varied depending on the location of the villages which ultimately governed the accessibility and benefits from the area. A study by Jim et al.(2002) in the Shimentai Nature Reserve situated in Yingde, Guangdong Province, China, revealed that although many respondents had inadequate knowledge and understanding about conservation, most of the respondents welcomed the expected park-related dividends but the most affected near-zone villagers anticipated losses due to restriction on traditional resource-extraction activities in the forest. While analyzing the stakeholder attitudes towards wildlife policy and Bénoué Wildlife Conservation Area, North Cameroon, it was found that local people's attitudes towards protected areas depended on the management category of the particular protected area. It was found that local people were positive towards the existence of park but negative towards the system of hunting concession area. Ninety-three percent of the respondents who knew about Bénoué National Park perceived its presence positively where 88% wanted it to remain and called for increased involvement of local people in management, off-take and harvesting the benefits from both park and hunting concession activities but the park staff were skeptical about local participation and saw such endeavors as a threat to a sound biodiversity management schemes (Weladji et al., 2003).

Examining the local people's perceptions as decision support for protected area management in Wolong Biosphere Reserve in China, it was revealed that though 67.9% of local people were satisfied with the reserve, only 42.3% showed positive response while 32.8% and 24.8% showed neutral and negative response respectively to the reserve policies and the perceptions were affected by education, gender, residence location, household size and acreage of land owned (Xu et al., 2006). Many factors were known to be affecting the opinions and attitudes of local people towards conservation areas and the reasons varied depending on many factors. In the same study by Xu et al. (2006) to understand the local people's perception in decision support for protected areas it was found that the perceptions were affected by education, gender, residence location, household size and acreage of land owned.

A study on community attitudes towards protected areas in Upper Myanmar by Allendorf et al. (2006) reported that categories from where positive perceptions emerged were natural resource conservation, availability of resources for extraction and protected area management while negative perceptions categories emerged from prohibition of resource extraction, conflicts with protected area management and crop and property damage by wildlife. Examining the attitudes of farmers towards conservation policies of Jingme Singye Wangchuk National Park located in central Bhutan revealed that 52.2% local people disliked the Park and the Conservation Act and 67.5% supported exterminating of problem wildlife while 76.3% of the respondents appreciated the Park's development programmes. These attitudes were also related to age and literacy of the respondents, number of livestock owned and size of land holdings (Wang et al., 2006). People living around Kaziranga National Park of Assam, India were reported to be aware of the conservation status of the park but most of the respondents (58.3%) expressed negative attitudes showing high variation with ethno-religious groups, educational level, socio-economic and immigration status (Heinen and Shrivastava, 2009).

Greiner (2012) studied the implementation of community-based conservancies in conflict-ridden pastoralist areas of northern Kenya and whether whether the creation of protected areas can facilitate the resolution of conflict. It was found that in one case the implementation proved successful while in the other, it exacerbated tensions and led to ethnic violence.

A study by Tomićević et al. (2010) in developing local capacity for participatory management in Tara National Park in Serbia demonstrated that sustaining or providing alternative livelihood strategies was necessary in order to halt the exploitation of protected areas by local people striving to survive after analyzing the potential capacity of the local people to effectively participate in the management of the protected area by incorporating activities that promote biodiversity within their everyday livelihood strategies. Wunder (2000) analyzed ecotourism and economic incentives empirically in Cuyobeno Wildlife Reserve in the Ecuadorian region and it was concluded that tourism had provided significant additional income to the three indigenous Cuyabeno groups either through autonomous operations or by drawing salary.

A study carried out in the Pacaya-Samiria National Reserve area of Peru to find out the target for effective conservation-development initiatives found explicate heterogeneity in present resource use and suggested that attention should be given to differential patterns of resource use in designing conservation-development initiatives for tropical forests (Coomes et al., 2004). In a case study of Queen Elizabeth National Park, Western Uganda it was recommended that a multidisciplinary agriculture extension was to be started in the area to increase agricultural production and household incomes in order to prevent heavy dependency on protected area resources (Barirega et al., 2010). A survey on alternative livelihood options for Hong Kong's fishers, it was found that up to 75% of fishers interviewed were generally willing to leave fishery if they were provided with adequate compensation though they were not optimistic about finding suitable jobs due to their limited skills and education (Teh et al., 2008). The Earthy Goods and Services (2003) conducted a feasibility study of community based livelihoods options in Thembang village of West Kameng district and Zemithang village of Tawang district in Arunachal Pradesh and found that improving the traditional skills like making craft items, weaving, improve agriculture and vegetable cultivation, making incense sticks to be sold to tourist, handmade papers, fruit processing unit were viable options.

In view of the vast literature available from various parks and protected areas around the world to assess the opinion of the local communities for better participatory management there was a need to assess such opinion for people residing around KLNP which was lacking and devise strategies for improving the people park relationship.

### **1.3.3 Recreational value of protected areas**

The increase in human population and preferences for leisure activities often lead to an increase in demand for recreational use of public lands in many parts of the world (Foot, 1990 and 2004; Bowler et al., 1999; Nickerson, 2000). Nowadays, the fact is that environment is inseparable from the economy. No economic decision is made without influencing the natural and artificial environment and no environment change occurs without economic influence (Pearce and Turner, 1990; Costanza et al., 1997; Hein et al., 2006). In view of the vast literature available from various parks and protected areas around the world to assess the opinion of the local communities for better participatory management there was a need to assess such opinion for

people residing around KLNP which was lacking and devise strategies for improving the people park relationship.

As environmental goods and services are not traded in the usual markets, the benefits derived from these commodities are external to the market. Even when some expenditure is incurred for the consumption of these goods, for instance, the travel expenditure involved in reaching a tourist site, it is difficult to have proper pricing for the goods. The TCM is one of the oldest approaches for environmental valuation in which the behaviour of tourists in related markets were studied. It has been used to estimate the demand and consumer surplus for wildlife and nature conservation at recreation sites. The demand for a park was estimated by determining the change in visits as the cost per visit was changed.

Becker et al. (2005) estimated the economic value of viewing Griffon Vultures at the Gamla Nature Reserve, Israel by using the TCM and based on 143 questionnaires, generated a visit-distance function and derived the demand for the site and estimated monetary value. The potential annual benefit of Gamla was estimated to be between \$1.1 to 1.2 million. The value of wildlife tourism in Uganda was studied by using TCM and it showed that even under uniform pricing, Uganda's profits from gorilla tracking in the Bwindi Impenetrable National Park alone, could be increased by \$30,000 - \$2,20,000 depending upon the assumption of variation in social costs (Anderson et al., 2005).

Knetsch and Davis (1965) estimated the recreational value of Pittson Area Woods in Northern Maine, USA using both the contingent valuation (CV) technique and zonal travel cost method. Using the CV technique they found the maximum willingness to pay to be approximately \$72,000, while the zonal travel cost method yielded an aggregate benefit estimate of \$70,000. Grandstaff and Dixon (1986) estimated the use-value of the Lumpini Park in Bangkok and obtained a consumer surplus of 132 million baht per year using TCM while Farber (1988) estimated the recreational use value of the wetlands of Terrebonne Parish, Louisiana, USA which cover 6,50,000 acres, using TCM and found that the annual value of the wetlands was \$1.277 million. Calculating the value of Carnarvon Gorge National Park in Queensland for recreation use, Beal (1995) estimated a value of \$40 million alone in 1993-94. TCM used to measure the use-value of KhaoYai National Park by Kaosa-ard et al. (1995) showed a direct benefit of 1,420 bahts per visit, of which 870 bahts was the consumer surplus.

The consumer surplus computed from TCM was \$4.67 person<sup>-1</sup> year<sup>-1</sup> for Lake Mokoan in Victoria, Australia and by multiplying it with the total number of visitors; c \$29,100 was estimated as the recreational value of the Lake (Herath, 1999). Gillespie (1997) used TCM to estimate the consumer surplus associated with visits to national parks within Eden Comprehensive regional assessment/regional forest agreement region of New South Wales in Australia and it was found to be between \$2.4 million and \$9.6 million year<sup>-1</sup> for New South Wales and visits to State forests was between \$77,000 and \$3,06,000 year<sup>-1</sup>.

Travel Cost Method was applied to calculate the recreational value of Lake McKenzie in Australia which is one of the most highly used and popular destinations of all Fraser's Island natural sites, attracting 2000 visitors a day during peak season that yielded values ranging from \$13.7 million to \$31.8 million annum<sup>-1</sup> or from \$104.30 to \$242.84 person<sup>-1</sup> visit<sup>-1</sup> (Fleming and Cook, 2007). Tobias and Mendelsohn (1991) used TCM to measure the value of eco-tourism at the Monteverde Cloud Forest Biological Reserve in Costa Rica. Data collected from 755 domestic visitors to the park were used to estimate the consumer surplus for each canton and then aggregated to calculate the total consumer surplus of the whole forest.

In India, Murty and Menkhaus (1994) attempted to estimate the costs and benefits associated with the preservation of Keoladeo National Park at Bharatpur, Rajasthan. Their sample comprised of all the concerned groups like tourists, the local inhabitants, the Government and non-users. Both the CV and survey based techniques have been used for the purpose of this study. TCM was also applied by Chopra (1998) for the valuation of tourism and estimating the nature of demand for the Keoladeo National Park, Rajasthan. Using information from 235 Indian and 70 foreign tourists and considering both the local and total travel costs incurred by the tourists, the consumer surplus was estimated from the semi-log demand function. The consumer surplus based on the total travel cost was found to be much higher than the one based on the local travel cost which was due to multiple purposes of the visit besides touring the park and the joint product nature of the services provided by the park. Thus it was considered more appropriate to consider the local cost for the purpose of estimating consumer surplus.

Mitra (2000) attempted to estimate the recreational value of selected tourist sites of Arunachal Pradesh. Using TCM the estimated consumer surplus per visit of Indian

tourist was ₹991.51 and ₹1,232.48 for foreign tourist and the travel cost results showed that the economic benefits of tourism can be increased both by increasing the visitor charges and number of tourists in Arunachal Pradesh.

De and Devi (2011) estimated the recreation value of tourist sites in Cherrapunjee, Meghalaya, India using the TCM and people's willingness to pay for the preservation and improvement of the area through contingent valuation technique. The estimated surplus per domestic tourist was found to be ₹1,787.46 and that of foreign tourist to be ₹15,872.00 for Cherrapunjee. Considering the willingness to pay of the visitors over the actual expenditure in the form of higher entry fee, parking fee, entertainment tax revised regression increased the consumer surplus to ₹1,933.15 and ₹17,292.00 for domestic and foreign tourist respectively and the approximate surplus generated considering the annual zonal visit rates by all the visitors indicated a surplus of ₹37.31 crores.

Studies using CV method to quantify the value of protected areas and endangered species have also been done by many workers elsewhere to estimate the benefits of species preservation. Boyle and Bishop (1987) were one of the firsts to conduct species valuation study to estimate the existence value for wildlife species. Van Kooten (1993) studied the economic value of waterfowl in Canada and the shadow values of marginal land converted to waterfowl habitat were estimated to be \$50 to \$60 acre<sup>-1</sup>. Loomis and Larson (1994) valued the Gray Whale conservation and estimated the WTP between \$16 and \$18 household<sup>-1</sup>. Boman and Bostedt (1995) estimated the mean WTP of \$126 year<sup>-1</sup> for conservation wolf in Sweden.

Analyses to study the non-economic motives behind the willingness to pay for biodiversity conservation in Donana National and Natural Park SW Spain revealed a strong correlation between individuals' attitudes towards particular species and their stated willingness to allocate funds for their conservation (Martin-Lopez et al., 2007).

Dehghani et al. (2009) studied the recreational value of Hara Biosphere Reserve in southern Hormozan in Iran and showed that 81.2% of the individuals were willing to pay \$5 visit<sup>-1</sup> for recreation value of the mangrove forest which was estimated to be \$97.5 acre<sup>-1</sup> annum<sup>-1</sup>.

A study was conducted by Hadker et al. (1996) to survey the residents of Mumbai and elicit their WTP for the maintenance and preservation of Sanjay Gandhi National Park

(SGNP) using CV method and reported that households were willing to pay exclusively for BNP, on an average, ₹7.50 month<sup>-1</sup>, for the following five years and extrapolating it to the city amounts upto ₹20 million month<sup>-1</sup> which suggested a strong interest in environment conservation. Saxena et al. (2008) estimated the value of habitat function of planted forests in a black buck breeding farm in Haryana, India, using contingent valuation method and estimated it to be ₹15,71,641 year<sup>-1</sup> for three villages out of which ₹12,24,112 year<sup>-1</sup> came from the willingness to pay in the form of labour mandays.

#### **1.4 Need for the present study**

Conservation of natural forest ecosystem had relied heavily on setting aside representative samples of eco-regions and keeping them under strict protection from human exploitation. Enforcement of these protected areas ignored traditional natural resource uses and socio-cultural values of local communities leading to conflicts between local people and protected area managers. It is neither ethically right nor administratively or politically feasible to disregard the legitimacy of people's claims on the protected areas. Therefore, there arises a need for studies that take a holistic approach in scrutinizing the contributions that forests make to overall livelihood strategies of local people (Hedge and Enters, 2000). Since 1990s the 'inclusive' or participatory approach to conservation is being adopted all over the world including India, the issues of local people's livelihoods vis-à-vis biodiversity conservation remain the key challenge faced by the management of protected areas.

Still there is an extraordinary dearth of information about the social impacts of protected areas even though protected areas have expanded threefold in recent years covering about 6% of the land surface of the planet (Brockinton et. al., 2006). To address the above issues as well as the ethical issues of equity i.e. who benefits and who pays for the conservation of natural resources, it is important to analyze the linkages between the socio economic structures of the people with the protected area so as to address their livelihood issues as well as to develop their stakes in conservation. The socio-economic conditions of the local people residing in and around the protected areas, pattern of natural resource extraction, their quantification and dependence on the park are necessary in the planning of protected area management. The close relationships of local communities with the natural

ecosystem and their knowledge with their participation could be of immense help in the successful conservation of biodiversity and their management.

However, such studies have not been given much attention in the management of Keibul Lamjao National Park (KLNP) which harbors one of the most endangered sub- species of Eld's deer *Rucervus eldii eldii* McClelland, 1842, locally known as Sangai and a park which boasts as the only floating national park in the world with a unique and endangered ecosystem. Most researches on KLNP tend to focus on flora and fauna and addressed problems from the perspective of reserve managers or governments. The present study was conducted to evaluate the interaction of local people with the park by taking into consideration the demographic conditions of the people, their resource dependency from the park and its impact, the local perceptions and attitudes of the people towards the conservation of Sangai in KLNP and also the economic value of the park. The information obtained from this study will enable the managers to identify what roles people can play and how their participation can help for the successful conservation of Sangai.

### **1.5 Objectives of the study**

To provide information which would be essential for drawing up a lasting management plan for KLNP, the following objectives were taken up for the present study.

1. To examine the socio-economic and demographic conditions of the villagers around KLNP.
2. To quantify the resources extracted from the park and its contribution to the livelihoods of the local people.
3. To assess the impacts of anthropogenic activities on the wildlife habitat.
4. To examine the conservation awareness and attitudes of people towards the park and alternative livelihood options.
5. To assess the recreational value of the park.

### **1.6 Research questions**

For meeting the above objectives, the following research questions need to be answered.

1. What is the social structure and economic conditions of the local communities?
2. How much natural resources are extracted from the park and what are its contribution to the livelihoods of the people?
3. What impacts do the anthropogenic activities have on the wildlife habitat?
4. What are the attitudes and perceptions of local people and other stakeholders towards conservation of Sangai?
5. What is the recreational value for of the park?

### **1.7 Organization of thesis**

This thesis is organised into seven chapters. **Chapter 1** deals with the general introduction, background, need for the study and objectives. The theoretical and conceptual frameworks are outlined in this chapter. The history of establishment of parks and their values are discussed here. **Chapter 2** gives the brief historical background of Keibul Lamjao National Park. The geophysical conditions, locations and boundary, floristic and faunal diversity and the villages surrounding it are described here. **Chapter 3** describes the socio-economic and demographic conditions of the villages. The characteristics of households, primary and secondary occupations and other socio-economic parameters are explained. **Chapter 4** estimates the quantity of resources extracted, the pattern of extraction, its contribution to the family income and the factors which influence these activities. The impact of these activities on the habitat on the park is also dealt in this chapter. **Chapter 5** is about the awareness and attitudes of people towards conservation of Sangai. People's attitudes towards resource extraction, the importance of park for conservation of Sangai are discussed in this chapter. It also deals with people's willingness to contribute for conservation of Sangai and the compensations they were willing to accept to forego the benefits from the park. Other livelihood options people opted to reduce their dependency on the park and their feasibility are discussed here. **Chapter 6** describes the valuation of recreational service and the attitudes of the tourists towards conservation of Sangai and the park and **Chapter 7** concludes the findings of this research and their implications towards management and conservation. Each chapter has an introduction, methodology, results, discussion and conclusion.

## **2.1 Introduction**

Wetlands are areas where water is the primary factor controlling the environment and the associated plants and animals' lives. They are found at places where the water table is at or near the surface or where the land is covered by water. In Uganda wetlands are called 'swamps' which consist of seasonally flooded grassland, swamp forests, permanently flooded papyrus and grass swamp and upland bog (Balirwa, 1995). In Nepal, wetlands have been defined as 'landmass saturated with water due to high water table through ground water, atmospheric precipitation or inundation which may be natural or artificial, permanent or temporary, static or flowing, freshwater or brackish' (Shrestha and Bhandari, 1992). As per the classification given by Cowardin et al. (1979) and Schot (1999), wetlands can be classified into five types as i) Marine - Open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs like the high-energy, rocky, marine shoreline; ii) Estuarine – Deep water tidal habitats with a range of fresh-brackish-marine water chemistry and daily tidal cycles like mangroves; iii) Riverine - Freshwater, perennial streams comprised of the deep water habitat contained within a channel; iv) Lacustrine - Inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30% vegetation cover like the reed beds grow in fresh, shallow water on the margin of lake; and v) Palustrine - All non-tidal wetlands that are substantially covered with emergent vegetation -trees, shrubs, moss, etc. like the cat tails on the margin of a marsh.

Wetlands were treated as transitional habitats in succession from open water to land ecosystem, but now they are considered as a distinct ecosystem with definite ecological characteristics, functions and values (MoEF, 2009). They are very dynamic, changing according to season and stage of succession. They sustain high levels of productivity and biological diversity; therefore become an important ecosystem from a conservation standpoint (Mitsch and Gosselink, 2000).

## **2.2 History of Keibul Lamjao National Park (KLNP)**

Keibul Lamjao National Park (KLNP) is the last and only natural home of endangered brow-antlered deer (*Rucervus eldii eldii* McClelland, 1842), locally known as Sangai which is a species of Eld's deer that was once distributed across much of South East Asia. Now only isolated populations are present in western part of Irrawady basin in Manipur and in Hainan Island of Southern Asia (McShea et al., 2001). Further it is the only floating wildlife reserve in the world. It is an area of low laying swamps, located in the southeastern part of Loktak Lake, the largest natural freshwater lake in northeastern India, covering 61% of the total extent of wetlands in Manipur (Trisal and Manihar, 2004). The lake is located 38 km south of Imphal city, the capital of Manipur in north eastern India. It lies between 24°25'N and 24°42'N latitude and 93°46'E and 93°55'E longitude. The lake can be broadly divided into northern, central and southern zones. The zones are different from each other in terms of biodiversity and anthropogenic pressures. The lake is one of the Ramsar sites, identified under the Convention on Wetland of International Importance on 23 March 1990.

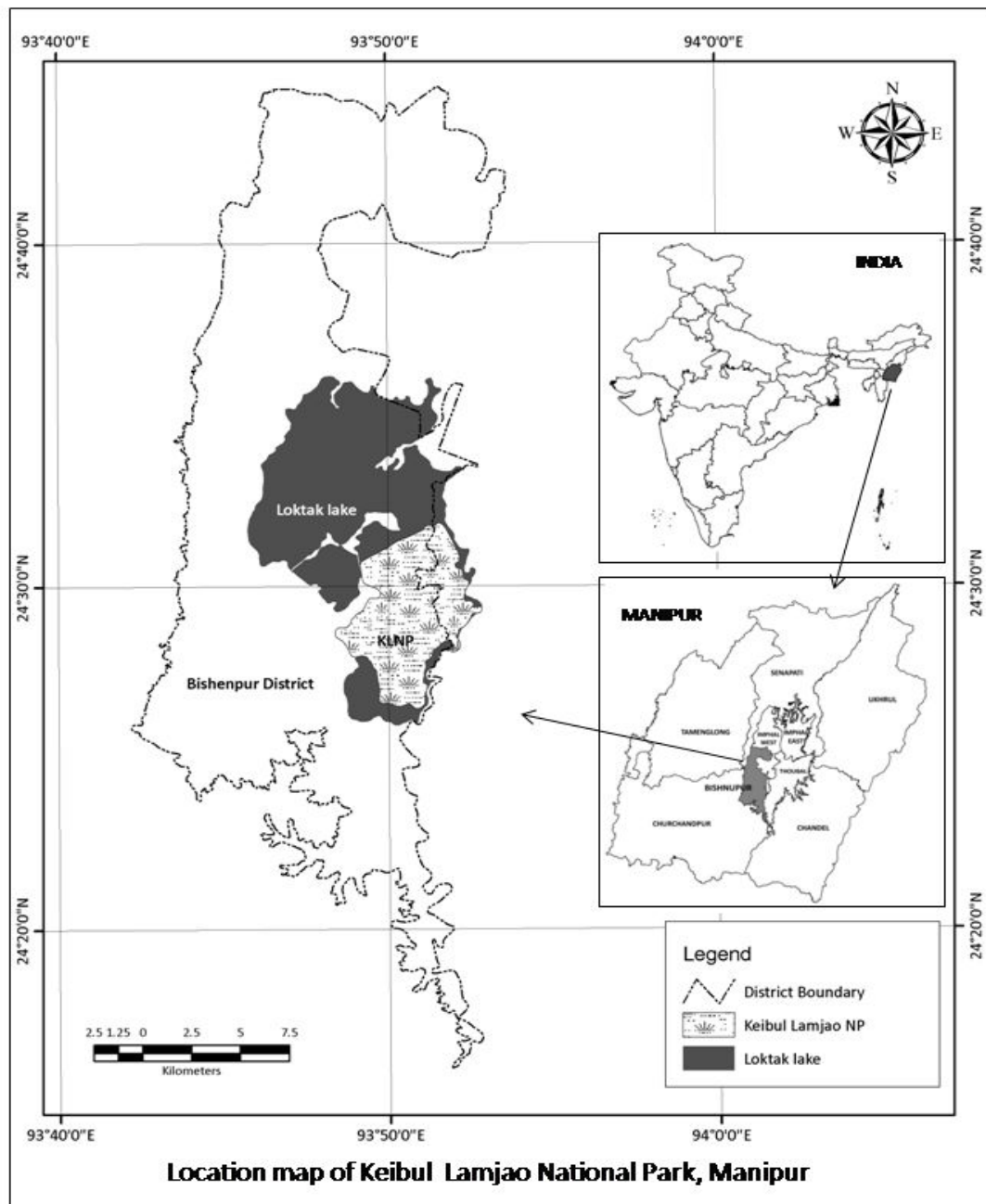
By 1950, the Sangai that was once found in Manipur valley was regarded extinct by the Government of Manipur until in 1953, the deer was rediscovered inhabiting in the floating meadows and adjoining hills of Keibul Lamjao by E.P. Gee, the then Honorary Secretary, Eastern Region, Indian Board for Wildlife. The Sangai and its habitat were declared a protected animal and protected sanctuary respectively in 1954. The area was reduced to 27 km<sup>2</sup> in 1959 and then increased to 40 km<sup>2</sup> in 1965. The area was officially declared protected in 1965, a reserved forest in 1974 and finally a national park in 1977 under the Wildlife (Protection) Act, 1972 (Singh, 1992b) in due appreciation of its unique fauna and flora and to preserve its flagship species, i.e. the brow-antlered deer, Sangai.

## **2.3 Physiography**

### **2.3.1 Location and Geo-topography**

The KLNP is a low laying swamp lying between latitude 24°26'N to 24°32'N and longitude 93°48'E to 93°52' E. It is situated in the southeastern part of Loktak Lake in Bishnupur district near the historical town of Moirang. The park has an area covering

40 km<sup>2</sup> (Figure 2.1) out of which 26 km<sup>2</sup> is covered with *phumdis* or floating meadows and the remaining 14 km<sup>2</sup> is open water.



**Figure 2.1:** Map showing location of KLNP, Manipur.

The park comprises of grasslands in the floating meadows, submerged grassland, elevated ridges forming islets and woodlands on the hillocks. Altitude varies from 768 m at the ridges to 792.5 m at the top of the hills. On the basis of the biogeography of India it comes under North East zone and Province 9B (Singh, 1992b). Geologically,

the hills are quite young as they were formed during the Tertiary Orogeny (2.5 - 65 million years ago) of the Himalayas from the shallow bed of Tethys Sea (Singh and Singh, 1994).

### 2.3.2 Biodiversity

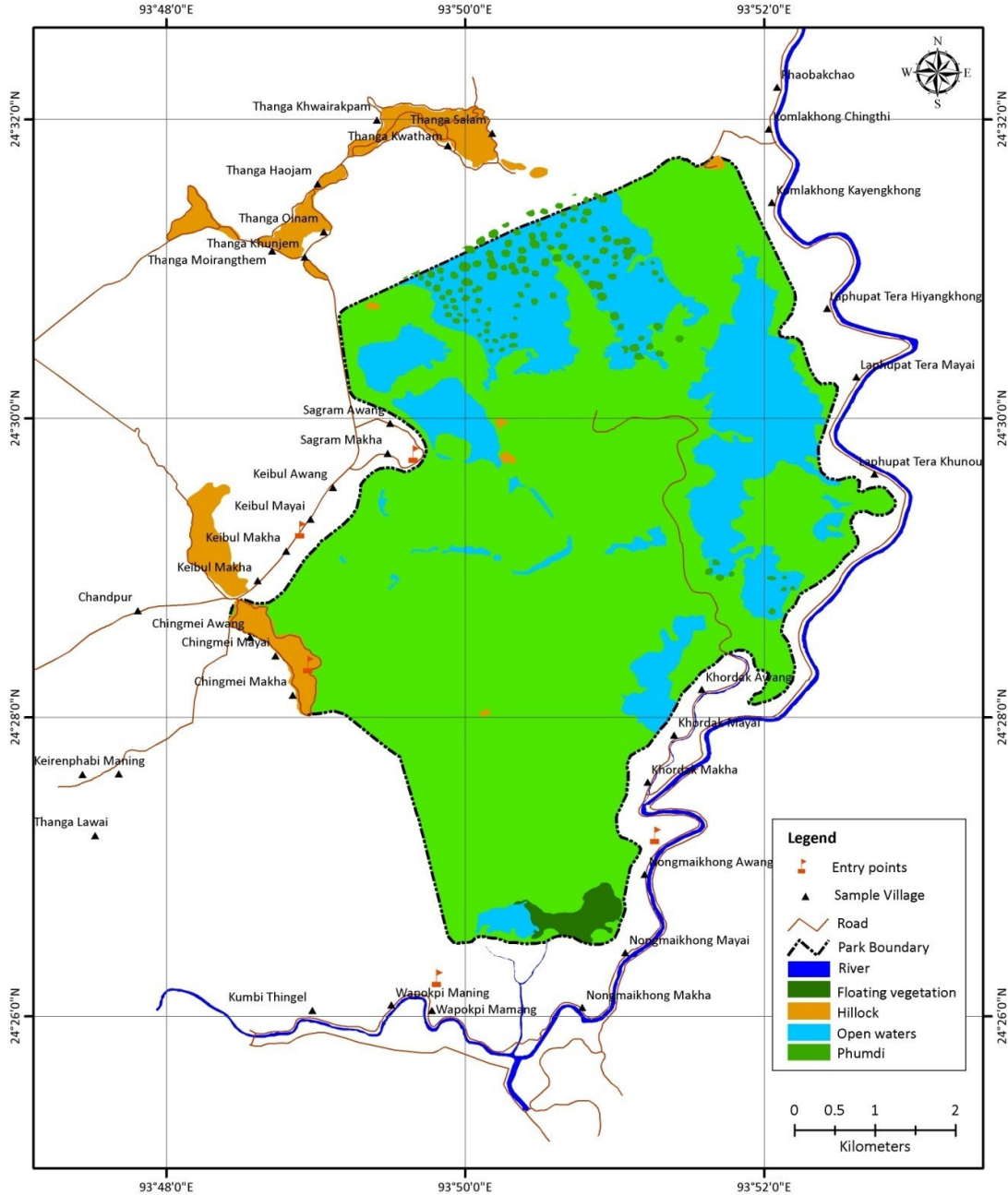
The forests of surrounding hills of KLNP may be categorized as 3C/C<sub>3</sub> to 'East Himalayan Moist Mixed Deciduous Forests' (Champion and Seth, 1968). The forest type is characterized by deciduous dominants and evergreen sub-dominants. The important species are *Quercus griffithi*, *Quercus serrata*, *Castanopsis* sp., *Schima wallichii*, *Mallotus philipensis*, *Bauhinia purpurea*, *Amoora rohitika*, *Rhus* sp. But most part of the hills in and around KLNP have pine (*Pinus kesiya*) plantation taken up by the Forest Department. In the grasslands of the park more than 100 species of grasses and sedges have been recorded with *Zizania latifolia*, *Phragmites karka*, *Saccharum munja*, *Narenga porphyrocoma*, *Leersia hexandra*, *Carex* spp., *Oryza perennis* and *Capillipedium* spp. constituting the major food items of the Sangai (Singh, 1985).

The park is rich in fauna and accounts for 81 species of birds, 25 species of reptiles and 22 species of mammals (Singh, 1992a). Some important mammalian species that inhabit the Park along with the Sangai are the hog deer (*Axis porcinus*), wild pig (*Sus scrofa*), large Indian civet (*Viverra zibetha*), small Indian civet (*Viverricula indica*), jungle cat (*Felis chaus*) and otter (*Lutra lutra*). The park is also a unique wintering ground for various migratory waterfowl, the spot-bill duck (*Anas poecilorhyncha*), gadwall (*Anas strepera*), shoveller (*Anas clypeata*) and common teal (*Anas crecca*), and the permanent home for many resident birds (Singh, 1997).

