People, Pressure and Conservation Issues of Bandevi Barandava Community Forest, Bharatpur, Chitwan National Park

Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
IN
ENVIRONMENTAL SCIENCE

Majoring in
Wildlife Management

From
CENTRAL DEPARTMENT OF ENVIRONMENTAL SCIENCE

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LETTER OF RECOMMENDATION

This is to certify that **Mr Raju Pokharel** has prepared this dissertation entitled "**People, Pressure and Conservation Issues of Bandevi Barandavar Community Forest, Bharatpur, Chitwan National Park**" as partial fulfillment of the requirements for the degree of **Masters of Science in Environmental Science** majoring in Wildlife Management and he had worked satisfactorily under my supervision and guidance. This Master Degree Dissertation work embodies his own work and fulfills as per the requirement of Central Department of Environmental Science, T.U.

I therefore recommend this dissertation for approval and acceptance.

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DECLARATION

I, **Raju Pokharel** hereby declare to the Dean of Tribhuvan University (TU) that this work entitled *"**People, Pressure and Conservation Issues of Bandevi Barandavar Community Forest, Bharatpur, Chitwan National Park**"* is my original work and all the sources of information used are duly acknowledged. This work has not been published or submitted elsewhere for any academic rewards.

.....

Signature

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LETTER OF APPROVAL

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Degree: Master of Science in Environmental Science, Majoring in Wildlife Management

Thesis Title: *"People, Pressure and Conservation Issues of Bandevi Barandavar Community Forest, Bharatpur, Chitwan National Park"*

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Raju Pokharel

May 2009

LIST OF ABBREVIATIONS AND ACRONYMS

BES	Bird Education Society, Chitwan
BZ	Buffer Zone
BZCF	Buffer Zone Community Forest
BZMC	Buffer Zone Management Committee
CAs	Conservation Areas
CF	Community Forest
CNP	Chitwan National Park
Dbh/DBH	Diameter at breast height
DNPWC	Department of National Park and Wildlife Reserve
FRSC	Forest Resources and Survey Center
FSSD	Forest Survey and Statistics Division
GoN	Government of Nepal previously HMG/N (His Majesty Government of Nepal)
GCP	Grass Cutting Program
IVI	Importance Value Index
KMTNC	King Mahendra Trust for Nature Conservation
LRMP	Land Resource Mapping Project
MEA	Millennium Ecosystem Assessment
MPFS	Mater Plan for Forestry Sector
MPFSN	Master Plan for Forestry Sector Nepal
NBS	National Biodiversity Strategy
NPs	National Parks
NPWCA	National Park and Wildlife Conservation Act
NTNC	National Trust for Nature Conservation
PAs	Protected Areas
PPP	Park People Programme
RCNP	Royal Chitwan National Park
SPSS	Statistical Package for Social Survey
UNDP	United Nations Development Program
VDC	Village Development committee
WWF	World Wildlife Fund for Nature Conservation

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Chapter 1

INTRODUCTION

1.1 Introduction

Achieving local cooperation and support without jeopardizing conservation goals remains a top priority for the parks (Wells & McShane, 2004). Ecosystem services provides the well beings everywhere to humans. Social safety nets tend to decrease the pressure on ecosystem services. On the other hand the poor social safety nets tend to increase dependence on ecosystem services. The resultant additional pressures can damages ecosystems to a degree that the probability of conflict increases (Millennium Ecosystem Assessment, 2005). It led Contemporary conservationists to recognize the need to work beyond protected areas if they are to sustain viable populations of wildlife (Treves & Salafsky, 2004).

The buffer zone approach to protected area management emerged as spin-off with the devolution of resource use right to local communities. Buffer zone had been institutionalized as an operational approach species and large-scale ecological process (Ebregt & Greve, 2000) to ensure the ecological integrity of protected areas, and enabling of local communities to sustain their livelihood through active management of natural resources outside the park. However, in spite of this approach, the strategy of buffer zone in protected area is ambitious and many anticipated it to resolve the much contested linkages diminishing societal support for protected areas and the conservation of biodiversity (Sanderson & Redford, 2003)With the establishment of Chitwan National Park in 1973, various conservation models and strategies have been employed for conservation in Nepal. The fortress model with exclusion of people in early seventies was heavily criticized for imposing restriction on local level usury rights and debarring local people (Heinen & Shrestha, 2006). Understanding the local communities need, impact zone concepts of nineties (NTNC, 1998) calls for strict control of forests within the adjacent park or reserve, combined with intensified agriculture and forestry on the public and private properties outside the protected areas with an intention to build local people self reliance (NTNC, 1998).

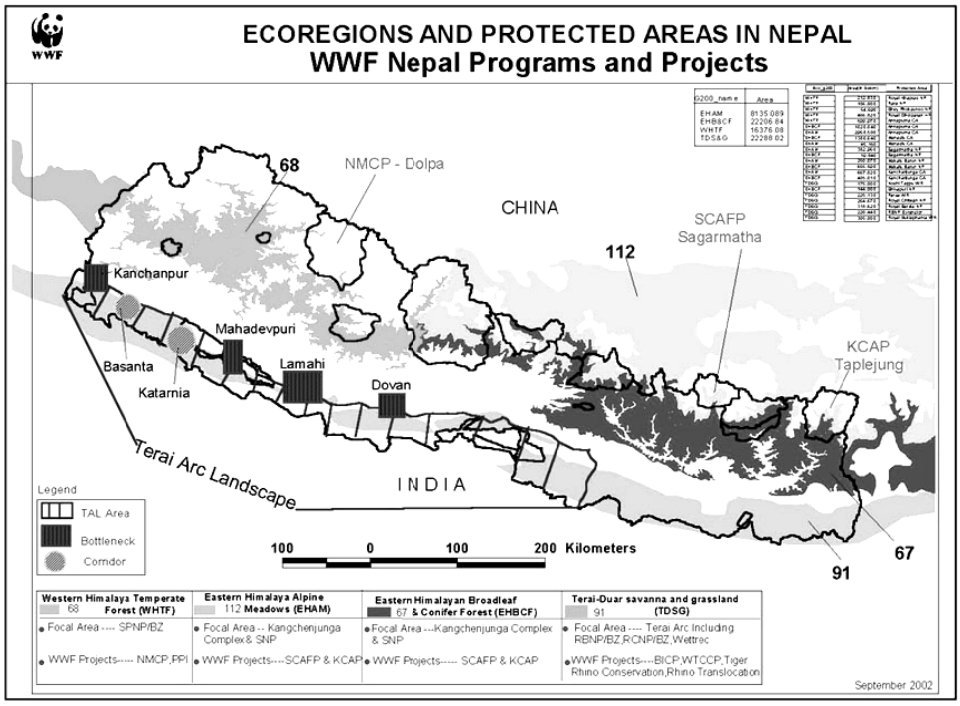


Fig 1.1 Ecoregions of Nepal

This conservation measures efforts to fix the local communities special needs as they are found to be inhabiting since long in a mix of settlements, agricultural lands, villages, open spaces, cultural heritage areas and other land use forms (NTNC, Project Title: Chitwan Habitat Restoration- III. project