The park is also the breeding ground of a number of fishes such as the common carp (*Cyprinus carpio*), grass carp (*Ctenopharyngodon idella*), swamp eel (*Monopterus albus*), channa (*Channa punctatus*), feather back (*Notopterus notopterus*), mola (*Amblypharyngodon mola*) and many others and continues to be an important fish resource. It also supports a significant population of reptiles such as the russell viper (*Vipera russellii*), common krait (*Bungarus caeruleus*), king cobra (*Ophiophagus hannah*) and Burmese python (*Python molurus*) (Singh, 1992b).

# Keibul Lamjao National Park, Manipur

(Location of study villages)



**Figure 2.2:** Map of the KLNP with the surrounding villages.

## 2.4 Boundaries

The boundary of KLNP is defined by villages, streams, rivers and hillocks as described in the notification of the constitution of the park and depicted in maps. The

park is surrounded by 40 villages on all directions comprising of different communities. The villages of Arong, Khordak, Komlokhong, Laphupat Tera and Phaobakchao are situated in the east, whereas Sagram, Keibul and Chingmei villages are situated in the west; Thanga villages are towards the north while Keirenphabi, Thanga Lawai, Kumbi, Wapokpi and Nongmaikhong are located to south of the park. The park is separated from Loktak Lake by the Thanga hills in the north, its eastern boundary is the Manipur River and the western and southern boundary are the paddy fields of the adjoining villages (Sinh, 1975).

The park has distinct ecological boundaries, which have been obliterated by the construction of a dam at Ithai, under the Loktak Hydro-Electric Project. Under the project the water level is maintained at 768 m which caused submergence of areas on both sides of Thangbirel-Yangbi which were the higher places in the park and the permanent floating meadows. The ecological boundaries have been changed drastically. There are broadly three ecological areas - firstly the areas under floating meadow which are the central, western and southern parts of the park which form the main habitat of Sangai and other bigger animals; second is the area consisting of three hillocks *viz.* Chingjao which is the northernmost, Pabotching a little south to Chingjao and Toyaching further more south and finally deep water in the northern sides without floating meadows which may be treated as an aquatic ecosystem. There is no existing specific zonation for setting internal boundaries.

## **2.5 Climate**

The park has moderately cold sub-tropical monsoon climate characterized by low temperatures and heavy dew at night from November to February and rapid rise in temperature during April and May. Frost and fog are common phenomena during the winter mornings and nights during December and January. The temperature ranges from a maximum of 34.4°C to a minimum of 1.7°C (Singh, 1992b). The average annual rainfall in and around the park is approximately 150 cm varying between 100 cm and 350 cm. The rainfall occurs mostly during west monsoon period during May to September. However, the park gets some rainfall during retreating monsoon in winter. On average 49% and 81% are the lowest and highest relative humidity recorded in the month of March and August respectively (Sinh, 1975; Singh, 1992b). However, the increasing trend is checked with occasional thunderstorms and light

showers. Maximum temperature recorded was 35°C and minimum 1.66°C (Sinh, 1975). Wind blows in the south-west direction.

## **2.6 Phumdis (Floating Meadows)**

*Phumdi* or floating meadow is the most important and unique part of the habitat. It is the floating mass of entangled vegetation, formed by the accumulation of organic debris and biomass with soil particles, which has been concentrated in solid form. It covers approximately 2/3 to 3/4 area of the park. Its thickness varies from few centimeters to about two meters. The humus of floating meadow is black in colour and very spongy with large number of pores. It floats with 1/5 and 4/5 part above and below water respectively.

Both non-biotic and biotic factors play critically important roles in the formation of floating meadows. Soils with plants of adjacent hills are brought down by rain water. The plant material in the lake sprouts and young shoots gradually spread to form thick mass of floating meadow with the accumulation of soil and vegetative debris and humus. Because of high proportion of vegetative materials, floating meadow floats. Sometimes its formation is initiated by aggregation of plants with *Azolla* sp. forming its nucleus. It gradually accumulates more and more aquatic plants, colonizing grasses, soil particles etc. in course of time it becomes thicker and gets converted into thick mass, which can support human beings and wild animals (Singh, 1992b). Area covered by floating meadow is the most important area of the park as it provides food, shelter, breeding place, playing field etc. to animals in general and Sangai in particular.

According to Devi (1993), structurally the floating meadow is composed of three distinct vertical zones. The uppermost root zone is generally 0-15 cm in thickness. The mat zone located just below the root zone varies in thickness in different localities from 15-65 cm. The mat zone is a layer of densely interwoven live, dead and decaying roots with some litter accumulation on the surface. The plant parts in this region still retain their identity. Below the root and mat zone is the peat zone. The thickness of this zone varies from 10-25 cm below this peat layer is a zone of free water; generally clear in nature and appearance that varies in depth with the lake water level. Next to the free water zone is a layer of organic sludge whose thickness

also varies with the water depth. The total distance between the marsh surface and the underlying hard clay surface of the lake bottom varies with the fluctuation of water levels. This floating meadow has been the natural habitat of the endemic and endangered deer, Sangai and thickness of approximately 75 cm can support a Sangai.

Earlier, the utilization of the plant resources found in the park had no significant impact on the ecology of floating meadows. But the present utilization trend coupled with the changed water regime presents a dismal scenario. The water from Imphal River and Khuga River entering in the park due to back flow washes the roots of floating meadows and in the process the soil particles, which provides nutrition and binding strength to floating meadows are washed away. Therefore, the floating meadows gets thinned and weakened over a period of time (Tuboi, 2013).

## **2.7 Impact of local communities on the park**

Despite its protected status, KLNP is under enormous anthropogenic pressure. Of the 145 plant species found in the park, 54 are important to the local people (Singh, 2002a). People residing around the park have been exploiting the aquatic plants and fishes for their livelihood. There are no strict regulations from the park authorities owing to lack of permanent staffs and personnel and there is no clear cut demarcation of park boundary or fencing. Moreover, after the commissioning of the Loktak Hydro-Power Project in 1983, large agricultural areas at the lake periphery have been submerged which have changed the economic life of the people. This coupled with the increasing population has caused serious stress to the habitat of Sangai and other wild animals in the park. Some of the main activities adopted by the local people in the park are fishing, vegetable collection, collection of fuel wood from the park and the surrounding hills, collection of plants for thatch, fencing, making mats, medicinal plants and for cultural activities.

The other factors which constrain to the conservation of Sangai are the impacts of Loktak Hydro Electric project, which alone is the main cause for the reduction of floating meadows thickness and extent (Rocky, 2002) decline of vegetation, silting up of Loktak Lake, grazing, uncontrolled burning of grass to improve the grazing ground, encroachment and accelerated use of land along catchments and watershed areas (Singh, 1991) and finally in-breeding due to its fatally low population.



Keibul Lamjao National Park during winter



Different vegetation stratification seen on the floating meadow



View of Pabotching and Chingjao in onset of spring

**Plate 2.1:** Different views of KLNP, Manipur.

# CHAPTER 3

## SOCIO-ECONOMIC AND DEMOGRAPHIC CONDITIONS OF PERIPHERAL VILLAGES AROUND KEIBUL LAMJAO NATIONAL PARK

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### 3.1 Introduction

Majority of protected areas are surrounded by a matrix of human-land use types and dense human populations from subsistence communities. In order to conserve biodiversity and natural places by the creation of protected areas, the local indigenous people are usually displaced or demised (Ferraro, 2002). Before the establishment of parks and imposition of restrictions and rules, the local communities were accustomed to unlimited harvest and use of forest products. But exclusion of the local people from the conservation programmes resulted in serious conflicts between park authorities and local indigenous people who were from marginalized and economically poor rural communities (Ferraro, 2002). The extinction or extirpation of species continues at breakneck speed, largely due to the inability of field biologists and resource managers to successfully influence behaviour and policy at the local level (Ceballos et al., 2005; Wake and Vredenburg, 2008).

The obstinate human dimension of social, economic and ecological forces complicated the efforts of conservation professionals to do their work. The values of the environment to local people is often immeasurable, with these communities having a long associated ancestral history with the land and are dependent on the environment for their daily needs, health, economic growth, cultural, religion and as a fail-safe in times of agriculture and economic hardship (World Bank, 2002). A better understanding of relations among ethnicity and socio-economic status of the local indigenous people is critical and the importance of interdisciplinary collaboration is recognized by both social scientists (Mascia et al., 2003) and ecologists (Lawton, 2007), particularly to inform policy in the management of socio-ecological systems (Sutherland et al., 2008). Alliance through the use of integrated methodologies can help policy-makers anticipate complex interactions between systems that affect ecosystem's health (Watkinson et al., 2000), factors affecting economic costs into conservation planning (Naidoo et al., 2006) and estimate the effects of conservation

policy on human well being (Millennium Ecosystem Assessment 2005; Boone et al., 2006).

Even though importance of common property resources to rural people is understood (Dei, 1992; Williams, 1998; Becker, 2001; Beck and Nesmith, 2001), issues of equity among various forest users is becoming a major challenge to environmental development, forest management and poverty reduction (Rocheleau and Edmunds, 1997; Byron and Arnold, 1999; Adhikari et al., 2004; Anderson et al., 2006). Thus, an understanding of factors influencing access to common resources, is vital for identifying the most vulnerable groups and for adapting natural resource management practices towards a more holistic and equitable system.

Several factors such as gender, household size, education level, age of the household head, total household income and other contextual factors may influence an individual's ability to derive various products from a given forest. Moreover, women are often constrained in accessing and controlling land and forest resources due to the presence of gender identities within households (Agarwal, 1997; Goebel, 1998). In addition, larger households clear more forest because they have more workers and more mouths to feed (Godoy et al., 1997). A higher level of formal schooling is often associated with less forest cutting (Godoy and Contreras, 2001), due to higher opportunity costs of time (Adhikari et al., 2004) and increased social status and economic opportunities in this rural context (Adhikari et al., 2004; Agrawal and Gupta, 2005). The age of the head of household may be positively related to forest resource utilization until a peak of physical strength is reached (Godoy et al., 1997). On the other hand, older people may possess superior knowledge about various forest resources and may utilize more medicinal plants and wild foods. Owing to improved off-farm employment opportunities (Angelsen and Kaimowitz, 1999) and access to credit (Godoy et al., 1997), total household income (wealth) may be associated with reduced forest clearance as a supplementary income-generating activity.

Keibul Lamjao National Park has a very deep connection with the surrounding villages located around its periphery. The park is an integral part of the local communities and it is heavily depended upon by them for sustenance as well as commercial purpose. So the study was taken up to have deep understanding of the socio-economic conditions of the villages which will help in better understanding the park-people relationship.

## **3.2 Methodology**

The way in which research was conducted may be conceived in terms of the research philosophy subscribed to, the research strategy employed and so, the instruments utilized in pursuit of the goal/s i.e. the objectives and the quest for the solutions – the research questions. It has been observed that no single research methodology is intrinsically better than any other methodology (Benbasat et al., 1987). A combination of research methods are called for to improve the quality of research (Kaplan and Duchon, 1988).

### **3.2.1 Sample population and village demographics**

Thirty-six out of the forty villages, situated around KLNK were selected for data collection. The villages were selected according to their proximity, about 3 km from the boundary of the park and four other villages that were distantly located from the park. None of the villages derive any direct benefit from the park and affect the park. The villages were clustered according to direction, occupation of people and there were distinct geographical demarcations like roads, fields, rivers, streams etc. separating them. Seven villages were sampled in northern direction, ten villages in western direction, nine villages in the south and ten in the east. These villages will be referred as northern cluster/villages, western cluster/villages, southern cluster/villages and eastern cluster/villages respectively. The names of the villages in each cluster with total number of households, number of households sampled and ethnicity of the residents are given in **Table 3.1**.

There were two ethnic groups in this area - the Meiteis which are the majority, and the Muslims or Meitei Pangals. The northern, western and southern clusters were exclusively inhabited by Meiteis only while the eastern cluster was populated by mixture of Meiteis and Meitei Pangals. The northern cluster had 542 households, western cluster had 704, southern cluster had 502 and the eastern had 927 households (**Table 3.2**). There were total of 2675 households around the park.

**Table 3.1:** Characteristics of sampled villages around KLNP, Manipur.

<b>Sl. No.</b>	<b>Name of village</b>	<b>Direction/ Cluster</b>	<b>Ethnic group</b>	<b>Total HH</b>	<b>HH surveyed</b>
1	Thanga Salam	Northern	Meitei	166	12
2	Thanga Kwatham	Northern	Meitei	53	6
3	Thanga Khwairakpam	Northern	Meitei	36	4
4	Thanga Haojam	Northern	Meitei	68	6
5	Thanga Oinam	Northern	Meitei	70	7
6	Thanga Khunjem	Northern	Meitei	70	7
7	Thanga Moirangthem	Northern	Meitei	79	8
8	Sagram Makha	Western	Meitei	53	6
9	Sagram Awang	Western	Meitei	45	4
10	Keibul Thana Leirak	Western	Meitei	14	3
11	Keibul Awang	Western	Meitei	78	6
12	Keibul Mayai	Western	Meitei	97	7
13	Keibul Makha	Western	Meitei	180	8
14	Chingmei Awang	Western	Meitei	80	7
15	Chingmei Mayai	Western	Meitei	24	3
16	Chingmei Makha	Western	Meitei	23	2
17	Chandpur	Western	Meitei	110	4
18	Keirenphabi Mamang	Southern	Meitei	80	9
19	Keirenphabi Maning	Southern	Meitei	65	6
20	Thanga Lawai Mamang	Southern	Meitei	75	8
21	Kumbi	Southern	Meitei	109	10
22	Wapokpi Mamang	Southern	Meitei	30	3
23	Wapokpi Maning	Southern	Meitei	47	5
24	Nongmaikhong Awang	Southern	Meitei	30	3
25	Nongmaikhong Mayai	Southern	Meitei	32	3
26	Nongmaikhong Makha	Southern	Meitei	34	3
27	Khordak Awang	Eastern	Meitei	28	3
28	Khordak Mayai	Eastern	Meitei	55	5
29	Khordak Makha	Eastern	Meitei	34	4
30	Laphupat Tera Khunou	Eastern	Meitei	87	8
31	Laphupat Tera Mayai	Eastern	Meitei	104	10
32	Laphupat Tera Heiangkhong	Eastern	Meitei	162	16
33	Komlakhong chingthi	Eastern	Both	147	15
34	Komlakhong Kakyenkhong	Eastern	Both	20	4
35	Phaobakchao	Eastern	Both	35	4
36	Phaobakchao Bazar	Eastern	Meitei	255	21
<b>Total</b>				<b>2675</b>	<b>240</b>

HH=Household

**Table 3.2:** Numbers of villages and households sampled during the study.

<b>Direction/ Cluster</b>	<b>No. of villages</b>	<b>Total HH</b>	<b>No. of HH surveyed (%)</b>
Northern	7	542	50 (9)
Western	10	704	50 (7)
Southern	9	502	49 (10)
Eastern	10	927	90 (10)
Total	36	2675	239 (9)

HH=Household

### **3.2.2 Sampling procedure**

Data were collected from November 2007 to July 2009, using structured questionnaires. Interviews were conducted during late morning to late afternoon (09:00 am to 03:00 pm). The questionnaire was modified after encountering some insufficiency in the data after a reconnaissance survey. A total of 240 households were randomly selected and one person from each household was interviewed and 239 were successfully interviewed. So, 50 households in north and west, 49 households in south and 90 households in east were interviewed. Only adults (above 18 years old) were interviewed irrespective of gender.

To avoid potential bias it was made clear to the participants that the investigation was for academic research without any affiliation with the management authority or any of the administrative set ups. To avoid any influence of opinion from other members of the family attempts were made to hold a face-to-face interview. The questionnaires had both open ended and close ended questions. The fixed response and the possible alternative answers were read to interviewees, while the open ones were asked subsequently to gain an in-depth understanding of their answers.

### **3.2.3 Household questionnaire survey**

In order to understand how local people integrate the available livelihoods assets, household interviews were conducted. Information regarding compositions of the household, sources of incomes, occupations was noted using both open and close ended questionnaires. The demographic information on gender, education level, age, ethnicity, occupation, and other household characteristics like family size, number of

adults and composition of family members, primary and secondary sources of income, type of house and landholdings were gathered. Various other aspects like source of energy or fuel wood, growing of home gardens, possession of fish farm or *athaphums*\* and other items like refrigerator, vehicle, television etc. were also gathered to assess the economic status of the family (**Appendix I**).

### 3.2.4 Data analysis

The information on demography and economy of the villages were tabulated and classified into categories with respect to the directions. Household income was computed by summing up all the incomes accruing from agriculture, fishery, vegetable collection, daily wages and other sources to an individual's household, as per following formula.

$$\text{Household income (Annual)} = \sum (\text{agriculture income}) + (\text{fishery income}) + (\text{daily wages}) + (\text{income from sale of forest produce}) + (\text{income from other sources})$$

To find out if there were any significant difference between the different clusters f-test was used for the analysis. The data gathered were analysed using percentage frequency method.

## 3.3 Results

### 3.3.1 Characteristics of households of the villages

Studying the socio-economic conditions of the villages around KLNP, the following observations were recorded. Out of 239 total individuals, 134 (56%) men and 105 (44%) women were interviewed during the study. Respondents' age ranged between 18 to 84 years with an average age of 45.31 years. Majority of the respondents (50.2%) tended to be in the 30 – 55 years age group (**Table 3.3**). With regard to education, 34.3% were illiterate, 11.3% attended up to primary school, 41% up to secondary school and 13.4% to the level of university. Three clusters were inhabited by the Meitei community while in the eastern cluster some villages were inhabited by both Meitei and Meitei Pangal communities.

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\* *Athaphum* is a traditional method of fishing, wherein circular enclosures are made in the lake using pieces of thick floating meadows.

**Table 3.3:** Characteristics of the respondents surveyed around KLNP, Manipur.

<b>Characteristics</b>	<b>Group</b>	<b>North (n=50)</b>	<b>West (n=50)</b>	<b>South (n=49)</b>	<b>East (n=90)</b>	<b>Total (%) (n=239)</b>
<i>Gender</i>	Male	32	22	33	47	134 (56)
	Female	18	28	16	23	105 (44)
<i>Age</i>	<30 yrs	14	12	10	24	60 (24.1)
	30-55 yrs	21	20	29	50	120 (50.2)
	>55 yrs	15	18	10	16	59 (24.7)
<i>Education</i>	Illiterate	12	19	09	42	82 (34.3)
	Primary school	10	04	07	06	27 (11.3)
	Secondary school	18	23	27	30	98 (41.0)
	University	10	04	06	12	32 (13.4)
<i>Ethnicity</i>	Meitei	50	50	49	68	217 (90.8)
	Meitei Pangal	0	0	0	22	22 (09.2)

### 3.3.2 Socio-economic and demographic conditions of the villages

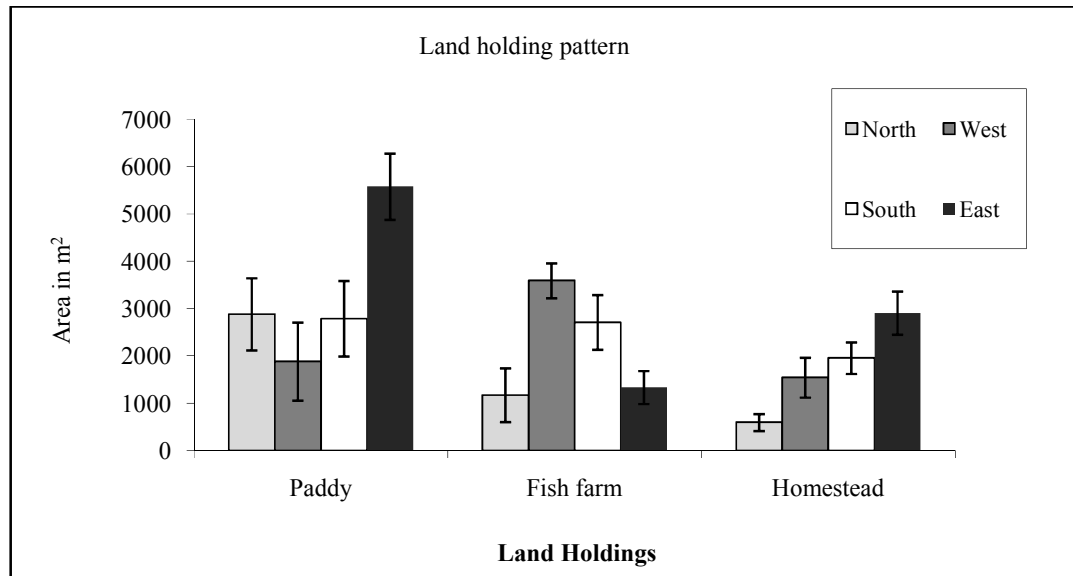
Comparing the household sizes of the four village clusters, it was found that there was a significant difference ( $p < 0.001$ ) in the household size among the village clusters (**Table 3.4**). It was largest (7.48 persons household<sup>-1</sup>) in the northern followed by the eastern villages (6.94 persons household<sup>-1</sup>) and the least (5.72 persons household<sup>-1</sup>) was in the western villages. The average household size was 6.56 persons household<sup>-1</sup>. There was a significant variation in the number of adults in a family ( $p = 0.045$ ) across the clusters. It was also found similar in the case of the number of men ( $p = 0.005$ ) and women ( $p = 0.015$ ) in a family. Each family had 4.33 adults with almost equal number of males (3.16) and females (3.4).

**Table 3.4:** Socio-economic and demographic characteristics of the 4 cluster villages located around KLNP, Manipur.

Parameter	North	West	South	East	Average	<i>p</i>
Household Size	7.48 (48)	5.72 (39)	5.76 (32)	6.94 (33)	6.56	0.000
No. of Adults	5.00 (48)	4.12 (42)	4.29 (42)	4.10 (42)	4.33	0.045
No. of men	3.64 (59)	2.86 (64)	2.80 (38)	2.64 (50)	3.16	0.005
No. of women	3.84 (54)	2.86 (64)	2.96 (44)	2.99 (56)	3.4	0.015
HH area (ha)	0.06 (212)	0.18 (163)	0.20 (121)	0.28 (152)	0.20	0.002
Total land holdings (ha)	0.47 (144)	0.70 (113)	0.75 (117)	0.98 (100)	0.77	0.008
No. of cattle per HH	0.08 (707)	0.52 (191)	0.18 (308)	0.31 (258)	0.28	0.027
No. of poultry per HH	3.72 (422)	2.2 (643)	1.29 (375)	0.77 (541)	1.79	ns
No. of piggery per HH	0.36 (569)	0.04 (707)	0.04 (700)	0.14 (337)	0.15	ns
Total annual family income (₹)	84300 (88)	72186 (67)	67317 (92)	60252 (70)	69228	ns

(Values in parentheses are CV-Coefficient of Variation), HH=Household, ns=not significant

The household area varied significantly ( $p=0.002$ ) with highest (0.28 ha) in the eastern cluster and lowest (0.06 ha) in the north. Similarly, total landholdings was highest (0.98 ha) in the eastern villages and lowest in the northern villages (0.47 ha) while the average landholding was 0.77 ha. Average area of paddy field was highest (0.56 ha or 5580 m<sup>2</sup>) in the eastern villages and least (0.19 ha or 1881 m<sup>2</sup>) in the western villages (**Figure 3.1**). The number of cattle varied significantly ( $p=0.027$ ) across the different directions of village clusters with 0.31 cattle household<sup>-1</sup> in the eastern village group and the lowest being in the north with 0.08 cattle household<sup>-1</sup>. Poultry and piggery did not vary significantly across the villages and the numbers were very less in all the villages. Total household income was found to be highest (₹83,504) in the northern villages followed by the western villages (₹71,984) and the least in the eastern with ₹60,247 annum<sup>-1</sup> family<sup>-1</sup> and there was no significant difference between the clusters.



**Figure 3.1:** Land holding pattern of the cluster villages.

The primary occupation (**Table 3.5**) of the villages differed in different clusters. In the northern villages, fishing in KLNP and Loktak Lake formed the main occupation (48%), and 16% were with government jobs. In the western direction of the park, only 14% of the villagers practiced fishing mostly in the park as their main occupation while 28% depended on agriculture and another 30% stated pisciculture to be the main occupation while 10% took to business, weaving, fish trading etc. as their main source of income. The residents of southern cluster depended mostly on pisciculture (33%) and agriculture (27%) and 18% depended on fishing in and around the park as the primary occupation. About 18% of the families had various other occupations like business, carpentry, fish trading, as labour etc. as primary occupation. Agriculture was the main occupation in the eastern cluster with 37% practicing it. Only 29% of them practiced pisciculture as their main and primary occupation. Only 2% of eastern villages' residents collected vegetable for their sustenance.

Apart from the main occupation which rarely sufficed the needs of the family, people took up various other secondary works to earn extra income (**Table 3.6**). In northern villages, 28% of the local residents took other means of livelihood like running small shops, weaving, *lu* (a fishing device) making, animal husbandry etc. as their secondary income source.

**Table 3.5:** Primary occupation of the villagers surrounding the KLNP, Manipur (n=239 households).

<b>Occupation</b>	<b>North (%)</b>	<b>West (%)</b>	<b>South (%)</b>	<b>East (%)</b>
Agriculture	14	28	27	37
Pisciculture	16	30	33	29
Fishing	48	14	18	12
Vegetable Collection	0	4	0	2
Govt. service	16	14	4	3
Others	6	10	18	17
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Table 3.6:** Secondary occupation of the villagers surrounding the KLNP, Manipur (n=239 households).

<b>Occupation</b>	<b>North (%)</b>	<b>West (%)</b>	<b>South (%)</b>	<b>East (%)</b>
Agriculture	10	16	12	16
Pisciculture	24	-	14	29
Fishing	-	28	14	8
Vegetable Collection	-	40	-	12
Others	28	20	31	17

Agriculture (16%), fishing (28%) and vegetable collection from KLNP (40%) were other sources of income in the western villages. In the southern villages, about 31% of the households had various activities like fish and vegetable trading, weaving, carpentry and other business as additional source of income. Pisciculture (14%), fishing (14%) and agriculture (12%) were also other means of secondary livelihood of southern villages. In the eastern villages, pisciculture (29%) was the main secondary occupation followed by others like business, labourer, traders, etc (17%) and agriculture (16%).

*Athaphums* were an important asset for the people around Loktak Lake and KLNP. They played a very important role in the socio-economic conditions of the people. Forty percent of local residents owned *athaphums* in the north which was highest in the region (**Table 3.7**) and very few in the west and east while maximum (44%) fish

farms were recorded in the southern villages. Agriculture-cum-pisciculture was practiced mainly in the eastern villages (17%).

Use of LPG as source of energy was highest (16%) in the northern villages. Firewood from homestead was least recorded (10%) in the northern villages and maximum (66%) in the eastern villages. Firewood procurement from market was highest (84%) in northern villages while its extraction from the park was highest (44%) in the western villages.

**Table 3.7:** Other socio-economic parameters of the villages surrounding the KLNP, Manipur (n=239 households).

<b>Household assets</b>	<b>North (%)</b>	<b>West (%)</b>	<b>South (%)</b>	<b>East (%)</b>
<i>Fish farm type</i>				
Own <i>athaphum</i>	40	4	0	1
Own fish farm	24	34	44	37
Agri-cum-pisciculture	4	4	0	17
<i>Source of energy for cooking</i>				
LPG	16	14	4	10
Firewood				
- From market	84	26	66	48
- Homestead	10	48	28	66
- From the park	14	44	6	17
<i>House Type</i>				
Pucca	4	6	2	3
Semi-pucca	86	81	69	79
Thatched roof	10	13	29	18
<i>Other assets</i>				
Television	66	60	57	12
Refrigerator	14	4	6	3
2-wheeler vehicle	12	10	6	1

Majority of the households had semi-pucca houses and houses with thatched roof were highest (29%) in the southern villages and least (10%) in the northern villages. Many of the households owned television sets except in the eastern villages where

only 12% families owned one. Refrigerator and 2-wheelers were also recorded maximum in the northern villages and minimum in the eastern villages.

### **3.4 Discussion**

It has been noted that in the past, the economy of the inhabitants of the study area was highly dependent on agriculture and less on fishery based. But due to the submergence of the agricultural areas (after the commissioning of the Loktak Hydro-Power Project in 1983) there had been a change in their livelihood patterns. Now they rely more on aquatic species which included plants and fish extraction. The consistently growing human population and its dependency on the aquatic habitat, combined with lack of alternative livelihood opportunities were threats to the habitat of Sangai. There is a growing recognition that the effective policies for biodiversity conservation need to focus on the reduction of socio-economic pressures on biodiversity, either directly or through modification of their underlying driving forces (Haberl et al., 2007; Spangenberg, 2007).

To determine the extent of disturbance on KLNP, knowledge of the socio economic and demographic conditions of the villages surrounding the park was essential. In the survey there was a good representation of female respondents in the study and as such there would not be any gender biasness in the findings. Moreover, there was a fair representation of all age groups. The decadal population growth rate of the Bishnupur district during 1981-1991, 1991-2001, 2001-2011 was reported to be 27.52%, 15.27% and 15.36% (Anon., 2012). The sex ratio of Bishnupur district accorded to 2011 census report was 1000 females per 1000 males. Similar ratio of male and female members (3.16 : 3.4) in the families was also observed. The literacy rate of the district is 76.35% while it was only 65.7% for the villages.

The larger family size in the northern villages may be due to the reason that most of the families were joint families as there was less scope of separating to new families owing to small land holdings. As the northern villages were located in island hillocks there was no provision to expand their existing household area. Alphonse and Gu (2009) in their study conducted in Akagera National Park, Rwanda found that variable household size had a positive relationship with forest dependency, suggesting that large families tend to rely on the forest resources in order to increase their income.

The same relationship between household size and Nyungwe forest resource exploitation also in Rwanda has been found by Masozera and Alavalapati (2004). People (48%) in the north were mainly depended on fishing as they were close to the fishing grounds of open water in the north of KLNP and have access to large open water of Loktak Lake just as in Papua New Guinea where dependence on fishing depended on factor like closeness to fishing ground and size of fishing ground (Cinner and McClanahan, 2006).

The people in the north had low (12%) illiteracy rate with more people (10%) attending university and they were most (16%) employed in government services. High literacy rate in northern cluster may be due to the fact that people have less land holdings with increased in population to follow the age old practice of agriculture and having a better option being educated people. Both primary and secondary education, can easily get employment in other fields than the illiterate one as also noticed in the adjoining villages of Mudumalai Wildlife Sanctuary in South Indian state of Tamil Nadu (Hedge and Enters 2000) and in neighbouring villages of Akagera National Park in East Rwanda (Alphonse and Gu, 2009) where education was one factor that alone can affect conservation of protected areas for the better (Mordi, 1987; Fiallo and Jacobson, 1995; Gillingham and Lee, 1999).

Larger household area in the eastern cluster facilitated more families to rear cattle which were a constraint for the northern villages. The number of cattle per household was small in all the clusters since there was no market for animal husbandry and poultry in the nearby areas. With limited land resources in the northern villages cattle rearing were almost negligible. So, the people dependence on the park for fodder for cattle was less and hence, the cattle entering the park was also less and were seen only in hard ground of Thangbirel Yangbi area of the park. However, owning fish farms have a positive relation with the park as also seen in Nepal (Sah and Heinen, 2001) and Rwanda (Alphonse and Gu, 2009) though ownership with large numbers of cattle heads lead to the depending on forest resources for fodder.

The economic activities of the local people were mainly for subsistence and commercial purpose. While activities such as agriculture and fuel wood extraction were mainly for subsistence; extraction of vegetable, pisciculture and fishing were usually for commercial purpose. Since the northern villages were located on the hillocks of Thanga surrounded by Loktak Lake and there were not many agricultural

lands, most of the villagers resort to fishing as primary occupation. Vegetable collection as a primary or secondary occupation was negligible in the north. This may be because of the difficulty in getting access to the park area by women as they generally collect vegetables. The park can only be accessed after crossing the open waters on the northern side of the park using a country boat. Apart from the primary source of income, other secondary source also supplemented the total income so was the case in the households of Chilimo in Ethiopia (Mamo et al., 2007).

After the submergence of many paddy fields due to construction of the Ithai barrage, the people have converted their paddy fields to pisciculture; this was one main reason why villagers in the western, southern and eastern villages had fish farms. Majority of the respondents in the eastern cluster had higher land holdings with larger paddy fields. The varieties of rice cultivated by the villagers were water tolerant varieties which could tolerate the high water logging condition of these fields. Bunds were raised around the fields to avoid excess water entering the field. Since other crops or vegetables cannot be grown in these fields, many farmers make use of the off season by turning to pisciculture by opening up the bunds and converting the fields into ponds. *Athaphum* fishing which are practiced in deep open waters were more prevalent in open lake area in the northern villages. This type of fishing at least assured some harvest throughout the seasons and most of the time acted as security for the people and there was no question of struggle or rivalry with other fishermen unlike fishing in open water.

Different sources of energy were used in the villages for cooking namely LPG, firewood from market or homestead or fuel wood from the park. The economically better households in the northern villages used LPGs and firewood procured from the market. Since their landholdings were small they could not plant trees in their homesteads and the source of fuel wood from the park was far from these villages. Households in eastern villages had larger homestead and majority of them could manage fuel wood resource within their homestead which was preferred. Comparatively much higher number of households in the western villages also sufficed their fuel wood requirement from the park which may be due to their proximity and easy access to the park resources. Other studies have found a similar relationship between village forest proximity and resource use (Karanth et al., 2006; Elmquist et al., 2007; Abram, 2008). Firewood remained the primary source of energy

since other sources like LPG and kerosene were not easily available in the area due to its remoteness and less supply. The semi-pucca houses were usually less costly than the pucca houses and more durable than the thatched houses. The total annual family income showed that households in the northern villages had better economic conditions which were also evident from the educational background of the local residents and other assets like television, refrigerator and two-wheelers.

### **3.5 Conclusion**

The socio-economic study in the clusters revealed that the northern villages with the smallest household area and landholdings have the largest family size, smallest cattle per household, however, with highest family income amongst all the other clusters. The main primary occupations of the villagers were agriculture, pisciculture and fishing. Fishing and vegetable collection from the park were main secondary occupations of the western villages. Owning *athaphums* (mainly in the northern cluster), fish farm or agri-cum-pisciculture fields were a common feature in all the villages. Though LPGs were used in some of the economically sound households, firewood remained the main source of energy for cooking which were purchased from market, cut from trees in the homestead or harvested from the park. Most of the houses were semi-pucca type, that is, the floor is pucca while the walls were made of mud with corrugated sheets as roofs. Majority of the households owned television set except in the eastern villages. The overall socio-economic status of households in the northern villages was better and the weakest were the eastern villages. The study was aimed for better understanding of the socio-economic conditions of the villages around KLNP for better implementation of conservation plans.



(a) Middlemen on the way to gather fishes



(b) *H. coronarium* on sale near the park



(c) *H. coronarium* on the way to Imphal



(d) Harvesting fishes from an *Athaphum*



(e) *Athaphums* on the northern side of the park



(f) Phabou nga (*Puntius chola*) ready to be smoked

**Plate 3.1:** Economic activities in and around the KLNP, Manipur.

# **CHAPTER 4**

## **RESOURCE EXTRACTION, DEPENDENCY AND ANTHROPOGENIC IMPACTS ON KEIBUL LAMJAO NATIONAL PARK**

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### **4.1 Introduction**

The study of interactions between human, plants, animals and the space that they live in is essential for understanding the bio-physical phenomenon associated with integrated ecosystem approach and its management (Folke et al., 2005). As pointed by Grove and Burch (1997) and Folke et al. (2005), the physical, chemical and biological processes of environment affect the human species while the biological and social characteristics of the humans (though shaped by evolution) affect their immediate environment.

Many protected areas have human settlements within or adjoining them which depend on forest products as a source of sustenance or consumption (Silori and Mishra, 2001; Davidar et al., 2008). Imposing protected areas on the resource dependent communities also had a large number of negative consequences. These conflicts and associated consequences were mainly due to lack of understanding of the locale specific needs and aspirations of the local populace and lack of understanding of the people-resource interaction (Badola et al., 2012). In the pretext of omnipresent people-park conflicts in the third world the 'species oriented' approach is now being seen in a broader perspective, i.e. 'ecosystem level approach'. This approach, involved the study of social forces, economic status and environmental quality that are affected due to human activities (Silori and Mishra, 1996) and had been applied to the studies of protected areas in the recent decades (Machlis and Tinchell, 1985; Machlis, 1989, 1992; Saberwal and Kothari, 1996; Badola, 1997b; Chandola, 2001; Semwal, 2006). Such inter-disciplinary approach of the merging social, economic and environmental forces to achieve the goal of conservation has more importance in a country like India where the use of natural resources had been the part of traditions and culture of the majority of the rural population (Panwar, 1990; Leach, 1991; Lynch, 1992; Badola, 1999; Hussain and Badola, 2010) and was also influenced by the economy and the policies. Understanding of the local social and economic systems, along with the local and regional policies may help in identification of

alternatives to the resources, it could predict availability and consumption pattern and can also project rate of exploitation of natural resources (Badola, 1997b).

The importance of non-timber forest products (NTFPs) were usually considered of little importance and primarily seen of as only local interest (Arnold and Pérez, 2001). However, during the last few decades, the role of NTFPs on rural development and conservation of natural resources had gained importance. The importance of NTFPs to the livelihoods and welfare of local communities, the local use of resources from forest, the extent of dependency and the factors influencing the use were essential to provide insights into the local community dynamics and help design more effective interventions to reduce dependency and improve the condition of the protected area. Understanding the resource use patterns of communities provide a basis for seeking the participation of such communities in forest conservation.

However, with the ever increasing population, the harvesting of forest products is no longer sustainable in many areas. Over-harvesting of forest products in a non-sustainable manner has had a drastic effect on the forest ecosystems in India (Anitha et al., 2003; Rai and Chakrabarti, 2001). From among different ecosystems, grassland ecosystems were distinguished owing to their species richness which can be attributed to the diversity in site conditions in which they occurred (Trąba et al., 2006) and the maintenance of these ecosystems depended both on natural factors as well as anthropogenic activities (Isselstein et al., 2005; Zaluski, 2002). Over time, natural disturbance regimes in the ecosystems undergone substantial change and were being replaced by human induced disturbance regimes which caused changes to grassland community structure and composition. Any process which altered the natural process resulted in reduced stability of communities and posed a threat to the maintenance of floristic diversity of grassland ecosystems (Šantrůček et al., 2002; Štýbnarová, 2009). There was also an increasing concern about the response of species and ecosystem to human altered disturbance regimes (Foin et al., 1998) and undesired plant succession in natural grassland ecosystem. Thus, maintaining a suitable disturbance regime was essential to persist and sustain the biodiversity of grassland ecosystems. One of the most critical issues for conservation management was to establish a disturbance regime based on sound ecological principles, without compromising the quality of the grasslands.

There are several natural factors that determine the structure of population and regeneration of given species but anthropogenic disturbances like fire or harvesting some particular species will also alter the plant composition (Hall and Bawa, 1993). It may be difficult to assess to what extent changes were brought about to the plant population due to harvest of the plants in a short study period. To get a quantitative valuation of the effect of harvest on the plant population (composition) of some few selected plants, commonly extracted by the peripheral villagers for livelihoods, an experiment was set up to examine the outcome of simulated harvesting of the target species at different harvesting regimes.

Before Keibul Lamjao National Park (KLNP) came into existence people living around the park had been deriving benefits from the area. Even after the notification of the national park local villagers around the park have been extracting resources since they have no other option to rely for their livelihoods (**Plate 4.2**). Pattern of natural resource extraction, their quantity and dependence of local villagers for livelihood on the park is of utmost importance for inclusive planning for participatory approach for conservation. To understand the extent of the above facts a detailed study was taken up to quantify the resources extracted from the park and the dependence of peripheral villagers on the park for livelihoods and the impact of anthropogenic activities on the park's habitat.

## **4.2 Methodology**

For collection of data, the methods were determined through literatures of other researches of similar works. The best and most feasible methods were chosen to carry out the current study. The format of the aspects for which information was to be collected was prepared in advance and copies were made. The interviews were usually done at the respondents' houses. The questionnaire was modified again to fit the situation, adding more useful questions and removing some irrelevant or sensitive ones (Abram, 2008).

### **4.2.1 Household questionnaire survey**

The objective of this part was to obtain data on the extraction of resources from the park. Out of the 40 villages around the park, 36 villages were selected based on their proximity to the park and on their degree of dependence on the park. According to the

reconnaissance survey conducted in March 2007, the other 4 villages were distantly situated from the park and the villagers have no direct benefits or direct effect on the park. A questionnaire survey of 239 randomly selected households was successfully conducted across the four directions of the park during November 2007 to July 2009. Interviews were usually conducted around 09:00 am to 03:00 pm as the villagers were generally at home as they take a break from their work for lunch and rest during this time.

Adults were chosen for the interviews according to their availability, though the head of family (male or female) was usually preferred as they had more knowledge of resource extraction related activities. Questions were verbally administered in local language, Manipuri. No monetary gratuity was offered to any respondent. To avoid any distraught on seeking information about park resources (as it is illegal to collect anything from park), it was made clear that the investigation was purely personal and for academic purposes only.

The interviewees were asked if they derived any resources from the park and if yes, what were the resources collected, the parts collected and the utilization of these resources. They were asked about the distance they travelled for extraction activities, the time spent and whether they go alone or in groups. The quantity extracted was also asked, whether in head loads or bags or boats or in weight as per the type of resource. These quantities were cross checked at the entry points of human foot trails. The recall method was used to determine which species was available in which season especially for fishing, distance travelled, and the fishing gears used for different species or sizes of fish. Finally, the monetary value from the sale of these resources was inquired about.

#### **4.2.2 Entry point monitoring**

Monitoring of every entry point to quantify the extent of resource extracted from the park was not possible as the park was very porous. There were no proper demarcation of boundary (about 30 km) and strength of forest staff was very less. So, anybody can access the park from any direction anytime. People preferred to enter from some common points depending upon the purpose, closeness from their houses and accessibility of the *phumdis* or floating meadows. Some entry points were common for all purposes that is vegetable collection, fish feed collection, fuel wood collection

and fishing (from floating meadows esp. swamp eels, box traps fishing). Entry points for boats for collecting fish feed and open water fishing were different.

Five main entry points were selected for monitoring the extraction pattern of resources from the park throughout the year. Three entry points were located in the western direction, one in the southern and one in the eastern direction. No entry point could be monitored in the northern side since the northern side of the park is open water and there were no specific entry point. The quantity of the resources extracted and the species composition of both plants and fishes were noted across different seasons. The time of entering and exiting the park, number of members of groups, composition of group and reason for entering, were also noted. While exiting, the products extracted were weighed using spring balance and species noted (*Appendix II*). This information was crosschecked with that obtained from the questionnaire survey to assess the average weight of head load of fish feed, fuel wood and vegetable and also quantify the average fish catch, their species composition and also extraction across different seasons following Badola (1997a).

#### **4.2.3 Transects and simulated harvesting methods**

To analyse the impact of anthropogenic activities on the Keibul Lamjao grasslands, studies were made using transect surveys and experimental plots. The location where evidences of human activities, animals' signs and traps encountered were noted and later plotted on the map of the park to give a better understanding of human-animal encounter. To study the changes in the grassland spatially due to human disturbances, transect surveys of 500 m were made from the edge of the grassland towards the interior of the park across different disturbance zones and 3 quadrates of 0.25 m<sup>2</sup> (50 cm x 50 cm) were randomly laid at every 100 m distance. Counts of different tillers of grasses species-wise and average heights were recorded. The quadrate data were analysed to see how the composition varies along the transects.

To understand the trend in which grass composition might have changed over the years in the park due to human disturbances permanent plot experiments were conducted for selected four commonly extracted plants namely *Zizania latifolia* (fodder and thatch material) *Phragmites karka* (fuel wood) *Hedychium coronarium* (vegetable) and *Leersia hexandra* (fish feed/fodder) for the study. Experimental plots were laid in selected areas inside the park where contiguous distribution of the target plants were located. In each of the four sites for the four species, main plots (10 m x

10 m) were fenced with bamboo poles and a 2 m buffer was cleared by cutting down grasses along the boundary to prevent damage due to fires from neighbouring areas. Sub plots of 1 m x 1 m were demarcated by fixing jute ropes tied to bamboo poles. Each quadrat was again separated by a buffer of 1m in between two quadrats. Three harvesting regimes of no harvest (0%) half harvests (50%) and complete harvests (100%) were employed. The three treatments were randomized within the 3 blocks (3 replicates). Initial readings were taken during May 2010 for each quadrat and treatments were given to each plot by simulating the above harvesting methods to each species accordingly to the intensity of harvests. *Phragmites karka*, *Leersia hexandra* and *Zizania latifolia* were cut at the base of the stem/tillers as done during harvesting by the villagers while for *Hedychium coronarium* part of the rhizomes were also harvested to simulate the way it was being extracted by the villagers. For 0% harvesting plots no cuts were made, in 50% plots half of the total stems/tillers were cut selectively while for 100% harvest plots all the grasses were cut after recording the numbers to study the regenerative potential. Subsequently readings were taken in November, 2010 and the treatments were repeated, and then readings were taken again in April, 2011.

#### 4.2.4 Data analysis

The information from the household questionnaire survey were tabulated and classified into categories with respect to the directions. The quantities of resources extracted were worked out by multiplying the quantity per trips from the entry point monitoring and the number of trips for the month and for the whole year.

Household income was computed by summing up all the incomes accruing from agriculture, fishery, vegetable collection, daily wages and other sources to an individual household, as per following formula.

$$\text{Household income (Annual)} = \sum (\text{agriculture income}) + (\text{fishery income}) + (\text{daily wages}) + (\text{income from sale of forest produce}) + (\text{income from other sources})$$

The quantity of resources extracted in a year was worked out by multiplying the quantity per trip derived from the human foot trail monitoring and the number of trips for that month for the whole year.

$$\text{Resource extracted per household (annual)} = \sum (Q_x * \text{no. of trips} * \text{no. of days}) + (Q_y * \text{no. of trips} * \text{no. of days})$$

Where,  $Q_x$  = quantity of x product

$Q_y$  = quantity of y product

Dependence on the park was assessed considering the contribution to total annual income from the sale of products from the park.

$$\text{Dependence on park} = \frac{\text{Income from resource extraction}}{\text{Total income}} \times 100$$

## 4.3 Results

### 4.3.1 Frequency and pattern of resources extraction

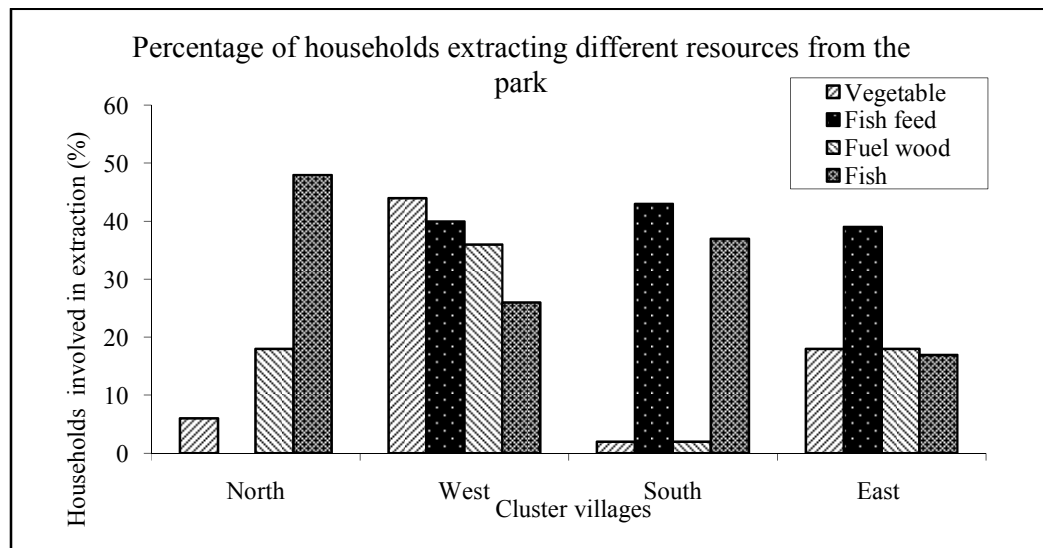
Though any sort of resource extraction is prohibited inside the KLNP, it occurred not only on the peripheral areas but throughout the length and breadth of the park. Besides depending on the park for commercial sale of vegetables and fishes, it was also found that people depended on the park for fuel wood for subsistence and fish feed (**Table 4.1**). Sixty-five percent of total households residing in the peripheral villages of the park extracted forest products in various forms with highest frequency (72%) in the western villages. It was observed that fishing was practiced by most of the families in all the clusters, the highest (48%) being in northern and least (17%) in eastern villages. Vegetable extraction was highest (44%) in the western villages as their secondary source of income while only 2% collected vegetable in the southern villages.

**Table 4.1:** Frequency of resources (%) harvested by respondents in KLNP, Manipur.

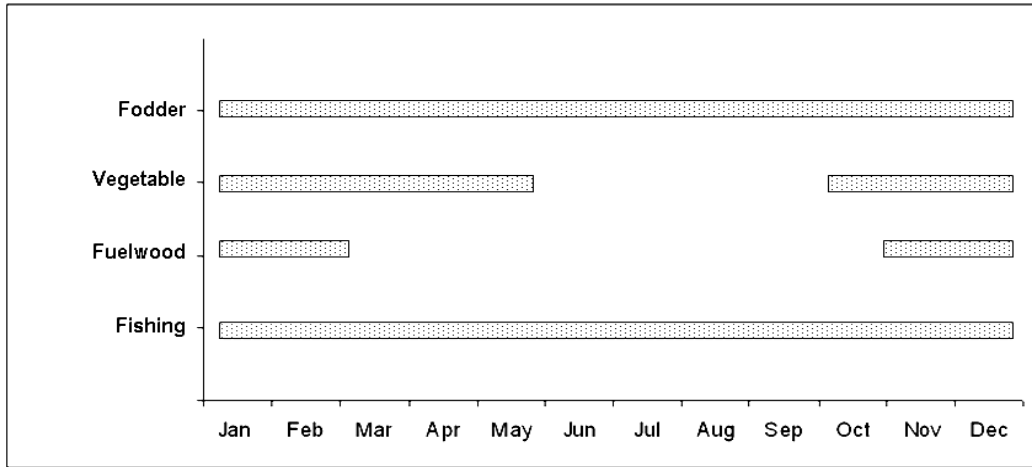
Resource	North		West		South		East		Total	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Fishing	48	52	26	74	37	63	17	83	29	71
Vegetable collection	6	94	44	56	2	98	18	82	18	82
Fuel wood	18	82	36	64	2	98	18	82	18	82
Fish feed	0	100	40	60	43	57	39	61	32	68
Any resource	54	46	72	28	63	37	68	32	65	35

Fuel wood extraction was highest (36%) in the western villages followed by northern and southern (18% each) whereas very few households (2%) collected fuel wood in the southern villages. Fish feed extraction was highest (43%) in the south owing to the large number of fish farms present there followed by the western cluster (40%) while nobody collected on the northern villages.

In the western cluster, many households collected most of the resources from the park while fishing was practiced by most of the families in the northern cluster (**Figure 4.1**). In the southern villages most of the households practiced fishing (37%) and collected fish feed (43%) while 39% families collected fish feed in the east. Extraction of resources from the park varied across the season as shown in **Figure 4.2**. Fish feed was collected throughout the season. The availability was less but young shoots were always available in KLNP since there was never a dry season. The extraction of vegetable started by October and continued up to May before the rains, the peak season being March and April when it coincided with the local New Year festival when the vegetables were more in demand. Fuel wood extraction was done only during the winter season i.e., November to March when the stems were mature and the leaves were dead and dry. Fishing was done throughout the year, the maximum catch was observed during May to August.

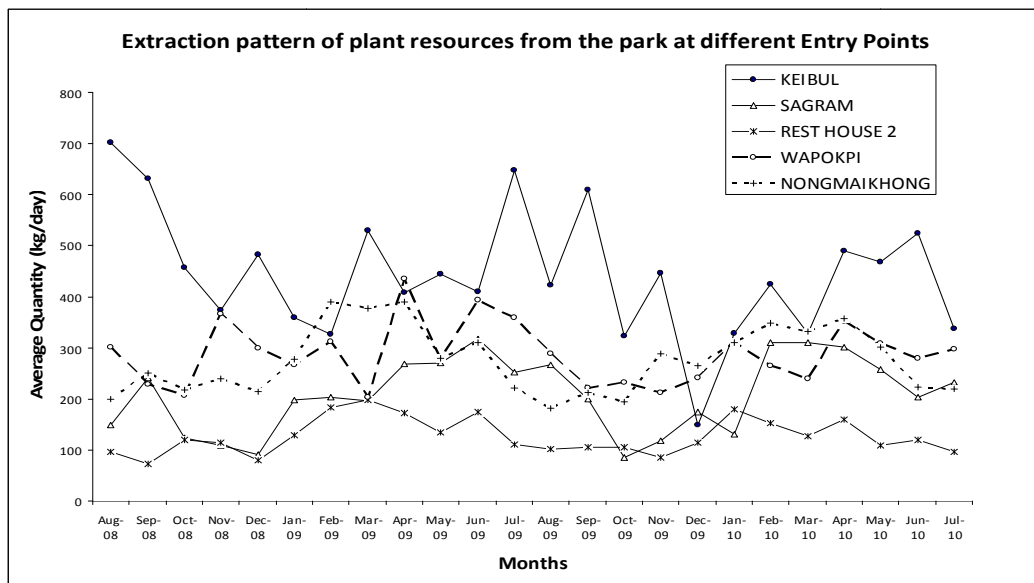


**Figure 4.1:** Percentage of households extracting different resources from KLNP, Manipur.

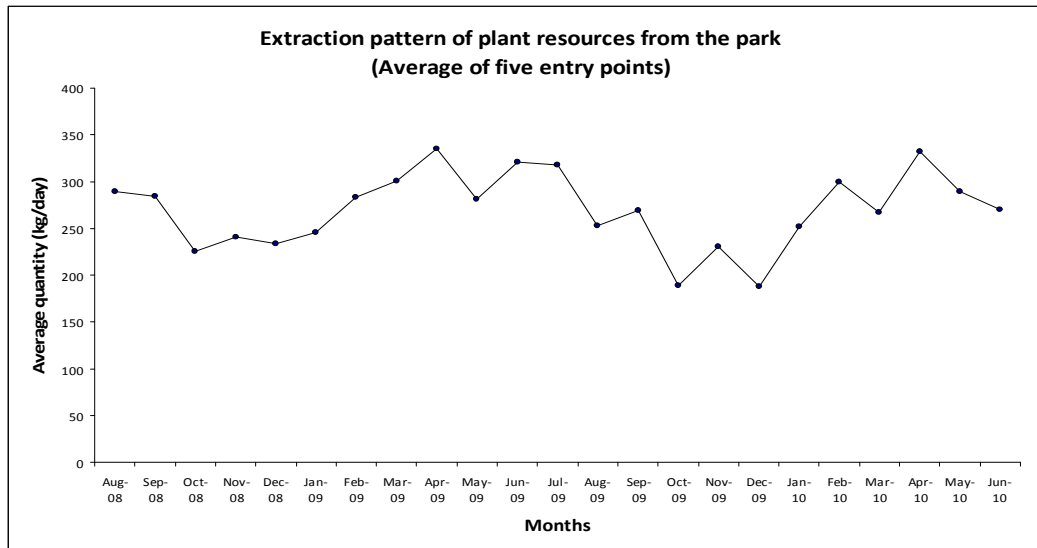


**Figure 4.2:** Resource extraction pattern across the seasons in KLNP.

From the five entry points monitored, maximum extraction was observed in the Keibul Mayai Leikai entry point located in the western cluster (**Figure 4.3**). The least was observed in the Rest House - II entry point which may be due to less people entering through this point as they have to pass through the KLNP's main gate. The daily average extraction of plants from 5 entry points is shown in **Figure 4.4**. There is an increasing trend in extraction starting December through April and decreases thereafter with lowest during October – November.



**Figure 4.3:** Extraction pattern of plant resources from the KLNP at different entry points.



**Figure 4.4:** Average monthly extraction of plant resources from KLNP.

Majority of the vegetable collectors were women and few men while fishing, fuel wood and fish feed collection were done only by men. Women go in small groups of 3-4 persons for vegetable collection while men go alone for fishing. Fish feed was usually collected solitarily in large quantities using dug out country boat. Fuel wood were cut and tied in bundles few days ahead and collected after some days during the dry season. They normally cover a distance of 2-3 km for most activities. Fishing was done during the early hours (04:00 am to 10:00 am) while vegetable collection was done after morning meal (10:00 am to 03:00 pm). Fish feed collection required less time and was done normally during morning hours (06:00 am to 09:00 am).

#### 4.3.2 Plant resources extracted

Various parts of the plants were extracted for different purposes. The main species extracted are listed in **Table 4.2** with their families and uses. Young and tender shoots of *Zizania latifolia* are edible and sometimes extracted for human consumption. The young leaves were mainly collected as fodder for cattle and as fish feed while the mature and dry leaves were used as thatch and as fencing material. Mature dry leaves were preferred over straw or hay for thatching since they do not attract rats unlike paddy stalks and can last about 10 years, longer than paddy stalks.

**Table 4.2:** Local uses of the plant products extracted from KLNP, Manipur.

Plant name	Family	Local name	Local uses
<i>Zizania latifolia</i>	Poaceae	Ishing kambong	Tender shoot edible, leaves as thatch, fencing material and fish feed
<i>Leersia hexandra</i>	Poaceae	Hoop	Fish feed and cattle fodder
<i>Phragmites karka</i>	Poaceae	Tou	Fuel wood and fencing
<i>Saccharum spontaneum</i>	Poaceae	Khoimom	Fuel wood
<i>Hedychium coronarium</i>	Zingiberaceae	Loklei	Rhizome and tender shoot as vegetable
<i>Hydrilla</i> spp.	Hydrocharitaceae	Charang	Fish feed
<i>Oenanthe javanica</i>	Apiaceae	Komprek	Tender shoot as vegetable

*Leersia hexandra* was extracted extensively and primarily as cattle and fish feed. *Saccharum spontaneum* was mainly used as fuel wood while *Phragmites karka* was used as fuel wood as well as fencing material since the stems are straight and stronger. The rhizome and tender shoots of *Hedychium coronarium* were extracted in large quantities to be commercially sold as vegetable. *Hydrilla* spp. were also collected from the water to be used as feed for fingerlings. The young shoots of *Oenanthe javanica* were extracted in lesser quantity to be used and sold as vegetable.

#### 4.3.2.1 Quantification of plant resources extracted

Through the questionnaire survey of 239 sample households (covering 36 villages located within 3km of the park boundary on all directions) out of the total 2675 households comprising 8.9% of the population using recall method for computing the yearly extraction of resources based on daily/weekly or monthly average collection in terms of weight or head loads, the annual extraction of plant resources from KLNP was estimated to be  $32,627.6 \pm 7,121.1$  ton year<sup>-1</sup> (fresh weight) (**Table 4.3**). Out of this computed estimate maximum collection was observed for fish feed,  $28,643.2 \pm 7058.9$  ton year<sup>-1</sup> (87.8%) followed by fuel wood,  $2863.9 \pm 1090.5$  ton year<sup>-1</sup> (8.8%) and least,  $1120.5 \pm 342.6$  ton year<sup>-1</sup> (3.4%) from vegetable collection.

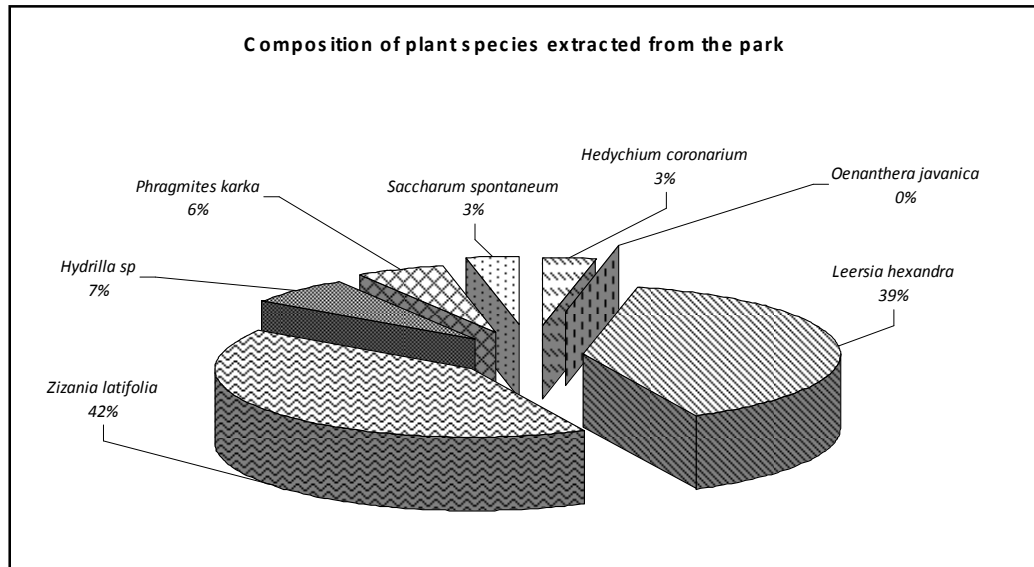
**Table 4.3:** Quantity of different plant materials extracted (ton year<sup>-1</sup>).

Type of resource	North	West	South	East	Total
Fish feed	0.0	8049.7	9607.5	10986.0	28643.2 ± 7058.9
Fuel wood	748.9	1379.9	7.0	728.1	2863.9 ± 1090.5
Vegetable	1.4	795.2	4.3	319.6	1120.5 ± 342.6
Total	750.3 ± 541.8	10224.7 ± 3546.6	9618.8 ± 3453.3	12033.8 ± 2645.5	32627.6 ± 7121.1

Overall maximum (42%) extraction was estimated for *Zizania latifolia* (13,592.9 ± 3,349.9 ton year<sup>-1</sup>) followed (32%) by *Leersia hexandra* (12,846.8 ± 3,166 ton year<sup>-1</sup>) (**Table 4.4** and **Figure 4.5**). *Oenanthe javanica* was extracted in least quantity (< 0.001%) with 4.9 ± 1.5 ton year<sup>-1</sup>. The extraction was highest in the eastern villages (12,033.7 ± 2,645.5 ton year<sup>-1</sup>) with maximum collection of *Zizania latifolia* (5,712.8 ton yr<sup>-1</sup>) and *Leersia hexandra* (4,723.9 ton year<sup>-1</sup>).

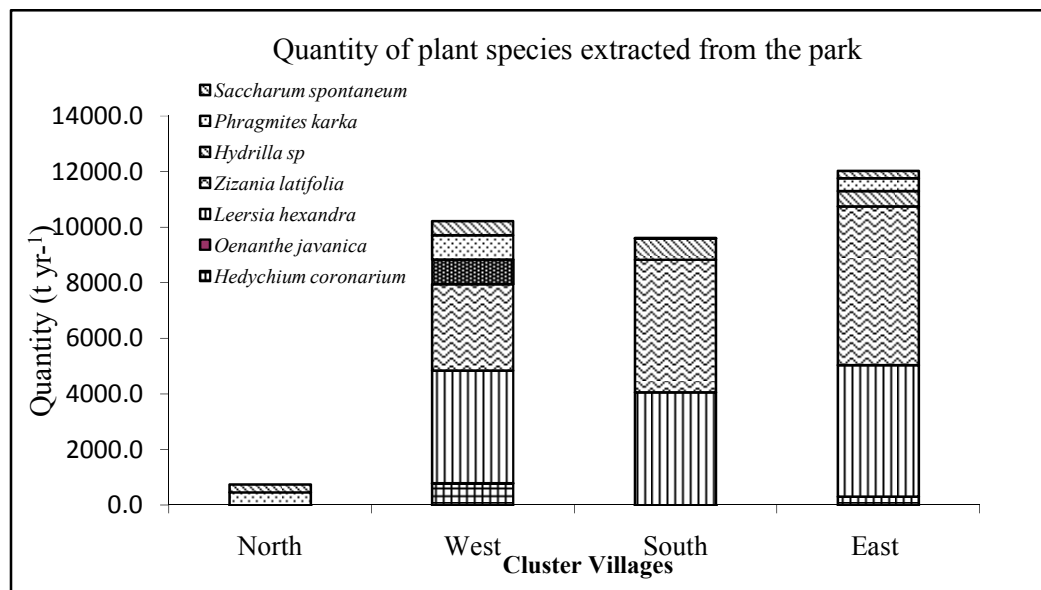
**Table 4.4:** Quantity of different plant species extracted (ton year<sup>-1</sup>) from KLNP.

Plant Species	North	West	South	East	Total
<i>Zizania latifolia</i>	0.0	3107.2	4772.9	5712.8	13592.9 ± 3349.9
<i>Leersia hexandra</i>	0.0	4057.1	4065.8	4723.9	12846.8 ± 3166
<i>Hydrilla</i> spp.	0.0	885.5	768.8	549.3	2203.6 ± 543.1
<i>Phragmites karka</i>	471.8	869.1	4.4	458.7	1804 ± 687
<i>Hedychium coronarium</i>	1.4	790.4	4.2	319.6	1115.6 ± 341.1
<i>Saccharum spontaneum</i>	277.1	510.6	2.6	269.4	1059.7 ± 403.5
<i>Oenanthe javanica</i>	0.0	4.8	0.1	0.0	4.9 ± 1.5
Grand total	750.3 ± 541.8	10224.7 ± 3546.6	9618.8 ± 3453.3	12033.8 ± 2645.5	32627.6 ± 7121.1



**Figure 4.5:** Composition of plant species extracted from KLNP.

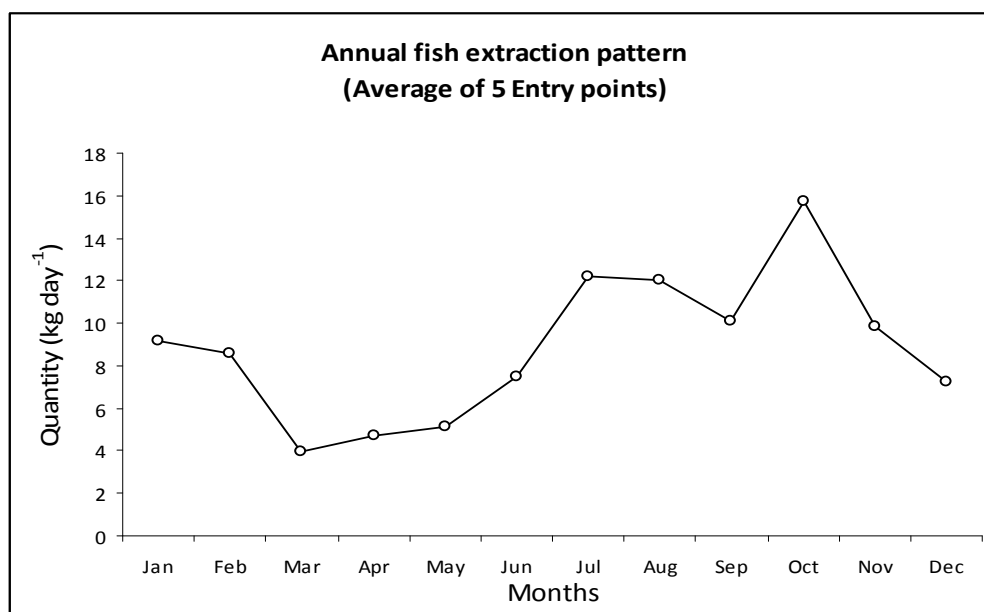
Similar pattern was observed in the western and southern villages (**Figure 4.6**). The least was observed in the northern villages ( $750.3 \pm 541.8 \text{ ton year}^{-1}$ ) with collection of mostly fuel wood species (*Phragmites karka* and *Saccharum spontaneum*). *Hedychium coronarium* was collected mostly in the western villages ( $790.4 \text{ ton year}^{-1}$ ) and half that quantity in the east ( $319.6 \text{ ton year}^{-1}$ ).



**Figure 4.6:** Quantity of plant species extracted from KLNP.

### 4.3.3 Fish resource extraction

Fishing was done throughout the year. Different fishing gears were used depending on the type of species, season and also the economic background of the household. Nets (**Plate 4.1/a**) and *hapha* (**Plate 4.1/b**) were usually used in open waters, *lu* (**Plate 4.1/c**) in floating meadows, hooks in fishing lines (**Plate 4.1/d**) in open water, hooks in rods (**Plate 4.1/e**) in floating meadows, and *chagairong* (**Plate 4.1/f**) for fishing in thin floating meadows. The catch gradually increases from March to November and again gradually drops during the severe winter months. The catches were usually sold off fresh to local middlemen, who in turn sold them in Imphal or other nearby markets. Sometimes the catches were smoked over fire and collections over 4/5 days were sold later. From the human foot trail monitoring the average fish caught per day was observed to increase from the month of June onward till October-November and then gradually decreased till March- April (**Figure 4.7**).



**Figure 4.7:** Annual fish extraction pattern according to entry point monitoring in KLNP.

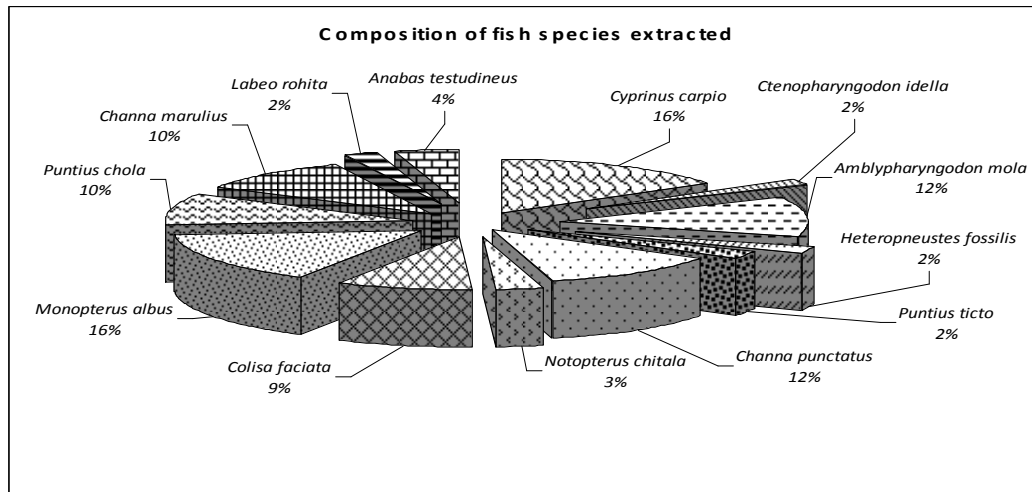
#### 4.3.3.1 Quantification of fish resources extracted

The total fish caught from the park was estimated to be  $304.9 \pm 45.1$  ton year<sup>-1</sup> (**Table 4.5**) with maximum (42%) in the northern villages ( $128.2 \pm 27.5$  ton year<sup>-1</sup>) followed by eastern villages. *Monopterus albus* was caught in maximum quantity ( $47.9 \pm 7.1$  ton year<sup>-1</sup>) in all the directions (16%) except the northern villages followed by

*Cyprinus carpio* ( $47.6 \pm 7.0$  ton year<sup>-1</sup>) (**Figure 4.8**). *Ctenopharyngodon idella* was caught in the lowest quantity ( $5.6 \pm 0.8$  ton year<sup>-1</sup>) only in the northern and eastern villages but it is one of the most highly priced fish. *Amblypharyngodon mola*, *Puntius chola*, *Channa marulius* were more common on the northern villages while *Monopterus albus* and *Colisa faciata* were caught more on the western villages. Common carp (*Cyprinus carpio*) dominated the eastern villages catch while *Monopterus albus* and *Channa punctatus* were more commonly caught in the southern villages. Overall *Monopterus albus*, *Channa punctatus*, *Puntius chola*, *Channa marulius*, *Cyprinus carpio* and *Amblypharyngodon mola* comprises 85% of the total catch.

**Table 4.5:** Quantity of annual fish caught from KLN (ton year<sup>-1</sup>).

Scientific name	Local name	North	West	South	East	Total
<i>Monopterus albus</i>	Ngapurum	-	24.9	16.8	6.2	47.9 ±7.1
<i>Cyprinus carpio</i>	Puk laolabi	15	1.2	3.5	27.9	47.6 ± 7.0
<i>Amblypharyngodon mola</i>	Mukanga	29.5	2.9	0.9	3.1	36.4 ± 5.4
<i>Channa punctatus</i>	Ngamu	19.6	3.8	10.4	2.5	36.3 ± 1.1
<i>Channa marulius</i>	Porom	20.7	-	-	9.9	30.6 ± 4.5
<i>Puntius chola</i>	Phabou	24.2	0.4	2.3	2.5	29.4 ± 4.4
<i>Colisa faciata</i>	Ngapema	-	16.8	8.5	1.9	27.2 ± 4.0
<i>Anabas testudineus</i>	Ukabi	-	9	2.5	1.2	12.7 ± 1.9
<i>Notopterus notopterus</i>	Ngapai	5.9	0.4	3.5	-	9.8 ± 5.4
<i>Puntius ticto</i>	Ngakha	7.4	-	-	-	7.4 ± 1.0
<i>Labeo rohita</i>	Rou	1.5	-	-	5.6	7.1 ± 1.1
<i>Heteropneustes fossilis</i>	Ngachik	-	-	6.9	-	6.9 ± 1.0
<i>Ctenopharyngodon idella</i>	Napi chabi	4.4	-	-	1.2	5.6 ± 0.8
Total		128.2 ±7.5	59.4 ±22.3	55.3 ±11.6	62 ±12.0	304.9 ±45.1



**Figure 4.8:** Composition of fish species extracted from KLNP.

#### 4.3.4 Dependency of people on KLNP

Access to products from natural forest enhances the welfare of the local people (Fisher, 2004). Incomes from environmental sources play an important role in rural livelihoods in developing countries (Babulo et al., 2009). Forests are important to rural people for subsistence and market income, for insurance in times of need and as ‘bank’ for self-financing of investments in alternate productive activities (Hecht et al., 1988; Godoy et al., 1998; Pattanayak and Sills, 2001; Takasaki et al., 2004; McSweeney, 2002). Products from forest environmental sources contribute significantly to rural households' economic well being (Vedeld et al., 2004; Fisher, 2004; Mamo et al., 2007). Studying the distinctive patterns of resource draw and reliance would be useful to suggest specific ‘targets’ and ‘means’ for efforts seeking to conserve forest resources and reduce poverty through enhanced forest use.

A close examination of the local households (**Table 4.6**) around KLNP revealed that as high as 65% (1,745) households in all villages depended on the park for some resource or other, the highest 72% (507) households in the western villages. Income as high as ₹39,676 ± 4,283 household<sup>-1</sup> from sale of resources like vegetables and fishes was derived annually in the western villages. As many as 62% (436) households directly derived income from park in western villages while it was only 32% (297) in eastern villages. Percentage contribution of income from the park resources to total annual income varied from highest (40.48 ± 5.0%) in the western villages followed by north with 32.07 ± 5.23% and least on the eastern villages (18.9 ± 3.47%). The percentage contribution to annual family income only for those who

depended on the park ranged almost equally for the entire village clusters varying from  $57.3 \pm 7.99\%$  to  $59.5 \pm 5.87\%$ .

**Table 4.6:** Dependence of the peripheral villagers on KLNP.

Parameters	North	West	South	East	Mean	<i>p</i>
Number of households	542	704	502	927	2675*	
Number of families depending on the park for any purpose (%)	292 (54%)	507 (72%)	316 (63%)	630 (68%)	1745* (65%)	
Average annual family income (₹) ± SEM	84300 ± 10463	72186 ± 6837	67316 ± 8820	60252 ± 4419	69228 ± 3610	ns
Average annual income from the park (₹) ± SEM	28726 ± 3121	39676 ± 4283	18711 ± 1904	26660 ± 2474	13931 ± 1610	0.018
Average % contribution to family income for the cluster villages ± SEM	32.07 ± 5.23	40.48 ± 5.0	23.37 ± 5.18	18.9 ± 3.47	27.08 ± 2.32	0.004
Average % contribution to annual family income for those who depend on the park. ± SEM	57.3 ± 5.95	59.5 ± 5.87	57.3 ± 7.99	58.6 ± 5.99	58.3 ± 2.9	ns
Number of families directly deriving income from extraction of resources (%)	206 (38%)	436 (62%)	206 (41%)	297 (32%)	1145* (43%)	

ns= not significant, Value with \* are total value

#### 4.3.5 Impacts of anthropogenic activities on KLNP

During the transect surveys, evidences of human activities like vegetable cutting, fodder/fish feed cuttings, fuel wood cutting were encountered. The scats or feeding signs of wild animals like Sangais, hog deers and wild pigs were also observed. Traps set to catch animals as well as birds were chanced upon (**Plate 4.3**). The locations of these evidences were plotted on the map (**Figure 4.9**). Vegetable extraction evidences were observed more in the thick floating meadows of western zone of the park. Hog deer scats were most encountered in the western and central zones. But the presence of Sangais and wild pigs were mostly in the western zone near the hillocks of Pabot and Chingjao. The presence of animals traps were in corresponding to the locations where the animals were also found, that is, in the western and central zones.

In the transect survey to assess the vegetation structure in relation to the disturbance in KLNP, 62 plant species were encountered across different zones of the park. Among the grass species highest (11.39%) occurrence was observed for *Leersia*



(a) Nets for general fishing



(b) *Hapha* for fishing in open waters



(c) *Lu* (Box trap) for fishing in floating



(d) Hooks for fishing in open waters



(e) Hooks for catching swamp eels



(f) *Chagairong* for fishing in thin floating

**Plate 4.1:** Fishing gears used for different conditions of KLNP.

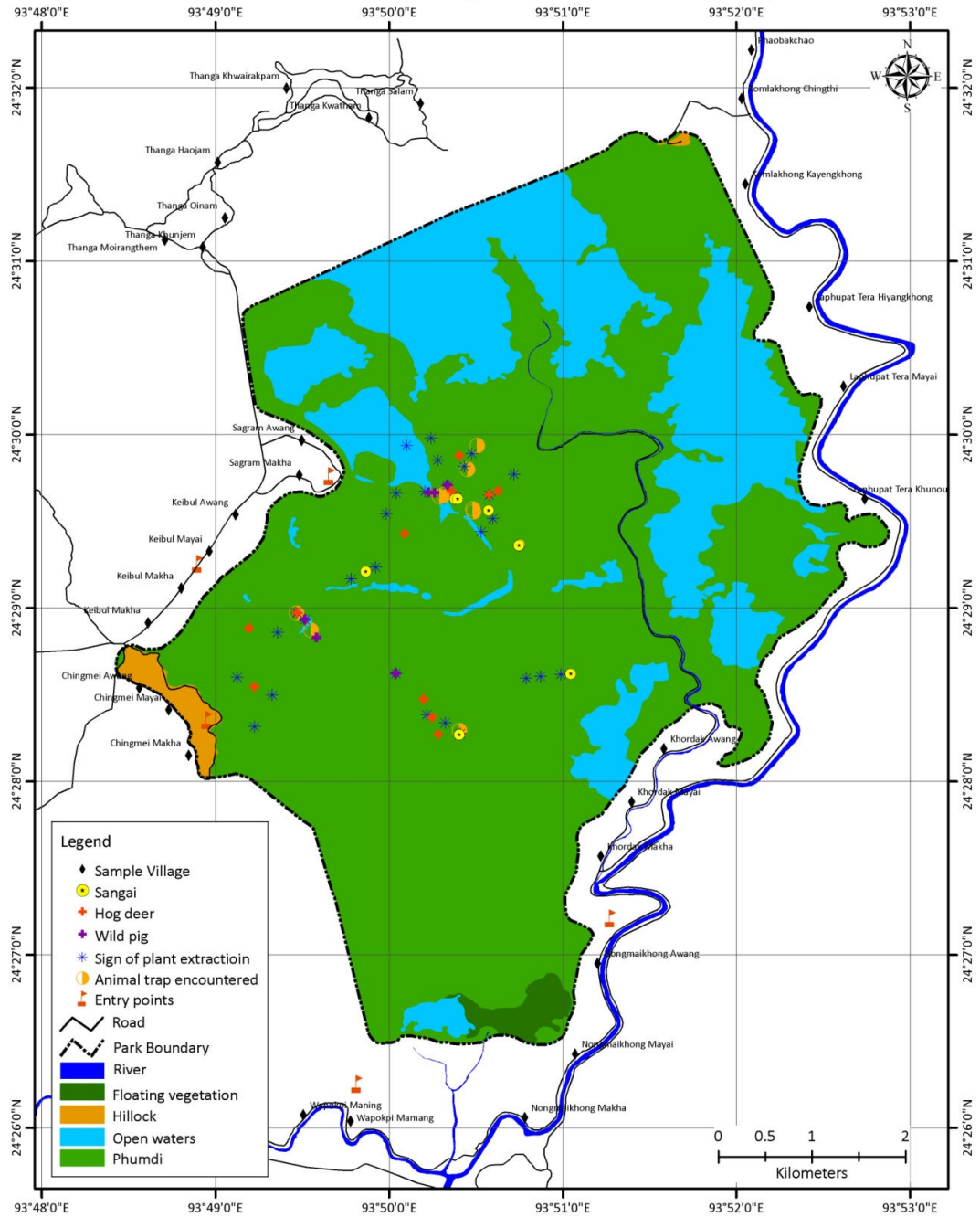
*hexandra* followed closely (10.06%) by *Capillipedium assimile* and *Zizania latifolia* (8.06%). Occurrence of ferns (*Pteris* sp.) was more common especially in open areas and preceded many of the other grass species in the park like tall reeds (*Phragmites karka*). Percentage occurrence of top 22 species are shown in **Table 4.7** and the rest of the grass species were clubbed together as others comprising of 16.93 %.

**Table 4.7:** Grassland composition of KLNP as recorded during 2010.

<b>Botanical name</b>	<b>Local name</b>	<b>% of occurrence</b>
<i>Leersia hexandra</i> Sw.	Hoop	11.39
<i>Capillipedium assimile</i> (Steud) A. Camus	Wana manbi	10.06
<i>Zizania latifolia</i> Griseb.	Ishing kambong	8.06
<i>Pteris</i> sp.	Changhang	6.96
<i>Phragmites karka</i> (Retz.) Trin.	Tou	6.41
<i>Blumea</i> sp.	Langthrie manbi	6.01
<i>Oenanthe javanica</i> (Blume.) DC.	Komprek	5.12
<i>Persicaria perfoliata</i> Linn. H. Gross	Lilha	4.82
<i>Saccharum munja</i> Roxb.	Khoimon	3.69
<i>Eupatorium</i> sp.	Kombirei manbi	3.57
<i>Heydichium coronarium</i> Koen.	Loklei	3.10
<i>Eclipta prostrata</i> Linn.	Phum khokchang	2.85
<i>Arundenlle nepalensis</i> Trin.	Pakhang paya	2.72
<i>Persicaria chinensis</i> (L) H. Gross	Yenghuman	1.66
<i>Fuirena umbellata</i> Rottb.	Lamthangchou	1.58
<i>Alternanthera philoxeroides</i> (Mart.) Griseb	Kabo napi	1.37
<i>Brachiaria mutica</i> (Forssk) Stapf	Napi tujombi	1.10
<i>Aspidopterya ellipta</i> Bl. (Juss.)	Uri	1.04
<i>Polygonum barbatum</i> Linn.	Morok sabi	1.00
<i>Carex indica</i> Linn.	Humdang	0.29
<i>Coix lachryma-jobi</i> Linn.	Yawa chaning	0.14
<i>Oryza rufipogon</i> Griff.	Wainu chara	0.13
Others		16.93

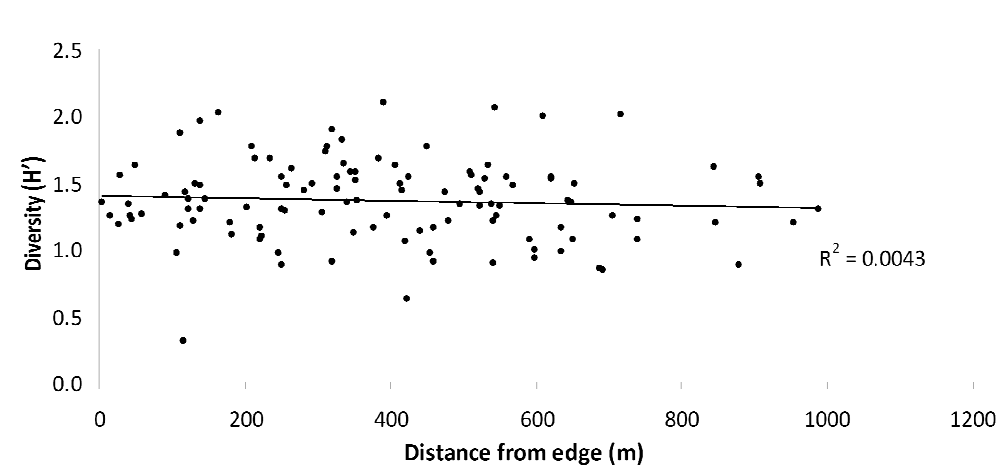
# Keibul Lamjao National Park, Manipur

(Location of human trails and signs of wild animals inside the Park)

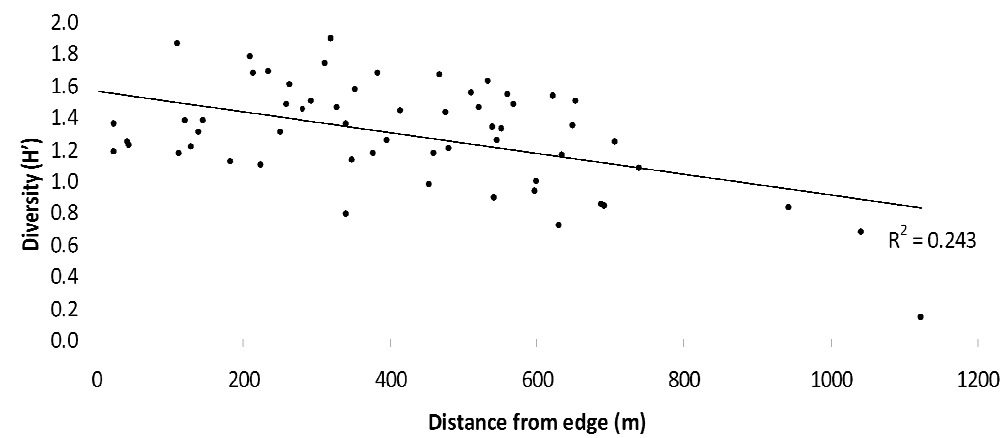


**Figure 4.9:** Map of KLNP showing location of human trails and signs of wild animals.

The diversity of plants along the transects showed significant difference spatially across different disturbance regimes and also from the grassland periphery towards the interior. Shannon Weiner's index ( $H'$ ) of diversity was greater for interior areas ( $H'=2.861$ ) than peripheral areas ( $H'=2.467$ ). The two indices were found to be significantly different ( $t=4.699$ ,  $df = 46$ ,  $p<0.01$ ). The Shannon Weiner index ( $H'$ ) plotted against distance from the edge of the grassland in two different zones of disturbance regimes (**Figure 4.10i and Figure 4.10ii**) also indicated that there was no particular trend in the less disturbed zone whereas significant ( $p<0.05$ ) decrease in diversity index was observed in the high disturbance zone.



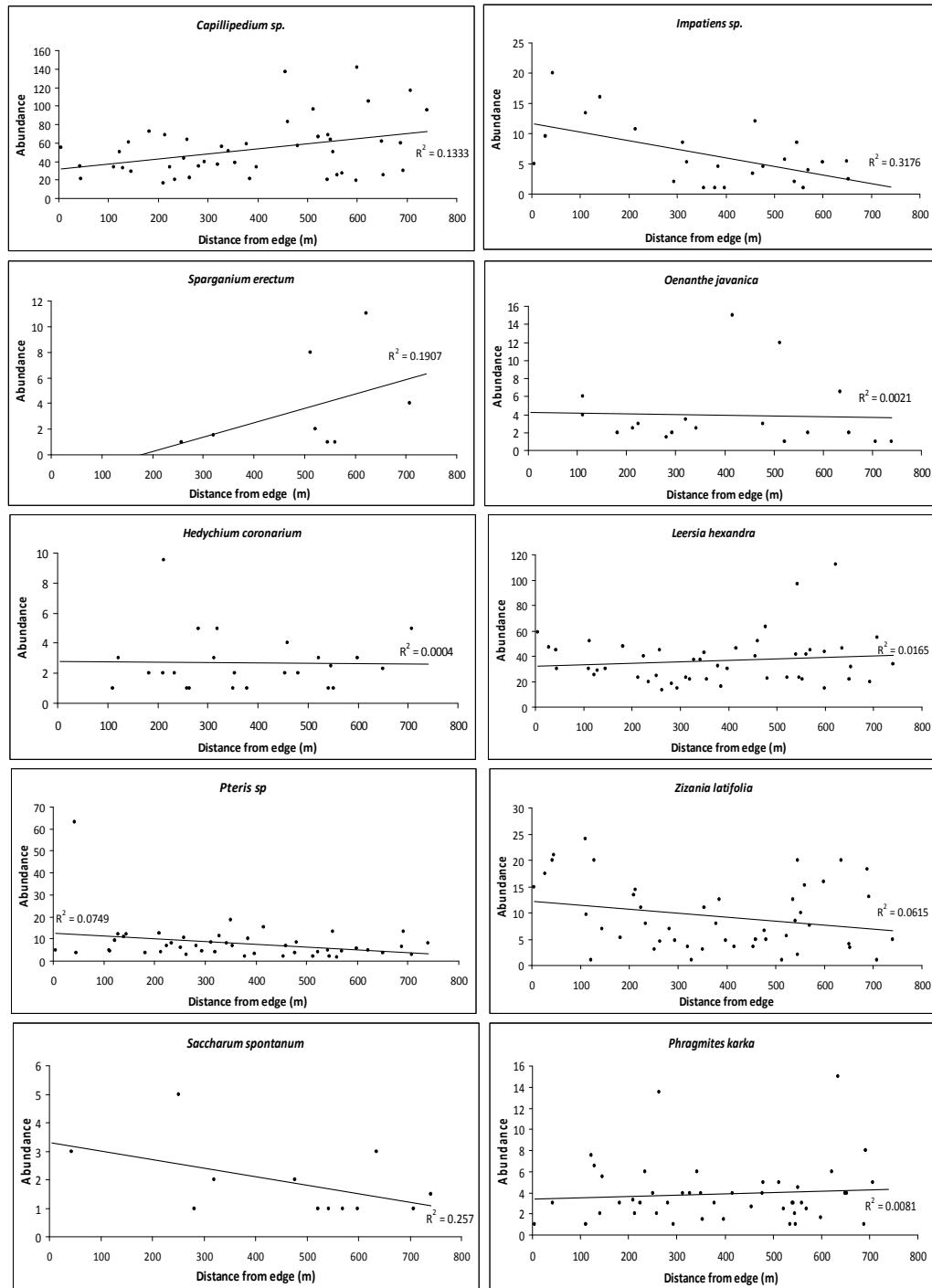
**Figure 4.10i:** Less disturbance zone of KLNP.



**Figure 4.10ii:** High disturbance zone of KLNP.

The results from the transect survey for abundance of grass species and herbs also showed varying trends for different species. While *Impatiens* sp. and *Saccharum* sp.

showed slight negative trend with distance from the edges, *Sparganium erectum* and *Capillipedium* sp. showed slight positive trend and the other species did not follow any trend (**Figure 4.11**).



**Figure 4.11:** Relationship between grass species abundance with distance from edge of KLNP.

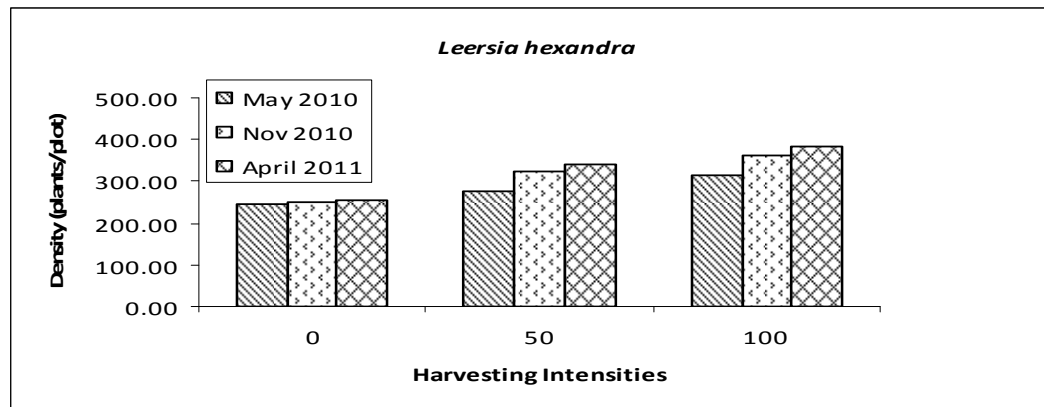
The results from the simulated harvest experiment of few important grass species showed varied responses to the different treatments. Significant increase in the plant densities were observed for control and complete harvest treatment in *Leersia hexandra* as compared to 50% harvesting (Table 4.8 and Figure 4.12).

**Table 4.8:** Density of individuals before and after subsequent harvests for *Leersia hexandra* at different harvest intensities (\* = significant at 0.10 level).

Level of harvest (%)	Density May 2010	Density Nov 2010	t-value
0	245.00 ± 13.23	250.67 ± 9.24	2.2
50	276.67 ± 25.17	323.33 ± 40.42	3.2
100	315.00 ± 5.00	360.00 ± 17.32	3.6

	Density Nov 2010	Density April 2011	t-value
0	250.67 ± 9.24	254.00 ± 10.39	5.0*
50	323.33 ± 40.42	341.67 ± 34.49	2.2
100	360.00 ± 17.32	381.67 ± 24.67	4.9*



**Figure 4.12:** Densities of plant before and after subsequent harvests of *Leersia hexandra* at different harvesting intensities.

In the case of *Hedychium coronarium*, controlled plot showed a significant increase in the plant densities (Table 4.9) whereas there was a significantly drastic decrease in densities in the 50% harvest. Decrease in plant densities was also observed in complete harvest plots though it was not significant (Figure 4.13).

In the case of *Zizania latifolia*, 50% and 100% harvesting intensities did not have significant impact on the densities of plants in the plots (Table 4.10) but significant increase in the density was observed in 0% harvest (Figure 4.14). Complete

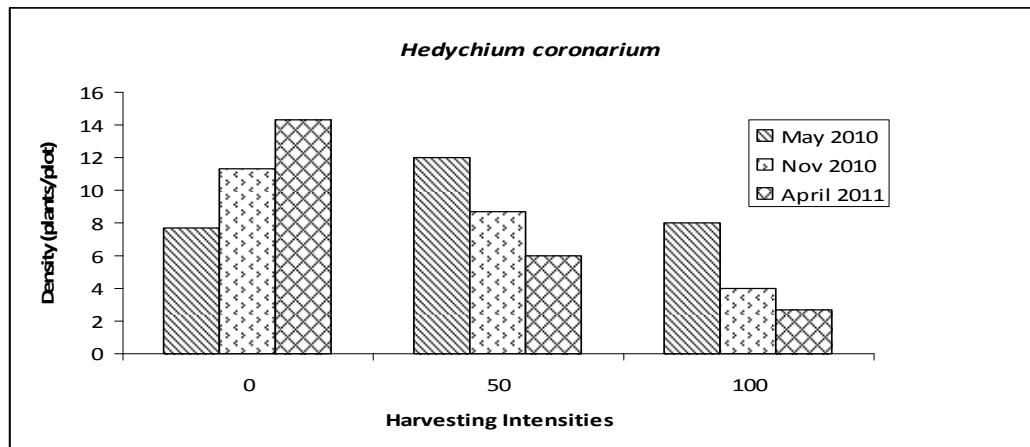
harvesting in *Phragmites karka* significantly reduced the plant densities in the plots while no harvest showed a significant increase in density (Table 4.11) whereas 50% harvesting shows a slight increase in densities which was not significant as compared to the control (Figure 4.15).

**Table 4.9:** Density of individuals before and after subsequent harvests for *Hedychium coronarium* at different harvest intensities (\* = significant at 0.10 level).

Level of harvest (%)	Density May 2010	Density Nov 2010	t-value
0	7.67 ± 2.1	11.3 ± 2.31	11.0*
50	12.00 ± 5.20	8.67 ± 1.86	2.8
100	8.00 ± 6.56	4.00 ± 2.00	1.5

	Density Nov 2010	Density April 2011	t-value
0	11.3 ± 2.31	14.33 ± 1.16	2.6
50	8.67 ± 1.86	6.00 ± 2.65	8.0*
100	4.00 ± 2.00	2.67 ± 1.16	4.0



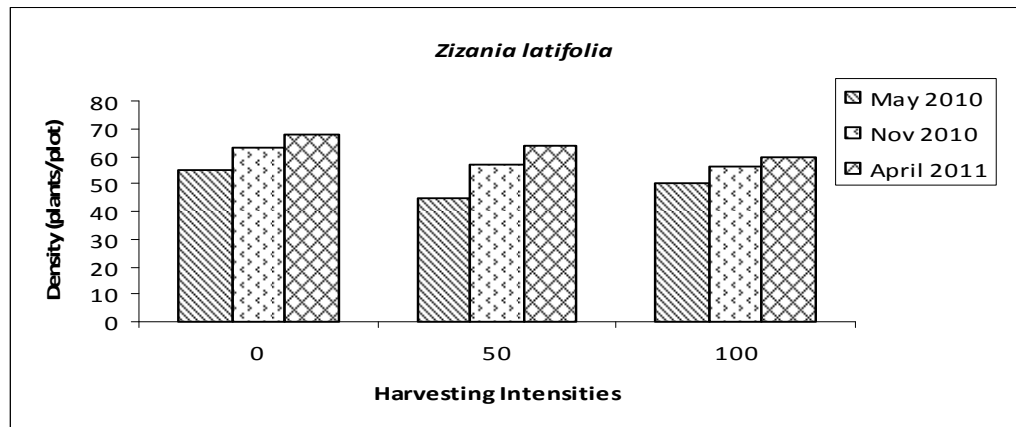
**Figure 4.13:** Densities of plant before and after subsequent harvests of *Hedychium coronarium* at different harvesting intensities.

**Table 4.10:** Density of individuals before and after subsequent harvests for *Zizania latifolia* at different harvest intensities (\* = significant at 0.10 level).

Level of harvest (%)	Density May 2010	Density Nov 2010	t-value
0	55.00 ± 21.79	63.00 ± 22.61	13.9*
50	45.00 ± 15.00	56.67 ± 16.07	3.5
100	50.33 ± 20.01	56.00 ± 17.69	2.4

	Density Nov 2010	Density April 2011	t-value
0	63.00 ± 22.61	67.67 ± 23.11	7.0*
50	56.67 ± 16.07	64.00 ± 18.25	2.8
100	56.00 ± 17.69	59.33 ± 16.92	3.8



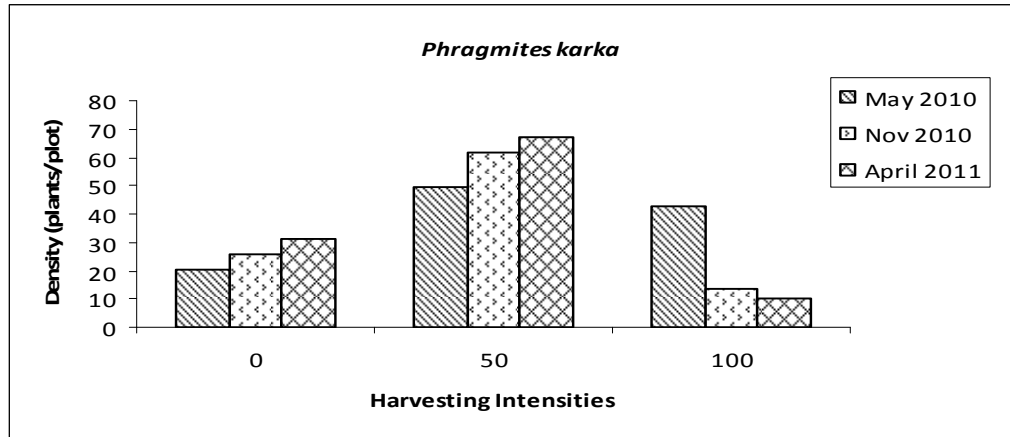
**Figure 4.14:** Densities of plant before (May 2010) and after subsequent harvests *Zizania latifolia* at different harvesting intensities.

**Table 4.11:** Density of individuals before and after subsequent harvests for *Phragmites karka* at different harvest intensities (\*= significant at 0.10 level).

Level of harvest (%)	Density May 2010	Density Nov 2010	t-value
0	20.67±11.02	25.67±13.05	3.3
50	49.67±25.70	61.67±33.29	1.8
100	42.67±8.74	13.33±5.77	5.5*

	Density Nov 2010	Density April 2011	t-value
0	25.67±13.05	31.00±14.73	4.4*
50	61.67±33.29	67.00±35.68	3.7
100	13.33±5.77	10.00±4.36	3.8



**Figure 4.15:** Densities of plant before (May 2010) and after subsequent harvests of *Phragmites karka* at different harvesting intensities.

#### 4.4 Discussion

Illegal resource extraction threatened conservation in protected areas in developing world (Skonhoft and Solstad, 1996). In contrast to the extraction of timber from forest areas, the people benefiting from the sustainable collection of NTFPs were the population in and around the forest. But it was also sometimes essential to accurately quantify the number of people using resources within a protected area. By understanding who the resource users were (Infield, 1988; Newmark et al., 1993; McGregor, 1995) or how many of them exist (Narendran et al., 2001) park managers can use such data to guide programmatic decisions; thereby increasing the likelihood that conservation goal will be achieved.

Despite declaration of Keibul Lamjao National Park in 1977 with the settlement of all rights, illegal collection of plant materials for vegetable, fuel and fodder and fishing was going on (Prasad and Chhabra, 2001). The claims were settled and compensations were paid to the effected farmers before finally declaring the KLNP but the dependence of local population on the products from the park for their livelihoods which was a traditional right since time immemorial was not addressed properly. Due to the sudden prohibition of collection of plant materials and fishing in the park which was the sole source of their livelihood, there was a public uproar in 1979 which damaged parts of the park and forest offices which proved to be a serious threat to the existence of Sangai in the park. In order to prevent the antagonisation of the local people towards the park and to prevent the repeat of that incidence, collection of

plants and fishing was allowed but with constant monitoring. Even E.P. Gee had mentioned about this issue in his report during his visit in 1959 and 1960 (Gee, 1960). When the park was a wildlife sanctuary he had observed the dependence of local people on the park and one of his recommendations was ‘fishing and cutting of reeds in the sanctuary, if an established right and not preventable, should be carefully watched so that there will be a minimum danger and disturbance to the deer’. Singh (1997) had also reported that total prohibition of illegal entry and extraction of resources from the park was difficult to be achieved and the local people around the park still preferred the park to be their fishing ground, and for their own use for cultivation and collection of reeds.

Different type of activities of resource extraction (Sah and Heinen, 2001) from KNLP prevailed in different villages located at different directions of the park in the form of plant and fish resource extraction (de Boer and Baquete, 1998). Majority of the villages collected some resources or other from the park as the park was almost ‘open access’ to all. According to the survey conducted during early part (Trisal and Manihar, 2004) of the last decade, it was estimated that 33% of the lakeshore households harvest aquatic vegetation for use as fuel; 18% for use as vegetables; 2% for use as fodder and 1% for manufacturing handicrafts.

However, with the present survey detailing into villages across different directions around the park a deeper insight of the use of the park for different use has been revealed. While resources like fish feed and fish were extracted throughout the year, vegetable and fuel wood were seasonal. Similarly, in a study conducted in the Nilgiri Biosphere Reserve, it was observed that collection of NTFPs took place throughout the year but some species were collected only during particular seasons of the year (Narendran et al., 2001).

Moreover, majority of the economically important plant species were distributed/ confined to the thicker floating meadows on the western side of the park as indicated in the report from a study by Loktak Development Authority (Loktak Atlas). The grass collected for fish feed was higher in the southern villages as more households owned fish farms, and pisciculture was a major primary occupation as compared to other cluster villages (*please see Table 4.1 and Table 4.3*). Nobody collected fish feed in the northern villages since majority of them owned *athaphums* which does not use green fish feed to feed the fish but rice husks and bran to attract the fish inside the

*athaphum*. Fish feed collection was a yearlong practice as depicted on **Figure 4.2** since it was required to feed the fish with fresh feed daily. Fuel wood collection for the entire year was done during the drier season. It was highest in the western villages as majority of them depended on the park for it as compared to other clusters and fewer families purchased it from the market (*please see Table 4.3*). The other reason was that more of the thick floating meadows where the fuel wood species grow were located on this side of the park. According to the reports from Loktak Development Authority (Trisal and Manihar, 2004), in the northern villages of Thanga islands and surrounding villages 28% of the households depend on aquatic vegetables for use as vegetables while in the south western villages around the lake 46% depended on the aquatic vegetables for fuel, 26% for vegetables and 3% for fodder. The villages around Phoubakchao in the northeastern periphery of the park 20% of the households depend on the aquatic vegetation for fuel, 8% for vegetable, 3% for fodder and 1.5% for handicrafts.

Vegetable collection was not done during the monsoon rainy season except very few individuals who make an earning out of it throughout the year. Although *Zizania latifolia* and *Leersia hexandra* were extracted in large quantities they did not contribute directly to the income of the family unlike *Hedychium coronarium* which were mainly extracted for commercial purpose (*please see Table 4.4*). Vegetable collection was one of the major activities as secondary occupation especially in the western villages. This may be attributed to the easy access to the thicker floating meadows in close proximity where movement on the floating meadows was not a problem for the women. Annually 15,400 MT of plant biomass was harvested for use as fuel, 1,900 MT for use as vegetables, 230 MT for use as fodder and 40 MT for making handicrafts (Trisal and Manihar, 2004).

Fishing was practiced throughout the year regardless of the season. Fishing was not only confined to the northern cluster where there were open waters of the lake but also in the western side of the park though there was no open water. In the northern and the southern villages mainly long nets (different numbers were used for different size of fish) and hooks were used for fishing in open water while the western villages used the boat canals and thin floating meadows using box traps, hooks and nets. Swamp eels (*Monopterus albus*) were mainly caught in the western side (*please see Table 4.5*) by using hooks on the thin floating meadows. This type of fish dwelled

only in soil or floating meadows, they were not open water species, so they were not recorded on the northern villages. The fishing gear and method used for fishing eels were easier and simpler and less costly than the other gears which were the reasons for its higher quantity of catch. Mukanga (*Amblypharyngodon mola*) although small in size were recorded the most on the northern side as these fishermen use small mesh gauge in the open waters. The quantity of catch of this species was less in the western side as this species was open water species. This species was highly in demand and were sold fresh as well as smoked. The Grass carps (*Ctenopharyngodon idella*) caught probably were those that escaped or washed away from nearby fish farms during floods. They were usually caught in the northern and eastern sides as these species were larger in size and were found in open waters.

The annual fish production of Manipur state was estimated to be 11,600 ton (Trisal and Manihar, 2004) out of which annual fish landing of Loktak Lake was estimated to range between 1,261 ton to 1,685 ton. The estimated fish catch of 304.9 ton year<sup>-1</sup> from the park indicated that it contributed about 20% of the fish production of the lake. The higher record of common carp (*Cyprinus carpio*) and murrels like *Channa punctatus* and *Channa marulius* from the park confirmed the report of dominance by these species during the earlier survey by LDA. The common carps had their breeding areas in open waters and the murrels breed among the floating meadows (Trisal and Manihar, 2004) which might have led to the lower catch of *Cyprinus carpio* on the western side and higher in the east and north.

The extraction and sale of vegetables and fish from the park were important sources of livelihood for many of the households just as collections of *Grewia flava* and *Grewia retinervis* have played important subsistence and economic roles for the people of Kalahari area (Twyman et al., 2001). Around 65% of the households depended on the park for some resources either for sustenance or for commercial purpose. A similar dependence rate on forest resources was also observed in Dendi district of Ethiopia where more than 35% to ca. 60% of the local people depended on the park and resources from the park contributed 40% to 57% of total income as estimated by Mamo et al. (2007).

Poverty (Sills et al., 2003; Tickin, 2004; Osman et al., 2000; Roderick and Hirsch, 2000; Belcher and Kusters, 2004, Quang and Anh., 2006), no alternate livelihood, low or no capital requirement for harvesting the resources, proximity to park (Richman,

2004) and high demand of the resources were some of the reasons responsible for high dependence of people on the park. More than 50% of their cash income was contributed by sale of NTFPs in Nilgiris (Narendran et al., 2001) and also in Veitnam (Quang and Anh, 2006). A similar contribution was also seen in the households near KLNPN. So, if there would be a total prohibition to enter the park area then there would be nearly 60% reduction in the income of those who depend on the park for their livelihood with maximum sufferers of 62 % of households in the west and minimum sufferers of 32 % in the east.

Though there have been no legal action taken up against local residents collecting plants and fish resources from the park, hunting of wild animals and birds were strictly prohibited. Many traps and snares encountered during transect surveys in the park were located at the same areas where human activities were taking place. The reasons could be use of same food and shelter plants of animals were also extracted by local communities on the thick floating meadows which can carry both man and animals and moreover the local people have more knowledge about the park and animal behavior. There were some instances where poachers were caught and booked under law.

On 19 January 2003, Sangai Forum volunteers caught two poachers who had killed a Sangai. The poachers were handed over to the Moirang Police Station and a criminal case was filed against them (Anon., 2003). In April 2009, forest officials found the carcasses of a hog deer and a Sangai which was probably killed about a month back (Anon., 2009a). During anti-poaching drives conducted by the park officials since August 2009, 234 traps laid for trapping animals and birds have been recovered from Keibul Lamjao National Park (Anon., 2009b). In December 2010, forest guards apprehended a gang of six poachers in the Khodakhong area in eastern side of the park (Anon., 2010). In April 2010, one person was caught by forest guards and police with a SBBL gun for hunting inside the park and was fined ₹5,000 in March 2011. This was the first ever conviction in the state under the Wildlife Protection Act, 1972 (Anon., 2011). On 01 February 2013, forest guards caught 2 poachers red handed while dressing carcass of Sangai after killing it inside the park. They were handed over to Moirang Police Station and were booked under the provisions of the Wildlife Protection Act (Anon., 2013).

In the present investigation on the impact of anthropogenic activities in the grasslands of KLNP using quadrat surveys in transects, 62 plants were encountered as against 223 reported by Singh (1991), 145 aquatic, semi aquatic and terrestrial plants by Singh (2002a), 117 reported by Angom and Gupta (1999) and 185 by Tuboi (2013). The variations and similarities in these reports may be due to the different objectives of the investigation where higher species were encountered in case of plant resource inventory and fewer in case of abundance and density variation studies as in the latter case (quadrat survey).

The present findings of species composition as inferred from the percentage frequency of occurrence (**Table 4.12**) revealed that there had been drastic changes in the composition of grassland in KLNP over the years. The data available from earlier studies of 1960s by (Gee, 1960) and 1980s and 1990s by Singh (2002b) reported the KLNP grassland of having a different scenario as compared to the present scenario. Earlier in the 60s, the park was dominated by tall reeds *Phragmites karka* (45%) and *Narenga porphyrocoma* (25%) but surveys during 1983-84 by Singh (1993) revealed that *Leersia hexandra* dominated the grassland with about 25% of occurrence followed by *Zizania latifolia* (18.3%), *Phragmites karka* (14.4%) and *Capillipedium assimile* (11.1%). In a similar survey conducted by him in 1996 (Singh, 2002b), he reported that percentage of occurrence of *Zizania latifolia* and *Phragmites karka* had reduced to 14.6% and 10% respectively while it had increased to 32.5% in the case of *Leersia hexandra* and 14.2% in *Capillipedium* sp.

**Table 4.12:** Grassland composition of KLNP derived by Gee (1960) and present study.

Botanical name	Local name	% of occurrence Gee(1960)	% of occurrence Present study
<i>Phragmites karka</i>	Tou	45	6.41
<i>Narenga porphyrocoma</i>	Singut	25	-
<i>Saccharum munja</i>	Khoimom	15	3.69
<i>Zizania latifolia</i>	Ishing kambong	5	8.06
<i>Alpinia allughas</i>	Pulei	5	-
<i>Saccharum procerum</i>	Singnang	2	-
Others		3	16.93

**Table 4.13:** Percentage of occurrence of plant species in KLNP during 1983-84, 1996 and present study.

<b>Botanical name</b>	<b>Local name</b>	<b>1983-84</b>	<b>1996</b>	<b>Present study</b>
<i>Zizania latifolia</i>	Ishing kambong	18.3	14.6	8.06
<i>Phragmites karka</i>	Tou	14.4	10	6.41
<i>Saccharum munja</i>	Khoimom	4.7	4.2	3.69
<i>Narenga porphyrocoma</i>	Singut	1.9	2.5	-
<i>Leersia hexandra</i>	Hoop	24.7	32.5	11.39
<i>Carex</i>	Hundang	3.9	3.1	0.29
<i>Oryza perennis</i>	Wainu chara	7.7	1.8	0.13
<i>Coix lachryma jobi</i>	Yawa chaning	4.2	1.6	0.14
<i>Capillipedium</i>	Wana manbi	11.1	14.2	10.06
Others		8.6	15.5	16.93

Source: Singh (2002b)

He was of the opinion that there had been a decreased in shelter plants and an increased in food plants and the ratio in recent years was 40 : 60 (Shelter : Food). However, our present field observations during the investigations revealed that the occurrence of food plants had further decreased over the years and the ratio of shelter species and food species now stood at 27 : 37. This showed that availability of food has also decreased along with loss in shelter plants. There has been a high degree of change in the plant composition in the grassland which was not in favourable direction for Sangai. The findings were in conformity with the study reported by Rocky (2002) that non palatable grasses had started replacing the palatable ones (food plants of Sangai) and the food plants were restricted. Successions in grassland takes place in nature but the anthropogenic disturbances had altered the grassland composition. The regrows in burnt areas of the grassland were usually dominated by *Pteris* sp. In **Table 4.7**, *Pteris* sp., *Persicaria perfoliata* and *Eupatorium* sp. together occurred in more than 20% of the quadrates which was not the case earlier.

The harvesting simulation results indicated that increased harvesting intensities decreased the plant density in case of *Hedychium coronarium* and complete harvest was detrimental to the regrowth of *Phragmites karka*. This indicated that the results from the quadrat study and comparison over the years confirmed to one of the probable reasons for the decreased occurrence of *Phragmites karka*. The cause of the change may be due to the continuous harvesting of *Phragmites karka* resulting in increased abundance of species with vegetative reproduction due to flowering being hindered as also opined by Fischer and Wipf (2002). Excessively intensive management as well as complete abandonment or improper utilization of grassland results in deterioration of both its natural and economic value. Most often it resulted in disappearance of valuable species and appearance of unwelcome expansive taxon (Laser, 2002; Nadolna, 2009).

Role of other anthropogenic activities might also have resulted in the change in composition of the KLNP grassland. Fire could be another factor which might have contributed to the change. Stuwe and Parsons (1977) and Stuwe (1986) stated that fire was not only significant in maintaining an open sward, but also had the potential to control the invasion and spread of exotic species in native grasslands. However, on the contrary in the present study, unwanted plants like *Pteris* sp. came up in areas that were burned though this needs to be substantiated with further studies. Khatri and Barua (2011) also reported that frequent burning in *Phragmites karka* dominated grasslands of Kaziranga National Park led to replacements by *Saccharum*, *Themeda* and *Imperata* species. Gill et al. (2002) also opined that few studies had verified the claims that fire was beneficial but burning season remained the least understood component of the disturbed regime. Dornbush (2004) also opined that burning may have exerted selective forces altering the composition of the native community over the years in Kalsow Prairie, Iowa. Another probable reason for the change in the composition may be the nutrient loading in the lake ecosystem from inflowing river from the main settlement areas in the valley. Kosygin (2002) had reported that in a year 372.6 ton of nitrate nitrogen was received from the inflowing rivers out of which 76.8 ton was deposited in the Loktak Lake water and nitrogen concentration of the lake water was estimated at  $2.3 \text{ g m}^{-3}$ . This high loading of nutrient in the lake water had also led to proliferation of floating meadows in open waters of the lake. This might also be one of the causes for the change in the overall grassland composition as

nitrogen addition experiments in grasslands indicated that one of the consequences was a reduction in plant diversity (Aguilar, 2005) dominance of a few species and suppression of many other species (Silvertown, 1980).

#### **4.5 Conclusion**

The study revealed that majority of the people residing around the park depended on the bio-resources from the park for their livelihoods and the local economy was based on it. Vegetable collection was highest in west while fishing was highest in north. Fuel wood extraction was highest in west while fish feed extraction was highest in south. The income from sale of fish was more than that from sale of vegetables. However, contribution to income from sale of the resources was more than 50% for the families who depended on the park. Fishing and fish feed collection was observed throughout the year while vegetable collection and fuel wood collection was observed seasonally. Annually  $32,627.6 \pm 7,121.1$  ton (fresh weight) of plant resources was estimated to be extracted from the park out of which fish feed constitute 87.8%. About  $1,115.6 \pm 341.1$  ton of *Hedychium coronarium* was estimated to be extracted annually with 71% of the extraction in the west for deriving income. Annual fish caught from the park was estimated to be  $304.9 \pm 45.1$  ton with maximum extraction in the north. Swamp eels and *Chhana* sp. were found to be the most extracted fish species. Extraction of resources from the park contributed up to 40.48% of the total annual household income and about 43% of the families derived direct income from the extraction of resources.

Due to anthropogenic activities the grassland composition in KLNP had changed over the years. Overharvesting and unscientific management may have led to the change in the grassland composition which was not in favour of Sangai. Overall plant species diversity was significantly higher in the interior than periphery areas whereas in high disturbance zone higher diversity was observed in periphery areas. Based on the findings of the present study, policies for proper maintenance of the grassland composition were suggested for controlled/regulated harvesting and moderate cutting/harvesting of the plants resources to provide optimum food plants and shelter plants for Sangai.



(a) Making of box trap



(b) Fishes trapped in box trap



(c) A big catch of fish



(d) A man collecting *Z. latifolia*



(e) Women after a day's vegetable collection



(f) Family members cleaning *H. coronarium*



(g) Headloads of tou (*P. karka*)



(h) A pile of fish feed (*Hydrilla* spp.)

Plate 4.2: Different activities of resource extraction taking place in KLNP.



(a) Cycle brake wire used for trapping big animal



(b) Strings used for catching birds



(c) Chinese nylon ropes used as snares to trap big animals

**Plate 4.3:** Different types of materials used to trap wild animals and birds in KLNP.

## **CHAPTER 5**

# **ATTITUDES OF LOCAL PEOPLE TOWARDS CONSERVATION OF KEIBUL LAMJAO NATIONAL PARK AND ASSESSMENT OF ALTERNATIVE LIVELIHOOD OPTIONS**

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### **5.1 Introduction**

Worldwide experience in the management of protected areas over the last few decades showed the danger of excluding local people and importance of the residential population's participation to the successful management of protected areas (Govan et al., 1998). A protection strategy that alienated local communities from conservation was not only unjust to the human rights but also harmful to conservation programmes (Kothari et al., 1995). Till the 1970s, the main objective of parks or protected areas was to preserve the natural resources after the aesthetic, spiritual and recreational use. The conventional park model was to set aside large tracts of land with natural features, landscapes, ecosystems and wild life to be left unaltered by human interventions. This model of protection was replicated in many of the developing countries where local people were often disadvantaged if not wholly displaced (Batisse, 1997).

Excluding local people from protected areas and imposing regulations restricting exploitation of resources which were either their livelihood and survival or their main economic alternative aggravated the conflicts between reserve managers and local people (Quyang et al., 2002). These situations led the local people to lose the feeling of owning the forest and developed negative attitudes towards them (Tewari, 1996). Such widespread and intensifying park-people conflicts have caused more damage to valuable habitats, ecosystems, flora and fauna that were supposed to be protected and failures of many conservation programmes (Harkness, 1998; Coggins, 2000; Han, 2000).

Many of the opinions were that protection of natural forests in human occupied landscapes often brought conflicts between globally-inspired conservation goals (e.g., biodiversity conservation) and local needs (Pfeffer et al., 2001; Schelhas and Pfeffer 2005). Local people have little encouragement to support conservation unless they

gain something from it or at least not be deprived of major benefits they already enjoyed (Badola, 1997a; Boonzaier, 1996; Tisdell, 1995; Renard and Hudson, 1993).

Of late, there is a growing realisation that sustainable management of protected areas ultimately depended on the co-operation and support of local people (Wells and Brandon, 1993). Though environmental protection programmes through the integration of conservation goals with local habitants' needs and participation have received wide attention (Kaus, 1993), conflicts or disagreements among people whose goals are incompatible and are potential interference in achieving goals of conservation and/or preservation of natural resources is one of the greatest challenges of the 21st century (Lee, 1993; Peterson, 1997; Daniels and Walker, 2001).

The needs, aspirations and attitudes of local people living in and around protected areas who have important and long-standing relationship with these protected areas need to be considered (McNeely, 1990; Xu, et al., 2006) which as Sewell (1973) pointed out, will offer promise and help to identify problems and find potential solutions for developing suitable management strategies. There is also an increased recognition that local communities must be actively involved in conservation and their needs and inspirations have to be considered (Sah and Heinen, 2001; Obiri and Lawes, 2002) and ensuring local support for protected areas is increasingly viewed as an important element (Walpole and Goodwin, 2001) for biodiversity conservation to be sustainable.

Besides, the Millennium Ecosystem Assessment argued on a strong and obligatory aspect that well being of human depended on the services provided by nature (Tallis et al., 2008). Concerns have been raised that much of biodiversity in this human-dominated landscape will be lost by the end of this century unless alternative approaches are developed (Karanth and Defries, 2010). To compensate the loss of benefits and negative effects from the establishment of protected areas it has been recognized that protected areas should play a role in sustaining livelihoods of local people (IUCN/UNEP/WWF, 1980; McNeely, 1995; Ghimire and Pimbert, 1997). This can be achieved through sustainable use of biological diversity by generating non consumptive economic benefits to local people e.g. through eco-tourism (Sehkar, 2003; Barbier et al., 1997; Sterner, 2003; Brander et al., 2007). Pressure on the forest resource can also be reduced if measures to increase agriculture and livestock production and generate off-farm employment opportunities for locals in and around

protected areas (Panwar, 1990; Alphonse and Gu, 2009) are taken up. Livelihoods have been described to comprise of capabilities, assets and activities required as means of living (DFID, 2002) which promote developments that are sustainable not just ecologically but also institutionally, socially and economically and to produce genuinely positive livelihood outcomes (Ashley and Carney, 1999). A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Carney, 1998). In livelihood studies, the importance of a secure (or sustainable) livelihood was acknowledged, for example, by Chambers (1995) who was among the first to write about the vulnerability of the poor. Vulnerability here is referred to exposure to contingencies and stress and difficulty in coping with them. Vulnerability thus has two sides: an external side of risks, shocks, and stress to which an individual is subjected; and an internal side which is defenselessness, meaning a lack of means to cope without damaging loss.

In the present study, the local people's awareness and attitude towards conservation of Sangai in KLNP; their response to restriction of access to the park; the probable factors influencing their attitude towards conservation have been studied. The local people's willingness to contribute for conservation of Sangai and what they were willing to accept to forego the benefits from the park were also investigated. It was also attempted to work out the feasibility of alternative livelihoods the local people wanted to adopt to stop their dependence on the park.

## **5.2 Methodology**

### **5.2.1 Household survey of local communities**

The local communities around KLNP were surveyed using structured and semi-structured questionnaires. Besides personal information like gender, age, educational qualification, community, socio-economic indicators such as land holding, occupation, family size and income, the residents were asked regarding the importance of KLNP and Sangai to them. The villagers were also asked how much they were willing to contribute for conservation of Sangai. The local people were also asked about any benefits they received/derived from government or from establishment of national park. Questions relating to impacts on the park due to their

activities and management were put to them. During the survey, the respondents were presented a scenario where the resources they were extracting from KLNP would not be accessible to them and they were asked to state the compensation for giving up the benefits from the park that would keep them at the same level of welfare as they were while receiving benefits from the park. The types of compensation suggested were noted.

It was recognised that livelihood priorities varied and outsiders cannot assume knowledge of the objectives of a given household or group. Therefore local people were asked regarding the alternative livelihoods they would like to take up to improve their economic condition and reduce pressure on the park. During a stakeholder's workshop at KLNP during 2010, feasibility analysis of the livelihood options as listed by the local people was carried out. The participants in this workshop included the local villagers, representatives from the Loktak Development Authority, Manipur University, Fishery Department, local NGOs such as Environmental Social Reform and Sangai Protection Forum (ESRSPF) and Youth Club Moirang. The livelihood alternatives proposed by the people were examined for their feasibility on the basis of five criteria (economic, social and cultural, environmental, technological and political), following Ashley and Hussein (2000) and Choi and Sirakya (2006). For each of the five criteria indicators were identified and scored on a scale of 0 to 3, from the least feasible (0) to most feasible (3) options were assigned. A total of 16 indicators were identified for the five criteria (**Table 5.1**).

### **5.2.2 Data analysis**

The responses were summarized and percentage frequency method was used to analyze the data. Frequency distribution data were cross tabulated into contingency tables and subjected to chi square analysis. Answers from all respondents were pooled when investigating potential influences on local people's attitudes towards the park and opinion against fencing, in order to obtain adequate sample sizes for chi square analysis. For willingness to contribute and the willingness to accept compensation, the data were grouped and tabulated and were subjected to frequency and percentage analysis. To test the influence of socio-economic factors on the willingness to contribute, regression analysis (Ordinary Least Square regressions) was used.

**Table 5.1:** Criteria and indicators developed to assess the feasibility of livelihood alternatives proposed by the local people.

<b>Criteria</b>	<b>Indicators identified for each criteria</b>
Economic feasibility	<ol style="list-style-type: none"> <li>1. The activity should provide enough economic output to induce people to take it up</li> <li>2. Market and production linkages should be easily available</li> <li>3. Economic benefits from the activity should be fairly well distributed throughout the community</li> </ol>
Social/Cultural feasibility	<ol style="list-style-type: none"> <li>4. It should have respect for social identity and culture of the area and its assets</li> <li>5. It should not have negative cultural and social impacts</li> <li>6. It should strengthen community co-operation and institutions</li> <li>7. It should not have negative impact on access to social networks of households or the broader community</li> <li>8. It should not have negative impact on the community's relations with the outside world, in terms of influence, co-operation or conflict</li> </ol>
Technological feasibility	<ol style="list-style-type: none"> <li>9. The local people should have the basic skills and techniques available for the activity</li> <li>10. They should not be dependent on outside technological help for repair maintenance and upkeep (i.e. increase their vulnerability)</li> <li>11. Scope for improving the skills and capabilities should be available at low costs</li> </ol>
Ecological feasibility	<ol style="list-style-type: none"> <li>12. The enterprise should not affect the sustainability of the natural resource base</li> <li>13. The activity should be spread throughout the year</li> <li>14. The activity should not coincide with or disturb the breeding season of the wild species</li> </ol>
Political/legal feasibility	<ol style="list-style-type: none"> <li>15. The livelihood activity should be in tune with the political conditions of the area</li> <li>16. It should be legally admissible to give the protected areas status.</li> </ol>

For analyzing the feasibility of the expressed alternative livelihood options, scores were given for each indicator of every criterion, the scores for individual criterion were then summed up and the average score was calculated. Finally the averages of all criteria were aggregated and the overall average gave the final feasibility score of the respective option (*Appendix III*).

## 5.3 Results

### 5.3.1 Conservation awareness and attitudes of local people towards KLNP

The attitudes of local people around KLNP were evaluated in order to get a general impression of local people's reactions towards the national park. **Table 5.2** presented the response of the people in favour of park. Proportion of local residents who acknowledged that 'Sangai is important' was highest (94%) in the northern villages and lowest (78%) in the western villages and it varied significantly across the different directions ( $\chi^2=10.7$ ,  $p=0.013$ ). More than 80% local residents in the eastern villages agreed that 'Sangai has given them recognition' the response varying significantly ( $\chi^2=9.68$ ,  $p=0.02$ ) among the clusters. There was no difference between the clusters that 'Conservation of wildlife is necessary for the future generations' with over 90% of local residents acknowledging it.

Over 90% of local residents in the northern and western villages believed that 'the national park is necessary to protect Sangai from poaching' while it was about 70% in southern and eastern clusters and difference was significant ( $\chi^2=43.5$ ,  $p<0.0001$ ). Almost half (48%) of the local residents in the western direction considered KLNP as their source of income either as primary or secondary with significant difference observed in the response ( $\chi^2=41.3$ ,  $p<0.0001$ ). There was a significant difference ( $\chi^2=38.33$ ,  $p<0.0001$ ) among the clusters that Ithai Barrage had caused damage to the park and its surroundings. There was no difference in response among the clusters agreeing to fencing of the park with highest (19%) of local residents in eastern villages and lowest (8%) in the northern villages. The western villages least (3%) favoured the complete restriction of resource extraction while 24% in the eastern villages agreed to it and the result was significantly different ( $\chi^2=19.79$ ,  $p<0.0001$ ).

**Table 5.2:** Local residents' response (%) in favour of KLNP.

Statements	North	West	South	East	$\chi^2$	<i>p</i>
Sangai is important	94	78	82	85	10.7	0.013
Sangai gives recognition	76	74	65	84	9.68	0.02
Conserved wildlife for the future generations	94	93	96	96	0.82	ns
KLNP is necessary to protect from poaching	99	94	76	71	43.5	0.000
KLNP is a source of livelihood	09	48	27	21	41.3	0.000
Barrage has caused damage to park and surrounding	82	94	75	89	38.33	0.000
The park should be fenced	12	8	17	19	11.01	ns
Resource extraction from the park should be completely restricted	14	3	16	24	19.79	0.000
Extraction of resources should be controlled	68	39	88	84	37.64	0.000
Vegetable and grass collection depletes Sangai's food	22	54	55	60	31.83	0.000
Tourism can bring benefits for the local villages	86	78	76	88	7.07	ns

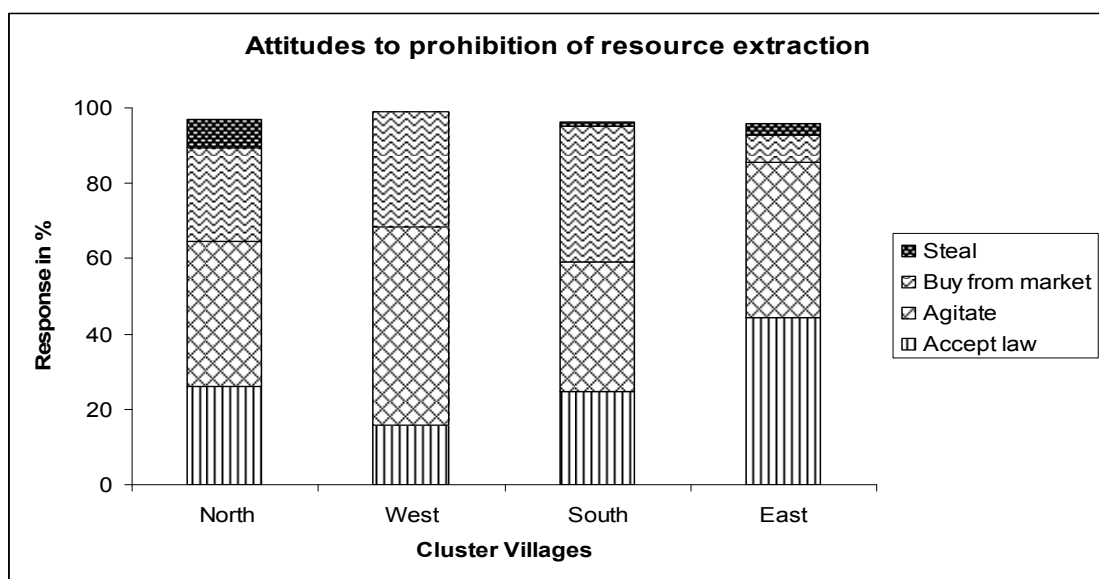
ns = not significant

Response of local residents to control of resource extraction differed significantly ( $\chi^2=37.64$ ,  $p<0.0001$ ) with 84% in eastern, 88% in southern and 68% in northern villages agreeing except in western villages where only 39% of local residents accepted the idea. More than 50% of local residents admitted that vegetable and grass extraction depleted the availability of food for Sangai while only 22% agreed in the northern villages and a significant difference ( $\chi^2=31.83$ ,  $p<0.0001$ ) was observed across the different clusters. Majority of the local residents agreed that tourism will bring benefits to the local people. None of the local residents mentioned have receiving any sort of benefit from the government from the establishment of national park but had lost more due to restriction of access to park.

### 5.3.2 Attitudes towards prohibition of resource extraction from KLNP

When the respondents were asked about their opinion on the prohibition of resource extraction from the park, 44% residents of eastern villages said that they will accept the law (**Figure 5.1**) while it was only 16% in the western villages. In the north, 26%

local residents expressed their acceptance and in southern villages by 25%. More than half (52%) in the western villages said they will agitate against the law and the number decreased to 41% in eastern, 38% in northern and 35% in southern villages. People willing to buy the resources from the market were highest (36%) in southern villages while it was lowest (7%) in the eastern and 26% in the northern villages and 31% in the western villages. Though prohibition was most opposed by the western villages none of the respondents expressed that they would steal from the park. The attitude to intrude and steal from the park gradually increased to 1 % in southern villages to 3 % in eastern villages and the highest (8%) was in the northern villages.



**Figure 5.1:** Attitudes of local people towards prohibition of resource extraction from KLNP.

### 5.3.3 Factors influencing the attitude of villagers towards KLNP

None of the selected factors significantly influenced respondents' opinions towards the park (Table 5.3). However, responses of people who derived resources and income from the park were significantly ( $p < 0.01$ ) related to whether they gave a negative opinion to the complete restriction of entry to the park or not. Respondents who perceived personal benefits from the park expressed more negative attitude towards fencing the park and complete restriction of entry inside the park than those who did not. Respondents' occupation as farmer or not, and owning a fish farm or not were also related to whether they gave a positive opinion or not but were not statistically significant ( $p < 0.10$ ).

**Table 5.3:** Factors that influence local people's attitude towards KLNP.

Factors	About the park (n=239)			About fencing the park (n=236)		
	Positive Attitude	Negative Attitude	$\chi^2$	Positive Attitude	Negative Attitude	$\chi^2$
<i>Direction of the</i>						
North	43	7	2.26	6	44	3.6
West	40	10		4	46	
South	43	6		8	39	
East	80	10		17	72	
<i>Age of respondents</i>						
<30 yrs	42	10	4.67	7	45	1.60
30-45 yrs	66	5		13	56	
45-60 yrs	64	13		11	66	
>60yrs	34	5		4	34	
<i>Household annual</i>						
<25000	45	5	0.85	5	44	1.21
25000-75000	99	17		18	98	
>75000	62	11		12	59	
<i>Landholdings</i>						
< median	104	15	0.29	16	102	0.30
>median	102	18		19	99	
<i>Family Size</i>						
<average	124	18	0.38	22	119	0.16
>average	82	15		13	82	
<i>Ethnic group</i>						
Meitei	185	32	1.75	2	21	0.75
Muslim	21	1		33	180	
<i>Gender</i>						
Male	116	18	0.04	20	112	0.02
Female	90	15		15	89	
<i>Education</i>						
No	68	14	1.12	12	69	0.00
Yes	138	19		23	132	
<i>Occupation</i>						
Agriculture	54	7	0.37	13	47	2.98*
Non agriculture	152	26		22	154	
<i>Own Fish-farm</i>						
Yes	75	9	1.04	17	66	3.24*
No	131	24		18	135	
<i>Own Athaphum</i>						
Yes	18	5	1.3	2	21	0.75
No	188	28		33	180	
<i>Derive benefits</i>						
Yes	137	21	0.11	15	141	9.9***
No	69	12		20	60	
<i>Derive income from</i>						
Yes	95	16	0.06	7	104	12.06***
No	111	17		28	97	

\* significant at 0.10 level, \*\* significant at 0.05 level, \*\*\* significant at 0.01 level

The local residents of western villages tend to oppose more against the fencing. Similarly respondents whose main occupation was agriculture and who owned fish farm tend to agree more towards fencing the park.

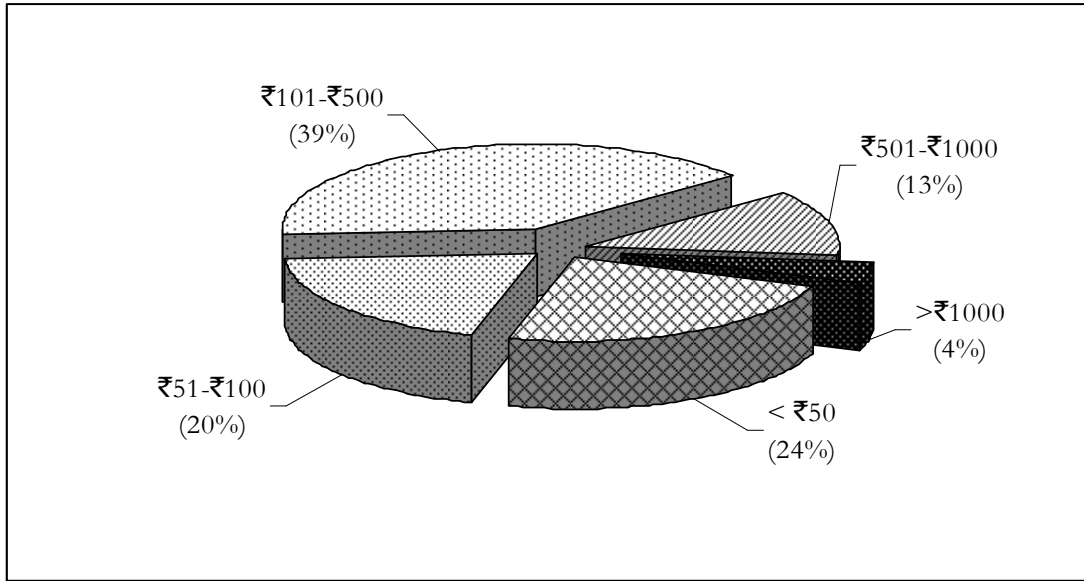
### 5.3.4 Willingness to contribute for conservation and willingness to accept compensation for foregoing benefits

More than 90% of local households were willing to contribute in the form of monetary terms or as manual labour for conservation of Sangai in KLNP while 6.3% of the households did not want to make any financial contribution for the conservation. Thirty four percent of local residents in north, 12% in south and 23% in the east were willing to work in place of monetary contribution for conservation of Sangai while 96% of the local residents in west were willing to pay some amount but were not willing to work for conservation directly. The willingness to contribute of the respondents ranged between ₹8 and ₹3,750 with a mean of ₹176.21family<sup>-1</sup> for one time. But if we take into account the monetary value of their willingness to work, the mean amount people were willing to contribute was ₹283.15 ± 30.17 (Table 5.4).

**Table 5.4:** Amount willing to contribute and monetary value of work (₹) of different villages around KLNP.

Direction	Amount willing to contribute (₹)	Monetary value of work (₹)	Total amount ± SEM
North	227.16	247.68	474.84 ± 98.43
West	157.50	0.0	157.50 ± 37.98
South	205.98	55.84	261.82 ± 70.87
East	142.08	116.00	258.08 ± 35.32
Mean	176.21	106.98	283.15 ± 30.17

It was found that majority (39%) of local residents wanted to contribute an amount of ₹101-500 followed by less than ₹50 (24%). Only 4% were willing to contribute more than ₹1,000 (Figure 5.2). Eight percent of local residents in northern villages were willing to contribute money as well as manual labour while it was 6% and 3% in southern and eastern village clusters respectively. Most of the local residents who were willing to contribute both money and manual labour were from the low income group.



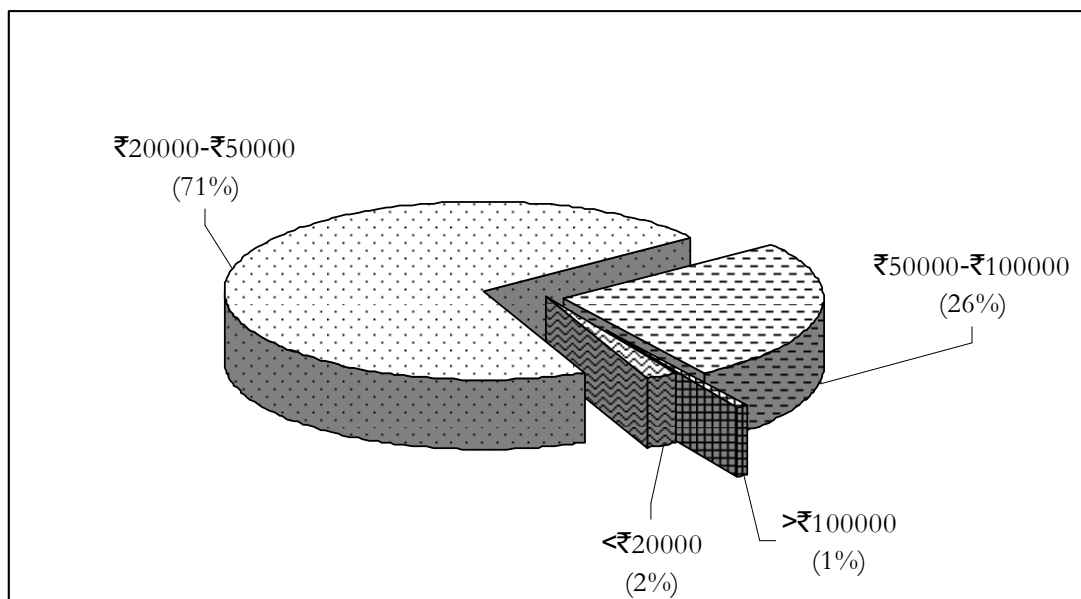
**Figure 5.2:** Willingness to contribute for conservation of Sangai in KLNP.

The amount people were willing to contribute for conservation of Sangai varied according to different income groups. Local residents with less income definitely wanted to give less and more income groups had more to give. People with annual income less than ₹25,000 were willing to contribute ₹103.78 ± 14.41 and with income more than ₹1,00,000 were willing to contribute ₹987.00 ± 488.94 (**Table 5.5**) and the amount differed significantly ( $p < 0.01$ ) across the different income groups.

**Table 5.5:** Amount (₹) willing to contribute across different income groups.

Income (₹)	Mean (₹)	SEM
<25000	103.78	14.41
25000-50000	297.02	102.44
50000-100000	339.02	136.84
>100000	987.00	488.94
F-test	$p < 0.01$	

More than 55.8% of the respondents who were willing to contribute for the conservation of Sangai were not willing to receive any form of monetary compensation while 73% of the respondents who were not willing to contribute anything for conservation were willing to receive monetary compensation.



**Figure 5.3:** Percentage of local people willing to accept money as compensation for foregoing entry to KLNP for conservation.

Of those who were willing to receive money, 71% were willing to receive an amount of ₹20,000- 50,000 while 26% were willing to receive between ₹50,000-1,00,000 and only 1% were willing to receive more than ₹1,00,000 (**Figure 5.3**). The amount people were willing to accept did not differ according to different income groups (**Table 5.6**).

**Table 5.6:** Amount (₹) willing to accept as compensation across different income groups.

Income(₹)	Mean(₹)	SEM
<25000	32571.4	3628.6
25000-50000	29024.4	3119.7
50000-100000	47407.4	15542.9
>100000	36666.7	10755.8
F-test	ns	

ns = not significant

The mean amounts of money people were willing to contribute and were willing to accept are shown in **Table 5.7**. As seen in the table that average amount of contribution of households for the conservation of Sangai in KLNP was ₹283.15 ± 30.17 and the average amount to accept was ₹36,481.48 ± 2544.43 which was a difference of 129 times of the former.

**Table 5.7:** Amounts (₹) willing to contribute and willing to accept by local people around KLNP.

Parameters	Amount willing to contribute (₹)	Amount willing to accept (₹)
Mean	283.15	36481.48
SEM	30.17	2544.43
Range	0-3750	0 - 150000
Median	75	20000

As seen in **Table 5.8** there was an important difference between amount willing to contribute and amount willing to accept and the direction of village clusters location. The amount willing to contribute and amount willing to accept were much higher in the northern cluster villages than that of others. The difference between the amounts willing to contribute and willing to accept ranged from 125 to 204 times in the three clusters while it is only 88 times in the north.

**Table 5.8:** Difference between amounts willing to contribute and willing to accept by local people around KLNP.

Village Clusters	Amount willing to contribute (₹)		Amount willing to accept (₹)	
	Mean	SEM	Mean	SEM
North	474.84	98.43	41973.68	4448.93
West	157.50	37.98	32166.67	4002.04
South	261.82	70.87	32916.67	10844.25
East	258.08	35.32	35178.57	4546.07
Mean	283.15	30.17	36481.48	2544.43

More than 96.19% female residents were willing to contribute for conservation of Sangai (**Table 5.9**) and their average amount was ₹279.60 ± 40.09 while lesser (91.79%) male respondents were willing to contribute and their average amount expressed was ₹297.02 ± 43.79. But there was no significant difference in the amount willing to contribute.

Few socio-economic factors had significant influence on amount respondents were willing to contribute. Regression analysis was used to assess the factors influencing expressed willingness to contribute for conservation of Sangai in KLNK including demographic and socio-economic variable. Ordinary Least Square (OLS) regressions were conducted. The results (**Table 5.10**) indicated that expressed amount was positively correlated with total landholdings and total income and negatively correlated with income from the park and age of respondent but the statistical tests revealed that they were significant predictors of the dependent variable (willing to contribute) except age of respondents.

**Table 5.9:** Gender-wise willingness to contribute (₹) for Sangai conservation.

Gender	% of respondents willing to contribute	Mean (₹) ± SEM
Female	96.19 %	279.60 ± 40.09
Male	91.79 %	297.02 ± 43.79
Z-test		ns

**Table 5.10:** Regression estimate for willingness to contribute function of households.

Explanatory Variables	Regression Co-efficient	Standard Error	t-value
Constant	115.708	96.082	1.204
Total landholdings	.003	.001	3.822*
Income total	.002	.001	3.583*
Income from park	-.002	.001	-1.988**
Age of respondent	-.010	1.851	-.005
Own <i>athaphum</i>	-241.268	98.436	-2.451*
R <sup>2</sup>	0.239	411.18	F=14.66*

\* Significant at 1%; \*\* Significant at 5% level of significance

The total amount local people were willing to contribute for conservation of Sangai was ₹7,38,917 annum<sup>-1</sup> as calculated from the local people's willingness to contribute. The maximum (₹2,57,363) contribution came from the northern villages while the minimum (₹1,10,880) was from the western villages (**Table 5.11**).

**Table 5.11:** Total amount willing to be paid (₹) by the local communities around KLNP.

Direction	Total households	Amount willing to contribute (₹)	Total willing to contribute (₹)
North	542	474.84	257363
West	704	157.5	110880
South	502	261.82	131433
East	927	258.1	239240
Total	2675	288.06	738917

### 5.3.5 Alternate livelihood options

The local residents were involved in various livelihoods to suffice the needs and demands of their families (**Table 5.12**). Currently majority of villagers were engaged in agriculture ( $40.73 \pm 7.70\%$ ), fisheries ( $34 \pm 13.41\%$  in fishing and  $24.67 \pm 5.16\%$  in pisciculture) and animal husbandry ( $21.99 \pm 6.96\%$ ). Other occupations like poultry, handloom, fish trading, carpentry, vegetable collection and small businesses were also followed by smaller sections of local residents.

**Table 5.12:** Percentage of respondents engaged in prevailing livelihood options.

Livelihood types	North	West	South	East	Mean $\pm$ SEM
Agriculture	28	46.34	28.57	60	$40.73 \pm 7.70$
Fishing	66	41.46	26.53	2	$34.00 \pm 13.41$
Pisciculture	28	34.15	26.53	10	$24.67 \pm 5.16$
Animal Husbandry	8	31.71	12.24	36	$21.99 \pm 6.96$
Poultry	16	7.32	10.20	8	$10.38 \pm 1.97$
Handloom	14	19.51	2.04	2	$9.39 \pm 4.40$
Fish trader	4	9.76	4.08	2	$4.96 \pm 1.67$
Carpentry	0	2.44	8.16	4	$3.65 \pm 1.70$
Driver	2	4.88	4.08	2	$3.24 \pm 0.73$
Business	4	0	4.08	2	$2.52 \pm 0.97$
Rice mill	2	0	0	2	$1.00 \pm 0.58$
Vegetable collection	0	24.39	0	0	$6.10 \pm 0$

However when the local residents were asked to give their preferred livelihood options that they thought would improve their socio-economic conditions, sustain their livelihood and reduce their dependence on the park, 82.1% wanted to venture in the tourism sector provided proper tourism infrastructures were developed by the government while 16% preferred to be given some form of employment and 6.8% wanted assistance for pisciculture (**Table 5.13**). Significant differences between the options suggested by males and females were found only in employment, handloom and animal husbandry and rest of the options had no significant differences.

**Table 5.13:** Preferred livelihood options as expressed by the local people around KLNP.

Livelihood options	Male %	Female %	Average %	t-value
Tourism	83.58	80.00	82.1	0.715
Provide employment	21.64	8.57	16.0	2.743***
Support for fish farming	6.72	6.67	6.8	0.015
Handloom	1.49	7.62	4.2	2.349**
Business	4.48	2.86	3.7	0.653
Fishing gears	1.49	3.81	2.6	1.138
Animal husbandry	0.00	3.81	1.6	2.279**
Alternative fodder supply	1.49	0.95	1.1	0.373
Carpentry	2.24	0.00	1.1	1.543
Poultry	0.75	0.00	0.5	0.889

\*\*significant at 0.05; \*\*\*significant at 0.01

### 5.3.5.1 Feasibility of options

Feasibility test for the livelihood options was done by scoring the livelihood options on a scale of 0 to 3, from the least feasible to most feasible options. The scoring was done against 16 indicators considering the economic, social/cultural, technological and political feasibility of each livelihood option.

The feasibility analysis (**Table 5.14**) revealed that handloom was the most feasible livelihood option (score 2.81/3) followed by businesses such as small shops or service providers and poultry (1.88/3) and fishery (1.75/3). Government services and tourism came after these with scores of 1.63/3 and 1.56/3 respectively.

Although the local people revealed their preference for tourism as the most preferred livelihood option the prevailing dismal law and order situation and the lack of proper infrastructure in the tourism sector did not give it a high score on feasibility.

Rice mill (1.38/3), animal husbandry (0.94/3) and carpentry (0.81/3) were the least feasible livelihood options. Handloom scored high on all the criteria except social, since it did not directly contribute to community cohesiveness although it was a part of the society and culture of the Manipuri people. Small business also scored high on most of the criteria except social cultural as they did not directly contribute to community cohesiveness. Although fishery scores the highest on economic criteria, it scored low on environmental and legal feasibility (Figure 5.4).

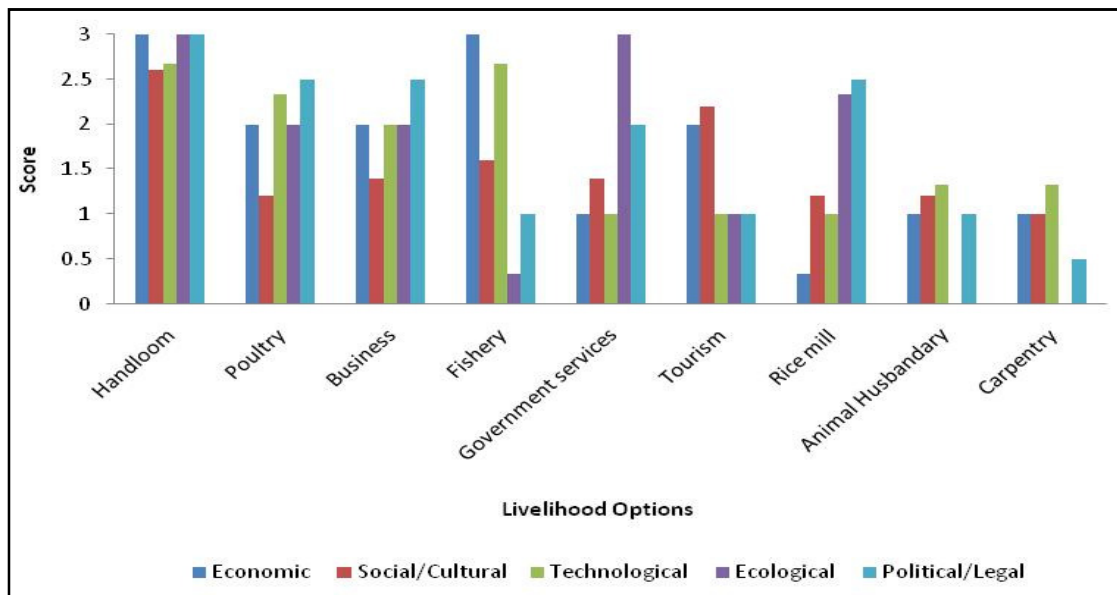


Figure 5.4: Feasibility of different livelihood options on different criterion .

## 5.4 Discussion

Most of the residents living around the park have generally positive attitudes towards Sangai and KLNP. They were aware about the importance of Sangai and the recognition it gave and the importance of KLNP to conserve Sangai from extinction. Majority of them were also aware of the harmful effect of the Ithai Barrage on the park and the surrounding areas. This may be due to the fact that many of the respondents were also victims of the land use change after the damming of Loktak. Many cultivable areas during the drier season had been submerged after the commissioning of the barrage.

**Table 5.14:** Feasibility analysis of different livelihood options proposed by the people living around KLNP.

Criteria	Indicator	Tourism	Fishery	Business	Handloom	Govt. services	Poultry	Animal Husbandry	Rice mill	Carpentry
Economic	Activity should provide enough economic output to induce people to take it up	3	3	3	3	3	2	1	0	1
	Market, production linkages and infrastructure should be easily available	0	3	2	3	0	2	1	1	1
	Economic benefits from the activity should be fairly well distributed throughout the community	3	3	1	3	0	2	1	0	1
	<b>Average Score</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0.33</b>	<b>1</b>
Social/Cultural	It should have respect for social identity and culture of the area and its assets	2	3	2	3	1	1	2	1	1
	It should not have negative cultural and social impacts	1	2	2	3	1	2	1	2	1
	It should strengthen community co-operation and institutions	3	1	1	2	1	1	1	1	1
	It should not have negative impact on access to social networks of households or the broader community	2	1	1	2	1	1	1	1	1
	It should not have negative impact on the community's relations with the outside world, in terms of influence, co-operation or conflict	3	1	1	3	3	1	1	1	1
	<b>Average Score</b>	<b>2.2</b>	<b>1.6</b>	<b>1.4</b>	<b>2.6</b>	<b>1.4</b>	<b>1.2</b>	<b>1.2</b>	<b>1.2</b>	<b>1</b>
Technological	The local people should have the basic skills and techniques available for the activity	1	3	2	3	1	2	1	2	1
	They should not be dependent on outside technological help for repair maintenance and upkeep (i.e. increase their vulnerability)	1	3	2	3	1	3	1	0	1
	Scope for improving the skills and capabilities should be available at low costs	1	2	2	2	1	2	2	1	2
	<b>Average Score</b>	<b>1</b>	<b>2.67</b>	<b>2</b>	<b>2.67</b>	<b>1</b>	<b>2.33</b>	<b>1.33</b>	<b>1</b>	<b>1.33</b>
Ecological	The enterprise should not affect the sustainability of the natural resource base	1	0	2	3	3	2	0	3	0
	The activity should be spread throughout the year	1	1	2	3	3	3	0	2	0
	The activity should not coincide with or disturb the breeding season and activity of the wild species	1	0	2	3	3	1	0	2	0
	<b>Average Score</b>	<b>1</b>	<b>0.33</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>2.33</b>	<b>0</b>
Political/Legal	The livelihood activity should be in tune with the political conditions of the area	0	2	2	3	1	2	2	2	1
	It should be legally admissible give the PA status	2	0	3	3	3	3	0	3	0
	<b>Average Score</b>	<b>1</b>	<b>1</b>	<b>2.5</b>	<b>3</b>	<b>2</b>	<b>2.5</b>	<b>1</b>	<b>2.5</b>	<b>0.5</b>
<b>Overall aggregate Score</b>		<b>25</b>	<b>28</b>	<b>30</b>	<b>45</b>	<b>26</b>	<b>30</b>	<b>15</b>	<b>22</b>	<b>13</b>
<b>Overall Average Score</b>		<b>1.56</b>	<b>1.75</b>	<b>1.88</b>	<b>2.81</b>	<b>1.63</b>	<b>1.88</b>	<b>0.94</b>	<b>1.38</b>	<b>0.81</b>

Lesser local residents agreed that the park was a source of their livelihood except about half agreeing to it in the western villages may be because many of them get monetary benefit from extraction of resources especially vegetables all year round which provided them a good source of livelihood unlike the other village clusters. The northern cluster residents did not depend much on the park for monetary benefits, which may be the reason why they did not agree to the statement. Majority of the local residents were also against fencing the park with least acceptance in the western villages. Since most of the villagers (65% local residents) depended on the park for some benefit or other they were against it. And as about 62% of the local residents got monetary benefit out of the park in the western villages contributing to about 59.5% of the total annual family income maximum opposition to fencing the park were recorded from the western villages. Similar was the condition in case of restrictions to resource extraction and the reason for the opinion will be the same but majority of them agreed to controlling the extraction of resources which may be due to their awareness that such activities (resource extraction) were not good for Sangai and as such many (more than half) agreed that vegetable and grass collection depleted Sangai's food plant. Lesser number of local residents in northern villages agreed to the depletion of food plant for Sangai than other clusters may be due to their ignorance about the food habits of Sangai or the habitat as most of them were fishermen and only few were involved in plant resource extraction. More than 80% of the respondents were optimistic about the benefits of tourism to the local people though most of the respondents had not benefited from tourism or had much contact with tourists. This may be a result of respondents answering in a generally positive than generally negative to a statement which they are not familiar with or maybe they hope people will get benefit out of tourism in future. Despite generally positive attitude towards tourism, those respondents who had benefited from access to park resources had a general objection to fencing and restriction of entry inside the park. Fewer respondents in the west opined that they will accept the law because most of them depend on the park resources for their livelihood (*please see Table 5.2*); they considered it as deprivation of their livelihood activities which may be the reason why majority of them also expressed that they will also agitate against it. But none of the respondents from the west were ready to intrude and steal resources from the park unlike other village clusters. This may be because those in the western villages resided close to the range office of the Forest Department and hence there were more

patrolling in this direction and most of the guards and boatmen were from this direction.

Demographic and socio-economic factors were unimportant for attitude towards the KLNP but contrary to it, these were sometimes important predictors for attitudes in other studies elsewhere (Sah and Heinen, 2001; Parry and Campbell, 1992, Mehta and Kellert, 1998) but similar to findings by de Boer and Baquete (1998) in Maputo Elephant Reserve, Mozambique, where opinions on fencing the park were influenced by whether a respondent derived benefits or income from the park. This was quite natural as fencing the park would deprive them of the benefits and this was also reflected in the respondents' village location where those on the western village who derived maximum benefits expressed more negative attitude to it. Although not statistically significant ( $p < 0.1$ ) those respondents whose main occupation was non-agriculture tend to express more negative attitude as farmers will still have sources of income if not from the park. Similar was the reason for those who have fish farm were socio-economically better and fencing might not impact their source of income. Thus our findings also agreed with the notion that local people's perception and attitudes of protected areas were influenced by the benefits they derived from the protected areas and by the negative consequences of its conservation measure as opined by many workers (Newmark et al., 1993; Fiallo and Jacobson, 1995; Studsrød and Wegge, 1995).

The amount of contribution for conservation was recorded highest in the northern cluster both in terms of monetary contribution as well as manual work. The number of people willing to work was higher than the number willing to contribute in the northern cluster which showed their willingness to contribute for the cause of conservation. Eighty three percent of the total respondents who were willing to contribute desired to pay upto an amount of ₹500 and the remaining were willing to pay higher. This revealed that the economic conditions of local residents affected the tendency to pay more for conservation of Sangai. This was also evident from the regression analysis which predicted that household annual income and total land holdings as important explanatory variable.

More than 55% of the respondents who were willing to contribute were not willing to receive any payment which was quite higher than the 11% who did not ask for any compensation in Kabartal wetland (Ambastha et al., 2007). Some of them do not want

to stop extracting resources from the park but some also felt morally responsible to conserve the park so they were not willing to receive any amount which was rather a good sign of attitude towards conservation. There was a large variation between the amount willing to contribute and willing to accept and willing to accept amounts estimates have generally been considerably larger than the willing to contribute estimates for the same environmental amenities in many studies (Horowitz and McConnell, 2002). There can be several other reasons for the disparity than contingent valuation's inconsistency with economic theory. The large empirical divergence between individuals willing to contribute and willing to contribute measures may not be indicative of some failure in the research methodology and this situation was acceptable as a general perception (Hanemann, 1991). The two measures were not the same and many economists found that they differ in many studies (Pearce and Turner, 1990). Some early empirical research also revealed that amount willing to contribute was several times lower typically one-third to one-fifth than amount willing to accept (Whitehead, 1994). In the present study the ratio between the two is quite large (88 to 204 times) and considering the scenario in the study area this result was indicative of the high dependency on the park and unavailability of an alternative substitute. Hanemann (1991) had also explained a similar situation where, holding income effects constant, the ratio of amount willing to accept to amount willing to contribute was larger when the public goods had few substitutes or the elasticity of substitution between the public goods and the composite commodity was low. According to Tversky and Kahneman (1991) people placed a higher marginal value on losses than on equivalent gains which caused the disparity and findings of Mansfield (1999) also supported Tverky's and Kahneman's loss aversion.

Amount of money preferred to accept for conservation was also highest among the northern respondents. This may also be due to their economic status and another likely reason was that most of them owned *athaphum* which floated freely inside the northern side of the park. If restrictions were there and if they have to accept the law, then their sources of income from the *athaphum* will be deprived. This might have tended them to demand for higher amount of money as compensation for conserving the park. More female respondents willing to pay than their male counterparts showed that female respondents were more concerned about wild animals especially Sangai

and the park. Negative regression coefficient with age of respondents showed that older respondents tended to pay lesser as compared to younger respondents since the older generation felt that the park had always belonged to them and as a result they did not need to pay more for something that belonged to them.

Conservation in densely populated areas with high dependency on natural resources is always difficult because of the complicated decision involved in resource allocation. Policies and measures to conserve biodiversity in such situations have ranged from policing and protection to involving the same resource dependent communities in conservation and management. The efforts have met with varying degrees of success, few of them having sustained (Badola and Hussain, 1999). For the sustainability of conservation efforts it was imperative that conservation be linked with mainstream economic development and the prevailing paradigm in integration of conservation and development read conservation is development and *vice versa* (Badola, 2000).

Majority (42%) of the local residents expected some sort of compensation for giving up benefits from the park while 22% wanted to be allowed to continue extraction. The various compensations wanted were mostly in the form of money or employment. However, compensation to the people can also be in the form of incentives like permission for legal removal of grass, buffer zones and revenue sharing schemes (Heinen and Shrestha, 2006).

While identifying the criteria and indicators for the present study, criteria that contributed to strengthening the livelihoods assets were prioritized. According to the feasibility analysis, handloom followed by small businesses and poultry were the most feasible livelihood options for the local people living around KLNP. They scored high on feasibility test because they were the traditional livelihoods of the people in the area, for which people have the skills, and the technical support was also available nearby, the market existed and these livelihoods do not have negative impacts on KLNP or the other stakeholders (Ashley and Hussein, 2000).

The local people have given the highest preference to tourism, since people perceived this as the easiest and most paying option. However when we examined the feasibility of this option in consultation with the stakeholders, it was agreed that the present political situation does not provide a conducive environment for tourism. Moreover, there was a lack of tourism infrastructure in the area which will need time and inputs

to build. The potential impacts of tourism on the KLNP and the Sangai need to be examined before promoting it as an alternative livelihood capacity.

## **5.5 Conclusion**

Local people living around the park had quite positive perception towards KLNP although some of them had been deprived of their rights when it was declared a national park in 1977. This was evident from the people's recognition of the intrinsic value of wildlife resources, and also by some of the benefits received from staying close to the park. Majority of the local people were optimistic that tourism will benefit them and tourists also agreed that tourism will help in conservation. Majority of the local population were against fencing the park and more than forty percent will agitate against it. Few of them will intrude and steal resources even if restricted except the western villages. None of the demographic and socio-economic factors influenced local people's opinion towards the park but whether a respondent derived benefit or not from the park was significantly related to whether they agreed to fencing of the park or not. More than 93% of local residents around the park were willing to contribute for conservation of Sangai and the park in the form of money or as manual labour. The mean amount willing to contribute one time was estimated to be ₹283.15 household<sup>-1</sup>. More than 55% of local residents who were willing to pay for the park were not willing to receive any monetary compensation for conservation of the park. The total amount willing to contribute for conservation of Sangai as calculated from the local people's willingness to contribute was ₹7,38,917. Seventy percent of the respondents who were not willing to contribute wanted to receive one time monetary compensation with a mean amount of ₹36481.48. Total landholdings and total annual income influence the respondent's amount willing to contribute. The feasibility of alternate livelihood options revealed that handloom enterprise will be a potential alternate avenue socially and economically acceptable followed by small business venture. Tourism though opted by majority of the local people and also by tourists as a good option to improve their livelihood and for better conservation of Sangai respectively was not feasible given the scenario of the law and order condition of the state.

	
<p>Tourist vehicles outside the Park</p>	<p>Handloom</p>
	
<p>Handloom products</p>	<p>Fish farms around the Park</p>
	
<p>Local employment</p>	<p>Fish from <i>athaphum</i> being prepared for sale</p>

**Plate 5.1:** Alternative livelihood options as opted by the local communities living around KLNPN.

## **CHAPTER 6**

### **RECREATIONAL VALUE OF KEIBUL LAMJAO NATIONAL PARK**

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#### **6.1 Introduction**

National parks like other natural resource systems provide valuable services to man and are used extensively by people for various purposes. Environmental systems provide materials and other benefits that contribute directly to human well being. The values of ecosystem can be divided into direct and indirect values and non-use values (Torras, 2000). Direct use values are those that are derived from ecosystem services and are directly used by humans, which include value of consumptive use such as harvesting of food products, timber, bush meat; and non-consumptive use such as recreational and cultural amenities (Torras, 2000). Indirect use values are derived from ecosystem services and benefits provided outside the ecosystem such as filtration function of wetlands, storm protection in coastal areas and carbon sequestration. Option values are derived from preserving the option to use services in the future, which may not be used at present, either by oneself in which case it is named option value or by others or heirs named as bequest value (Torras, 2000). Non-use values refer to those values people know exist even though they never use those resources directly. This kind of value is usually known as existence value or sometimes passive use value (Torras, 2000; Brun, 2002). These environmental services are rather a necessity than a luxury, because they tend to affect low-income groups more strongly than high-income groups (Hökby and Söderqvist, 2001).

National parks frequently face difficult budget decisions. Economics can facilitate making these decisions by suggesting that benefits and costs should be weighed in order to make efficient budget allocations. Nowadays, the fact is that environment is inseparable from the economy and no economic decision is made without influencing the natural and artificial environment and no environment change occurs without having economic influence (Pearce and Turner, 1990; Costanza et al., 1997; Hein et al., 2006). The recreational value is part of the use value of a natural system where the natural resources are used for recreation like hiking, climbing, fishing, wildlife and bird watching, water sports, spiritual and social utilities. 'Recreational valuation' like other ecosystem valuation has been used by many environmentalists as an

attempt to prove the importance of the ecosystem and to bring the values of services into cost-benefit analysis of land use strategies. However, this is often difficult in national parks since many park resources and amenities, such as scenic beauty and species preservation, are not priced in markets and at the same time, it is costly to maintain these resources. In effect, park managers face these costs in terms of money, but not the benefits. Non-market valuation is a tool of economics that can help alleviate this problem by estimating the value of resources and amenities that were not exchanged in markets.

Several methods of valuing environmental goods and services had evolved in recent years. One of them, the travel cost method (TCM) has been used extensively around the world to value public recreation sites with minimal or no admission charges. The travel cost approach is based on the theory of consumer demand. The fundamental principle of TCM is that the value people attach to a location of environmental significance can be inferred from the cost they incurred in traveling to it. By using this method, the expenditure related to recreation travel would be treated as travel costs as accounting an aggregation out of pocket costs associated with distance traveled and value of time spent traveling (Englin and Shonkwiler, 1995). In essence, the TCM evaluates the recreational site by relating demand for that site (measured as quantity of site visits) to its price (measured as the costs of a visit) and has been applied extensively for the valuation of resources such as natural and man-made tourist resources, national parks and sanctuaries, monuments and places of historical importance etc.

With the increasing awareness and interests on biodiversity conservation and their economic valuation elsewhere the present study was conducted to estimate the non-market value of KLNP so that the economic worth of the park and the economic value as perceived by the dependents or people residing close to it could be understood so that the park managers and policy makers could prescribe strategies and policies to meet the objectives of managing the park and also to provide the goods and services to the people. The recreation value and contingency values of the park was estimated for the study.

## **6.2 Methodology**

### **6.2.1 Questionnaire survey of visitors**

Data was collected by means of questionnaire survey administered through personal interviews more during the high tourist season and lesser during the off tourist season. Interviews were conducted mostly in the viewing tower near the Forest IB and also at the main gate. Sampling was done both on weekdays and weekends which were sampled from 09:00 am to 04:00 pm to make sure that highest numbers of tourists were interviewed (Petrosillo et al., 2007). Only one individual was interviewed from a small group (3-10 persons) of tourists but in case of larger groups (bus loads) 4-5 individuals were interviewed which consisted of representatives of different age group and gender. Visitors were very cooperative with very few refusals who happened to be young local visitors. Primary data was collected by survey method through direct interview using questionnaires from 112 tourists. Questions were structured in order to characterize visitors' profile in terms of gender, age, education level, income, place of residence, strength and composition of group, purpose of visit, frequency of visit, time taken to reach KLNP and travel expenses were gathered (*Appendix IV*).

Questions regarding conservation of Sangai and the management of park by Forest Department were also asked. The survey was carried out almost throughout the year more intensely during May and June as it was the peak tourists' season. Secondary data about the total number of visitors was taken from the Forest office's receipt of parking fee which was ₹5 for two-wheelers and ₹10 for four wheelers and buses. Travel Cost Method (TCM) was used to derive the recreation value of the park by using the data from the survey.

### **6.2.2 Data analysis**

Travel cost of the individuals was calculated by adding the opportunity cost of the time spent in travelling, the cost of fuel in case of private vehicles and the charge of hiring vehicles. Total travel cost was the summation of the travel cost of all the visitors. Regression analysis was used to estimate the equation that relates visits per capita to travel costs. The demand function was constructed using the regression analysis. The first point on the curve was the total number of visitors at the current access cost (in this case no entry fee). The other points were plotted by estimating the

number of visitors with different hypothetical entrance fees. The entrance fee was increased till the number of visitors become zero. By joining the points the demand curve for trips to the site is obtained. Finally, the economic benefit from recreation use was estimated by calculating the consumer surplus or the area under the demand curve. The responses regarding the tourists' attitudes were summarized and tabulated and subjected to percentage frequency data analysis.

## **6.3 Results**

### **6.3.1 Recreational value**

#### **6.3.1.1 Profile of tourists visiting KLNP**

In spite of the present law and order conditions in the state, KLNP still witnesses about 5,780 tourists annually from all walks of life. Out of the 112 representatives of the tourists interviewed, it was found that about 81% were male and only 19% were female (**Table 6.1**). Most of the visitors (44%) were between the age group of 18-30 years followed by 31-40 years (24%). About 39% of the tourists were graduates and 15% had completed post-graduation. None of the visitors were illiterate and had at least some years of formal education. While 14% and 23% were unemployed and students respectively, the rest of the visitors were engaged in government (24%), private jobs (21%) or were self employed (18%). Most of the visitors (43%) fell into the less than ₹3,000 month<sup>-1</sup> income group because many of them were students and unemployed people. Visitors in the ₹5,000-₹10,000 monthly income group constituted 22% of the total visitors while people with more than ₹25,000 monthly income composed only 5% of tourists.

Around 60% of the visitors came in their own private vehicles followed by hired vehicles (7%). About 51% were visiting KLNP for the first time while 25% for the second time. Most of the visitors (31%) came to the park for picnic while 30% visited KLNP *en route* to Thangjing Temple in Moirang. More or less equal percentage of tourists (16% and 17%) came to see Sangai and KLNP and for educational excursions. Most of the visitors (94%) did not see any animal while only 4% reported of sighting some unidentified animals.

**Table 6.1:** Profile of the visitors interviewed at KLNP. (Values in parentheses are percentage) n=112

<b>Parameters</b>	<b>Number (%)</b>	<b>Parameters</b>	<b>Number (%)</b>
<i>Gender</i>		<i>Mode of transport</i>	
Male	91 (81)	Personal vehicle	67 (60)
Female	21 (19)	Hired taxi	08 (7)
<i>Age</i>		Public conveyance	09 (8)
< 18 yrs	07 (6)	Govt. Vehicle	07 (6)
18 – 30 yrs	49 (44)	<i>Frequency of visits</i>	
31 – 40 yrs	27 (24)	First	57 (51)
41 – 50 yrs	14 (13)	Second	28 (25)
> 50 yrs	15 (13)	Third	11 (10)
<i>Educational qualification</i>		Fourth and above	16 (14)
PG	17 (15)	<i>Reasons for visit</i>	
Graduate	44 (39)	To see Sangai & KLNP	18 (16)
Matriculate	39 (35)	Educational tour	19 (17)
Undermatric	09 (8)	Picnic	35 (31)
Primary education	03 (3)	<i>En route to Thanjing Temple</i>	33 (30)
<i>Occupation</i>		Others	07 (6)
Govt. employee	27 (24)	<i>Animals sighted</i>	
Private job	23 (21)	Unidentified animal	04 (4)
Self employed	20 (18)	Nil	105 (94)
Students	26 (23)		
Unemployed	16 (14)		
<i>Income class (₹)</i>			
<3000	48 (43)		
3000 - 5000	16 (14)		
5000 - 10000	25 (22)		
10000 - 25000	18 (16)		
>25000	05 (5)		

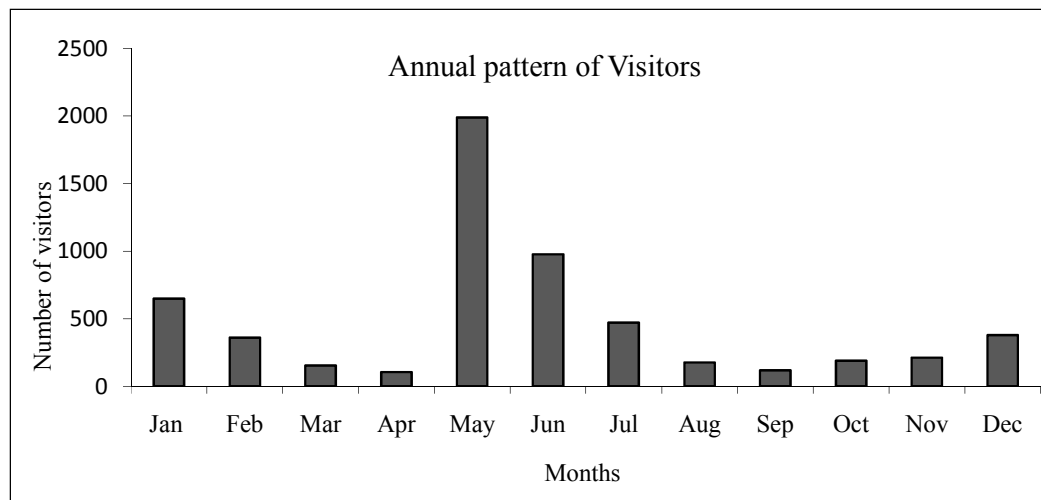
### 6.3.1.2 Pattern of tourists' visit

Monitoring of tourists at KLNP for a year (January - December 2008) revealed that maximum tourist visits were during the months of May and June which was due to the month long festival of Thangjing deity. About 50% of the visits were recorded in the months of May and June and about 23% in the months of December, January and February (**Figure 6.1**).

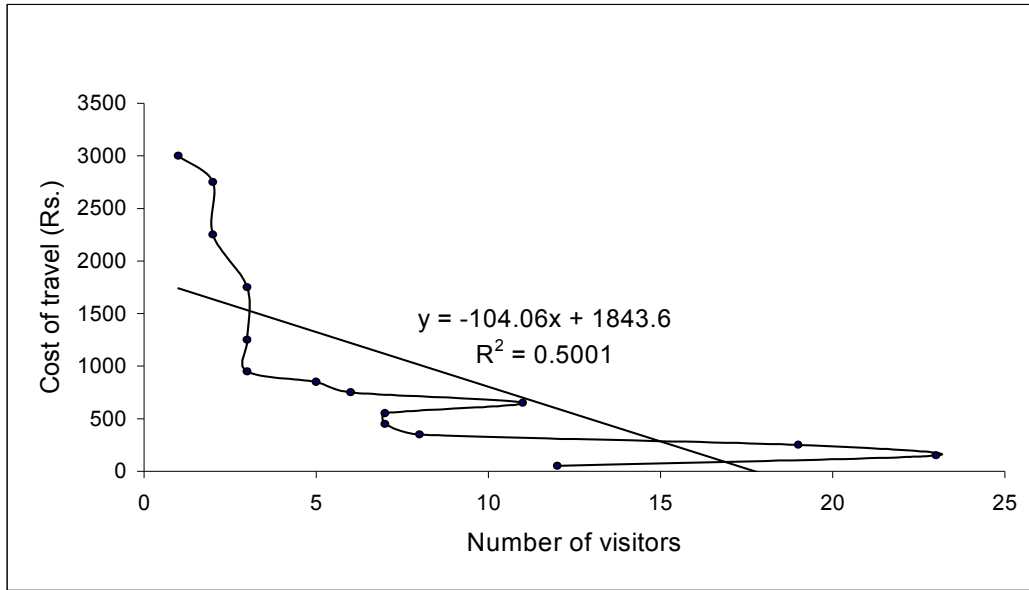
The visitors recorded during winter season were usually picnic parties and school children coming for educational tours which coincided with schools winter vacation, an ideal season for picnics. Most of the tourists (92%) were local tourists from within the state while only 5.3% were from outside the state who were on official visit to Manipur and visited KLNP as pleasure trip. The only foreign tourists, during the monitoring period, were 3 Bangladeshi students who stated that they had come to study the architecture of huts on the floating meadows of Loktak Lake.

### 6.3.1.3 Recreation value of KLNP

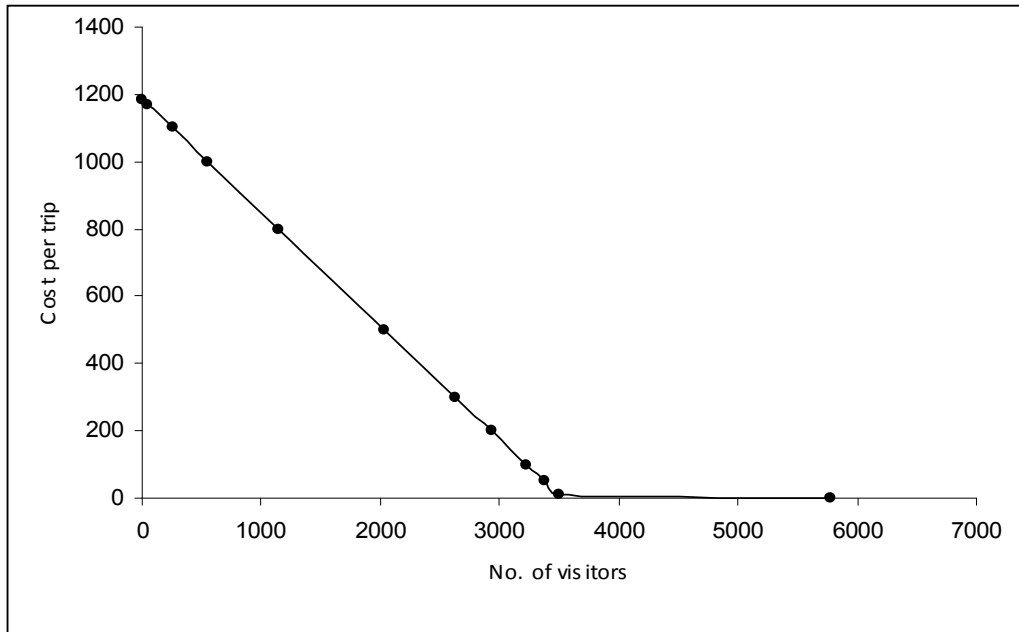
The number of visitors at different cost of travel was plotted to get a regression curve (**Figure 6.2**). From the function obtained for the demand curve  $y = -104.06x + 1843.6$ , the value of the ticket fee was replaced with succeeding higher values to get the consumer's surplus. In **Figure 6.3**, the first point on the curve was the total number of visitors at the current access cost (in this case no entry fee). demand curve for the site was obtained.



**Figure 6.1:** Histogram showing annual flow of visitors to KLNP.



**Figure 6.2:** Regression curve for Travel Cost and number of visits.



**Figure 6.3:** Travel Cost Demand curve.

The subsequent points were calculated by estimating the number of visitors with different hypothetical entrance fees until the number of visitors became zero and travel cost. Finally the recreational value was estimated by calculating the area under the demand curve which was the consumer surplus and was worked out to be ₹375.35

visit<sup>-1</sup>, and when extrapolated to the total number of visitors the total economic benefit from recreation use was estimated to be ₹21,69,523 annum<sup>-1</sup>.

#### 6.3.1.4 Conservation attitudes of tourists

When the tourists were asked about their opinions and views on Sangai conservation and its related issues, all the tourists agreed that the status of national park was necessary for the conservation of Sangai (**Table 6.2**). More than half (56%) of the tourists expressed satisfaction with the management of the park by the Forest Department while the rest were not satisfied. Ninety three percent agreed that tourism will help in better conservation of Sangai. On opinions to improve the condition of the park, fencing was mostly chosen (37%) while construction of dyke around the park was least (15%) opted. A high percentage of respondents (61%) expressed improving the habitat as priority for conservation of Sangai and captive breeding was least (13%) favoured.

**Table 6.2:** Tourists' attitudes towards conservation in KLNP (values in parenthesis are percentage) n=112.

<i>Is the status of National Park necessary for the conservation of Sangai?</i>	
Extremely necessary	44 (40)
Necessary	65 (60)
<i>Are you satisfied with the management of the park by the Forest Department?</i>	
Yes	65 (56)
No	46 (41)
<i>Do you think encouragement of tourism will help in better conservation of Sangai?</i>	
Yes	104 (93)
No	03 (03)
<i>Opinion to improve the park.</i>	
Fencing	43(37)
More tourist oriented	36(31)
Dyke	17(15)
<i>Remarks on means to conservation of Sangai.</i>	
Improve the park	78 (61)
Translocation	34 (27)
Captive Breeding	16 (13)

## 6.4 Discussion

Being the only floating national park in the world amidst the scenic beauty of Loktak Lake many local tourists flocked to the park usually with a hope to see the dancing deer and the floating meadow. A good number of the visitors were students who came in big groups on educational tour from schools and colleges between 18-30 years age group though at Lake Manyas in Turkey majority (61.90%) of the visitors were in 30-44 years age groups (Gürlük and Rehber, 2008; De and Devi, 2011). Large numbers of visitors from other parts of the state during the months of May and June related their visits to 'Thangjing *lai haraoba*' (month long annual festival and rituals of local deities) at Moirang, 7 km away, which was similar to the observation in Lake Manyas of Turkey (Gürlük and Rehber, 2008) where tourists had multiple destinations in one trip. Visits *en route* to Thangjing comprised mostly of elder people. Those who visit during the winter months were usually picnic parties as the weather was pleasant with no rains and most of the children had winter vacations.

About half of the respondents had visited the park for more than once and about a quarter had visited three or more times. This showed that the park has good potential for providing recreational and aesthetic services to the people locally. But many of them were disappointed as they could not see any Sangai or other wild animal inside the park. However, this did not deter them from visiting again which was evident from the fact that about a quarter of the respondents had been visiting the park for more than three times. The inability to see any wild animal or Sangai was quite probable as the tourists normally visit during the day more often in the afternoon as it takes time to reach the park from other districts while Sangais are active during the early morning and late evening hours and rest during the day.

The recreation value of ₹375.35 visit<sup>-1</sup> was found to be quite nominal considering the location of the park which was about 45 km away from the main town Imphal, from where majority of the tourists flocked. This value was lower compared to other prominent places like ₹550 in Pench Tiger Reserve (Kulkarani and Vidya, 2002), ₹427 in Bharatpur National Park (Chopra et al., 1997), ₹1,878.46 for Cherrapunji (De and Devi, 2011) but more than the ₹194.68 estimated for Valley of Flowers National Park (Gera et al., 2008). Large number of visitors came in big groups in buses which costs lesser travel cost and non-charging of entry fee may be some of the reasons why the recreation value was estimated to be low in KLNP. The recreation value was

estimated to be ₹21,69,523 annum<sup>-1</sup> much higher than the ₹5,88,332 of Valley of Flowers (Gera et al., 2008) but far lower than the ₹66,00,000 of Pench (Kulkarani and Vidya, 2002) and the ₹37.31 crores of Cherrapunji which is globally popular tourist spot due to its fame of being the wettest place in the world (De and Devi, 2011).

## **6.5 Conclusion**

The Travel Cost Method (TCM) is a potentially useful valuation tool producing uncompensated consumer surplus estimates of use value. It is best applied to the evaluation of well defined recreation sites or to the evaluation of a well-perceived, separable, environmental attribute within such a site. The result showed useful aspects like transports to park, categories of tourists, purpose for visit etc. that can play significant roles in generating valuable economic information for local government policymakers to place suitable management plans in maintaining quality of public park service in association with the preference of community to achieve the goals of national park to fulfill the conservational, recreational and educational objectives. The recreational value of the park was estimated to be ₹375.35 visit<sup>-1</sup> and the total economic benefit from recreation use was estimated to be ₹21,69,523 annum<sup>-1</sup>. All the tourists had positive attitudes towards conservation of Sangai and many agreed that more work need to be done to improve the park for better conservation of Sangai. More infrastructures and facilities were required to encourage tourism to the park.

## CHAPTER 7

### GENERAL DISCUSSIONS AND IMPLICATIONS FOR CONSERVATION

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#### 7.1 General discussion

In India, conserving the only remaining habitat of the most endangered Eld's deer *Rucervus eldii eldii* locally known as Sangai in Keibul Lamjao National Park (KLNP), Manipur is crucial for its long term survival. The deer was once widely distributed throughout the state of Manipur but is now restricted to the floating national park in the south eastern fringe of Loktak Lake. Though the status of being a national park does not allow extraction of any non timber forest products from KLNP, the biomass resources of the park have always been an important source of livelihood of the people living around it and it is still continuing so. The purpose of the present study was to understand the relationship of the local residents with the national park, so as to formulate the participation of local residents in developing appropriate measures for the conservation of this species and other wild life in the park.

The livelihoods of the local communities around the KLNP incorporate, among other things: fishing, rice-growing, sale of vegetables and fish collected from the park, poultry and small businesses. This livelihood diversity evident in KLNP is characteristic of people living around wetlands elsewhere (Allison and Badjeck, 2004; Geheb and Binns, 1997; Sarch and Birkett, 2000; Allison, 2004) and is interestingly a coping strategy to a variable natural environment. Although diversified livelihood strategies are now quite well documented and the reasons for their adoption well understood; management actions and policies are still typically conceived and implemented in sectoral terms (agriculture, fisheries, forestry, wildlife conservation etc.) and may thus undermine or block peoples' otherwise adaptive, cross-sectoral responses to the uncertainties they confront. Many development agencies and NGOs have tried to address this anomaly by adopting what has become known as the 'Sustainable Livelihoods Approach' or 'SLA' (Carney, 1998) as a framework for designing policy and management interventions that build on the strengths of peoples' existing livelihood strategies. Keeping in view the above discussion, the following

synthesis has been made based on the findings of the study for effective and successful conservation of Sangai and its wetland habitat.

The word 'Loktak' besides having an everlasting association with folklore, culture, and education of society of Manipur, is also the lifeline of many people residing in and around this unique ecosystem. Its importance has become inevitable by the presence of Sangai in the floating meadows or *phumdi* of Keibul Lamjao National Park. The park has become a symbol of recognition for the people residing around it. Since human settlement and resource use are characteristics of protected areas (Kothari et. al., 1989) with threats to protection coming from small scale activities of local communities it becomes critical to study these components of relation between the park and its local residents. Hence the present study was undertaken to understand the socio-economic conditions of the people residing around KLNPN.

The results of the study were revelatory of the people's dependence on the park. The local people around the park have to manage their families of 6-7 members with an average annual income of about ₹69,228. The villages in the northern direction had the highest average family income and the overall economic conditions of these villages were better as they have more number of residents with government jobs and own *athaphums* which give high returns confirming that high level of education and improved off-farm opportunities increase social and economic status (Angelsen and Kaimowitz, 1999, Godoy and Contreras, 2001, Adhikari et al., 2004; Agrawal and Gupta, 2005). The economy of the area was found to be mainly agrarian with most people engaged in marginal farming with small land holdings, cultivating single crop (paddy) owing to lack of irrigation facilities. The agricultural produce was rarely found to suffice their needs and people take up various other occupations to earn some extra income to meet their requirements. Pisciculture, fishing and vegetable collection were also other important activities taken up either as primary or secondary source of income for which the local people either directly or indirectly depended on the park and its surrounding wetlands (**Chapter 3**).

A 'holistics or ecosystem level' approach is needed to understand the dependence of people on the park and how their activities are affecting the ecosystem of park. Emphasis should be given on measures to reduce the dependence of people on the park and the attitudes and perceptions of the local people about the conservation of Sangai in order to incorporate all these aspects for a better management strategy.

The resources from the protected areas or parks have always played a significant role in the households of the local people residing in or around them (Silori and Mishra, 2001; Davidar et al., 2008). Though extraction of resources from the park are not allowed, but due to the lack of alternative sources, people continued to extract these resources illegally from the park (Gee, 1960; Singh, 1997; Prasad and Chhabra, 2001). The fish and plant resources from KLNP played key roles in the economic conditions of the local residents either for subsistence or commercial purpose. The types of resources extracted and the degree of dependency were affected by location or proximity of the village to the park, economic conditions and seasonality of resources (Murthy et al., 2005, Davidar et al., 2008, Kar and Jacobson, 2012). The economically better families in the north and eastern families who have planted trees especially *Eucalyptus* sp. on their homestead do not collect fuel wood from the park. Extraction of plants (*Leersia hexandra*, *Zizania latifolia* and *Hydrilla* spp.) as fish feed and for sale as vegetables (*Hedychium coronarium*) was highest amongst other extractions. The park was also the source of about 13 important species of fish from small species like *Amblypharyngodon mola* and *Punctius ticto* to larger species such as *Ctenopharyngodon idella* and *Cyprinus carpio* using different varieties of gears depending on the size and species of fish and also on the economic condition of the fisherman (**Chapter 4**). The park contributed about 300 ton of fish annually which is about 20% of the fish production of Loktak Lake (Trisal and Manihar, 2004).

Families depending on the park were highest (72%) in the west mainly because of the proximity to the park and lowest (54%) in the north where wealth status and higher education level were the main reasons for least dependence. Contribution to the household income was maximum in the west in which 40.48% of the total household income came from the KLNP and was minimum (18.9%) in the east.

The floating grasslands and the nearby hillocks harbour rich variety of plants as reported by different workers. Singh (1991) reported 223 plants, 145 by Singh (2002a), 117 by Angom and Gupta (1999) and 185 by Tuboi (2013). In the present investigation on changes in vegetation composition over the years 62 plants were recorded which is comparable with the 56 plant species reported by Angom and Gupta (2005). The present observation reveals that the ratio of shelter plants and food plants now stands at 27 : 37 against 40 : 60 as observed by Singh (2002b) in 1996. Decrease in percentage of occurrence of *Leersia hexandra*, *Capillipedium assimile*,

*Zizania latifolia* and *Phragmites karka* confirmed the observations made by Singh (1997) and Singh (2002b). The replacing of palatable species by the non palatable ones was in accordance as reported by Rocky (2002). The decrease in food plants and shelter plants of Sangai was a result of the overlap of the plants extracted by local people for vegetables, fish feed/fodder and fuel wood throughout the season and similar observation was also made by Angom and Gupta (2006).

In the experimental trial for testing the effect of different harvesting regimes, an increase in density of *Leersia hexandra* was observed when no or complete harvesting is done than 50% harvest but there was a decrease in densities of *Hedychium coronarium* with increasing harvesting intensities. No significant change in density of *Zizania latifolia* to different harvesting intensities was observed whereas 0% harvest showed a significant increase in density of *Phragmites karka* and 100% showed significant decrease in density. Thus the change in vegetation composition of the *phumdi* over the years was a result of continued extraction of plant resources by local communities besides occurrence of fire. Khatri and Barua (2011) also made similar observation on effect of fire in the grasslands of Kaziranga National Park. The high loading of nutrients from inflowing rivers (Kosygin, 2002) make the park hyper-eutrophic (Tuboi, 2013) which may also lead to reduction in plant diversity (Aguiar, 2005) dominated by few species and suppression of many other species (Silvertown, 1980). In view of this, restriction in extraction of plant resources from the park and development of sustainable livelihood options will help in reducing the anthropogenic pressure on the park.

Understanding the needs, aspiration and attitudes of local people around the park will help in identifying problems and finding solutions for developing appropriate management strategies. There was an overall significant positive response towards the park, and exploitation of the resources was linked to poverty and unemployment. Local people acknowledged the importance of Sangai and KLNP in their lives and many claimed Ithai Barrage responsible for the deteriorating ecosystem of KLNP and its surrounding areas. Lesser people agreed to fencing and complete restriction of resource extraction from park and were ready to agitate against rules that will completely deprive them of the park benefits but many agreed to regulated or controlled extraction (**Chapter 5**). Similar observation was also made by Gee (1960) on the opinion of local villagers on the restrictions to the entry of cattle for grazing in

KNLP. Respondents with off-park resources like land for agriculture and pisciculture agreed more to protection measures like fencing while people deriving benefits from the park opposed to it. Almost all the local residents felt that tourism will be able to help them in improving their living conditions. The attitudes and opinions of visitors regarding park management and Sangai conservation were also investigated. All the respondents agreed to the importance of national park for the conservation of Sangai. More than 50% were satisfied with the present management of the park by the Forest Department. The total amount local people were willing to contribute for the conservation of Sangai was ₹7,38,917. Although resource extraction in any form from the park is illegal, it could not practically be banned. Gee (1960) also reported about the prevailing established rights long before the park was declared, but suggested to restrict and control the extraction. To understand if the local people were willing to cooperate with the conservation of the habitat by reducing/banning the resource extraction, the respondents were asked if they would be willing to accept compensation and abide by the rules of the park to discontinue the extraction, the local respondents were willing to accept a onetime average amount of ₹36,481 ± 2544 family<sup>-1</sup>. However, there were people who were willing to pay for conservation of Sangai but not willing to accept any compensation.

For success of conservation efforts, conservation should link policies with economic development and involve the same resource depended communities in conservation and management which can sustain (Badola and Hussain, 1999). The local people expect compensation mostly in the form of money and employment to forego the benefits from the park. The livelihood options preferred by the respondents were tourism, followed by employment in jobs. However a feasibility assessment of the alternative livelihood options revealed that handloom work was the most practical and feasible option among women folk followed by small business and poultry (**Chapter 5**). This study revealed that people were willing to improve the condition of the park and help in conservation of Sangai provided they were given adequate alternative livelihood avenues as compensation for forgoing their dependence on the park.

Valuation is important to prove the importance of an ecosystem and bring the values of services into cost-benefit analysis of land use strategies. The recreational value of the park, estimated by Travel Cost Method (**Chapter 6**) was ₹375.35 visit<sup>-1</sup> or ₹21,69,523 annum<sup>-1</sup> which was less than many prominent places like Keoladeo

National Park (Chopra et al.,1997), Pench National Park (Kulkarani and Vidya, 2002) and Cherrapunjee (De and Devi, 2011) but higher than estimates of some less popular places like Valley of Flowers (Gera et al., 2008). Almost all the tourists (93%) felt that tourism will help in better conservation of Sangai and agreed that fencing, construction of dyke around the park and making the park more tourist oriented will help improve the park. Majority of the tourists were optimistic that improving the park was the best option for Sangai conservation than translocation and captive breeding.

For successful conservation of Sangai and its habitat in KLNP it is very important to have good understanding of the park and people relationship maintain a cordial relation with local people and park authorities just as reported by IIED (1994) that the benefits of wildlife management in terms of use and non-use. Use values like traditional and non-traditional products harvested for consumptive use and various ecological function provided by species and habitats and non-use values include the cultural and heritage values. The report also emphasized the growing importance of understanding the needs and perspectives of local people which led to the emergence of active participatory approaches involving people in wildlife management. The report also discussed about various schemes to compensate local people for loss of access to natural resources by providing an alternative livelihood source. Finally the report concluded that community wildlife management is like to be sustainable ecologically, economically and socially only if wildlife management can be made sufficiently attractive to local people for them to adopt the practice as a long-term livelihood strategy. Community-led wildlife management initiatives can be achieved by recognizing community rights to ownership of wildlife resources; building on formal and informal structures that facilitate community participation in wildlife management and by operation of effective mechanisms for sharing o benefits of wildlife resource management with communities. The sentiments and opinions of local communities who had suffered heavy loss from creation of the park should be respected so that a repeat of the incident of 1979 (Singh, 1997), which did damage to the park, does not happen again and involve them to participate in Sangai conservation to make Sangai conservation as a people friendly successful conservation story.

## **7.2 Conservation implications**

Protected areas do not exist in a socio-political vacuum, and are prone to negative feedbacks from their societal implications. It is important to incorporate local perspectives in protected area policy to reduce conflicts associated with conservation (Rastogi et al., 2010; Singh, 1996; Rangarajan, 2001; Wilshusen et al., 2002; Sarin, 2005). The existing protected area system in India allows little involvement of local communities in resource management. The resultant conflicts between different social groups and between the state and civil societies preclude setting up of sustainable resource management systems. Since the past two decades, in India, as elsewhere, there is a move towards involving local people living in and around forests in biodiversity conservation. This is a response to the legitimate demands of local people to be involved in activities that affect their lives, as also a necessary precondition for the success of conservation efforts. However this has also set up new challenges for the protected area manager. Managing a protected area with tremendous pressures from the local people adjacent to it has always been great task for park managers since there is no clear consensus on the most suitable approach for this incorporation (Rastogi et al., 2010).

Studies have indicated that although the conservation of wetlands may be influenced by larger policy decisions, their sustainable use relies mainly on farmers, fishermen and other users living close to wetlands (Pyrovetsi and Daoutopoulos, 1997; Sah and Heinen, 2001). Therefore, any conservation initiative in KLNP should address the socio-economic conditions of the rural villages specifically unemployment and poverty as well as to develop the stakes of local people in conservation of Sangai. Successful management in an area can only be accomplished by continuous participation and involvement of local people and other stakeholders in conservation activities and by developing sustainable livelihoods for the local people by building on the resources already present in the villages (Tomićević et al., 2010). Some of the socio-economic implications for formulating management plan for successful conservation of Sangai and its habitat are elaborated below.

### **7.2.1 Confidence building**

Organising social welfare programmes like free medical camps, entrepreneurship programmes, Self Help Groups, awareness of various governmental schemes and programmes, availing loans etc. are some of the ways which could help in gaining the confidence of the local people and establish good faith. Gaining the confidence is very crucial in establishing a good relation with the local people.

### **7.2.2 Education**

It was recommended by Walker (1994) that local NGOs and clubs would make the best educators as they were easily accepted by local people and have knowledge about the area and people. These NGOs could help in establishing a smooth relation between the government and local people before attempting to educate them. Education should be both formal and informal like school programmes and extension programmes. The Government of Manipur should allocate more funds for educational programmes in the Forest Department and as well as NGOs. The Forest Department and Education Department should include specialized information on both flora and fauna of Keibul Lamjao National Park in the school curriculum.

### **7.2.3 Reducing dependency of people on KLNPN**

The dependency of local people on the park for fuel wood, fodder, vegetable and fish is very high. If these can be shifted to other sources it can reduce the pressures on the park. If the villagers can be convinced to grow their own fuel wood and provided with fast growing fuel wood tree species that can be grown in and around their homesteads and on common and marginal lands, it will reduce the extraction of fuel wood from the park. Other energy source like biogas, briquettes made from charcoal, straws, rice husk and other easily available biomass should be introduced. Complete prohibition of resource extraction is not recommended since it did not work as seen in 1979 where there was hue and cry by public and people are still ready to agitate again if they are deprived of these benefits. Use of energy efficient stoves and hearths should be encouraged. Vegetable collection should be allowed only during particular season or for specific quantity through few check points under the strict surveillances of Forest Department and from other sites like the adjacent Takmu pat, Pullen pat etc., which will help decrease the impact on the park. Also restricted entry for vegetable collection through few check points can reduce the problem of poaching. Staff

maintained to enforce the provisions of law, maintenance of law and order and manage the park should be enhanced at different hierarchical levels.

#### **7.2.4 Developing sustainable livelihoods**

As suggested by the feasibility analysis, handloom as an alternative source of livelihood should be provided all support along with small businesses and poultry. Local people should be involved in departmental works such as patrolling, planting of saplings, firelines cutting, boat canal cleaning etc. giving them a sense of responsibility and involvement in conservation programmes. Opportunities can also be created in the field of education as guides or propagandists. Selling of souvenirs like pictures of Sangai, caps, T-shirts, handkerchiefs with Sangai or other logo related to wildlife conservation would not only help local people earn some extra income but also help in spreading awareness about Sangai and other wildlife conservation. The Interpretation Centre at the park should be made operational, staffed by local people and forest guards. Pisciculture should be encouraged to reduce the fishing pressure in the park and alternate source of fish feed should also be arranged such as using some part of the farm to grow fish feed or get the fish feed from Loktak Lake and other areas.

#### **7.2.5 Enhancing agricultural output**

The productivity of agricultural land is low and there is only one cropping of paddy. The utility of land can be increased following double cropping or growing of vegetables. For this, there is a need to improve the irrigation facilities. Trainings on improved and high yielding crop varieties should be imparted to the farmers by concerned line departments and these should be made available easily at subsidized rates. Also the *phumdis* removed from Loktak Lake are rich in nutrients and can be used as manure and provisions should be made to use the *phumdis* as an encouragement to organic farming. This will not only be beneficial to the local community in reducing the costs of agriculture but also solve the problem of *phumdi* proliferation and disposal in Loktak Lake and reduce pollution from nearby fields and farms.

### **7.2.6 Awareness campaign**

The local communities around the park are aware of the recognition they get due to the presence of Sangai in KLNP but have no knowledge about the consequences of their activities to the park and the wildlife in the park. Official special events (Wildlife Week, Wetland Day, Environment Day, Forestry Day, Earth Day etc.) should be fully utilized with students from local and regional schools and colleges. Quiz programmes, elocution competitions, painting and drawing competitions with wildlife themes should be conducted to get their attention on wildlife. Meetings and seminars, both formal and informal for both scientists and common man should be organized to enhance awareness and increase knowledge about the park. Awareness on values of conservation should be developed and seminars addressing the problems of the park, the causes and the solutions should be conducted for the politicians, administrators, business communities, scientists and local people to give them a sense of participation and the role they can play for protecting the area. Also, the government should provide incentives and rewards to people who have done any work towards the conservation of Sangai like rescuing Sangai, catching poachers, reporting or stopping illegal activities. The role of media in disseminating information and increasing awareness should be highlighted.

### **7.3 Conclusion**

Wetlands constitute some of the most important and threatened ecosystems in the world. They are known for their biological, hydrological, economic, social, cultural and aesthetic values. Their rich physical and biological resources are exploited for food, water, medicinal plants, fuel wood and materials for making handicrafts (Terer and Gichuki, 2001; Thenya, 2001; Terer et al., 2004). They are also important for tourism due to their unique landscape and rich biodiversity (Visser, 1992). Given that human activity is the primary threat to wetlands; effective solutions for sustainable management of wetlands are imminently required. It is vital to understand how the individuals, social networks or indigenous communities' that have ownership and directly utilise the living resources actually value the wetlands. People's livelihood, culture and spiritual attachment to wetlands should be respected and integrated in decision making. By involving the community in the management of the reserve, it

will be possible to ensure a sustainable future for forest, wetlands and the associated wildlife.

The socio-economic conditions of the local residents around the park, their dependency on the park, the factors affecting it and the impacts they cause to the habitat of Sangai and other animals of the park were analysed. Considering the attitudes and perception of local people and other stakeholders for Sangai's conservation and livelihood preferred and proposed by the people on the basis of the sustainability in light of their socio economic conditions, it was realised that protection of this park was crucial from society's interest, from both economic and ecological perspectives and an integrated approach involving all the stakeholders would be needed to protect and maintain the park and its ecosystem in a properly functional condition.

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## HOUSEHOLD QUESTIONNAIRE SURVEY

Name:.....Age:.....

Gender:( M/F)..... Educational Qualification.....

Village.....

**1. Family structure:**

M(>18y)	F(>18y)	Children	Total	Community

**2. Primary occupation:**

Agri.	Govt.service	Pisciculture	Fishing	Veg.coll	Others

**3. Secondary occupation:**

Agri. labour	Fishing	Veg. collection	Business	Others

**4. Income:**

Daily	Weekly	Monthly	Annually

**5. House type:**

Pucca house	Semi-pucca	Thatched house

**6. Land holding and use:**

Area	Paddy	Vegetables	Pisciculture	Others

**7. Animals:**

Cow	Buffalo	Pig	Poultry	Others

**8. Source of energy:**

Fuelwood	Kerosene	Electricity	Gas	Others

**9. Source of firewood:**

Purchased	Homestead	Park	Hills	Others

**10. Assets:**

Athaphum	Television	Refrigerator	2-wheeler

## RESOURCE EXTRACTION

### 11. Do you derive a any resource from the park?

Yes	No

### 12. Resources collected from the park:

Vegetable	Fuel wood	Fodder	Fish feed	Thatch

### 13. Extraction pattern:

Product	Quantity	Frequency	Distance	Time spent
<i>Vegetables</i>				
<i>Fuel</i>				
<i>Fodder</i>				
<i>Fish</i>				
<i>Thatch</i>				
<i>Others</i>				

### 14. Species collected:

Species	Part	Uses	Season	Who collects?			
				AM	AF	S	Gr

### 15. Marketing:

Amount sold	Frequency	Whole Sale	Retail	Middle man	Market	Income

## ATTITUDES QUESTIONNAIRE

### 1. Is Sangai important?

Very Important	Important	Not Important.	Can't say

### 2. If so, why is Sangai important to you?

Unique deer species	Gives recognition to Manipur	Mythological importance	Others

### 3. Is National park necessary?

Very necessary	Necessary	Not necessary	Harmful	Can't say

### 4. If so, why is the Keibul Lamjao National Park necessary?

To protect the Sangai from poaching	To conserve the habitat of Sangai	To conserve the other wildlife	Others

### 5. How is KLNP important to you?

Only habitat of Sangai	Source of livelihood	Cultural heritage	Gave recognition	Others

**6. Dam has caused damage to the park and surrounding area.**

Cause damage	Did not cause damage	Don't know	Others

**7. The park should be fenced.**

Should be fenced	Should be fenced	Don't know	Others

**8. Resources extraction from park should be completely restricted.**

Should be restricted	Should not be restricted	Don't know	Others

**9. Extraction of resources should be regulated or controlled.**

Should be regulated	Should not be regulated	Don't know	Others

**10. Extraction of resources depleted the food plants of Sangai and other wild animals.**

It depletes	It does not deplete	Don't know	Others

**11. If extraction from the park will not be allowed then,**

Accept the law	Agitate	Buy from market	Steal	Others

**12. How much are you willing to accept as compensation for non-extraction of biomass and what you will do with the money?**

Amount	Purpose

**13. Tourism will bring benefits for you.**

Yes it will bring benefit	No it will not bring benefit	It will harm local people	Don't know	Others

**14. What programs do you expect from the park authorities to improve the relation of people with the park or park authorities?**

Employment as official	Secondary employment	Involvement of local people in management	Others

**15. Suggestions to improve the park.**

No collection	Regularised collection	Fencing	Ring bund	No suggestions	Others

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**WILLINGNESS TO CONTRIBUTE**

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**19. Are you willing to pay for conservation of Sangai?**

Willing to Money	Willing to work	Both	Can't say

**20. How much are willing to pay?**

Money	No. of days	Both	Can't say

---

**WILLINGNESS TO ACCEPT COMPENSATION**

---

**16. What do you want to accept to forego the benefits from park?**

Money	Employment	Can't say	Others

**17. If money how much?**

<25000	25000-50000	50000-100000	>100000	Can't say

**18. What will you do with the money?**

Invest in pisciculture	Handloom	Business	Others



**FEASIBILITY ANALYSIS**

*Appendix III*

Criteria	Indicator	Tourism	Fishery	Business	Handloom	Government services	Poultry	Animal Husbandry	Rice mill	Carpentry
<b>Economic</b>	Activity should provide enough economic output to induce people to take it up									
	Market, production linkages and infrastructure should be easily available									
	Economic benefits from the activity should be fairly well distributed throughout the community									
	<b>Average Score</b>									
<b>Social/Cultural</b>	It should have respect for social identity and culture of the area and its assets									
	It should not have negative cultural and social impacts									
	It should strengthen community co-operation and institutions									
	It should not have negative impact on access to social networks of households or the broader community									
	It should not have negative impact on the community's relations with the outside world, in terms of influence, co-operation or conflict									
<b>Average Score</b>										
<b>Technological</b>	The local people should have the basic skills and techniques available for the activity									
	They should not be dependent on outside technological help for repair maintenance and upkeep (I.e. increase their vulnerability)									
	Scope for improving the skills and capabilities should be available at low costs									
	<b>Average Score</b>									
<b>Ecological</b>	The enterprise should not affect the sustainability of the natural resource base									
	The activity should be spread throughout the year									
	The activity should not coincide with or disturb the breeding season and activity of the wild species									
	<b>Average Score</b>									
<b>Political/ Legal</b>	The livelihood activity should be in tune with the political conditions of the area									
	It should be legally admissible give the PA status									
	<b>Average Score</b>									
<b>Overall aggregate Score</b>										
<b>Overall Average Score</b>										



## TRAVEL COST DATA SHEET

*Appendix IV*

Date: .....

Name: ..... Age: ..... Sex: .....

Address: ..... From where you have come from.....

Educational Qualification: ..... Designation: ..... Income .....

### 1. Mode of transportation:

Personal vehicle	Hired taxi	Hired bus	Public transportation	Others

### 2. Cost of visit:

Money spent (Rs.)	Time travelled (Hours)	No. of persons in the group	How many times you have come?

### 3. Reasons of visit:

To see Sangai	To see KLNP	Educational excursion	Picnic	<i>En route to</i>				Others
				Moirang	Thanga	CCpur	Others	

### 4. Which animal have you seen in the Keibul Lamjao National park during your visit?

No animal was seen	Yes animals were sighted				
	Sangai	Hog deer	Wild pig	Cattle	Unidentified

**5. Is the status of National Park necessary for the conservation of Sangai?**

Extremely necessary	Necessary:	Not necessary	Can't say	Remark

**6. How do you feel on the condition and management of Keibul Lamjao National Park by the Forest Department?**

Extremely happy	Happy	Not happy	Ok	Can't say

**7. Do you think encouragement of tourism will help in better conservation of Sangai?**

Strongly agree	Agree	Disagree	Can't say	Remark

**8. Opinions to improve the Park**

Fencing	Ring bund	More tourist oriented	Proper management	Others

**9. Remarks on conservation of Sangai**

Improve the park	Captive breeding	Translocation	Can't say	Others

**Remarks:**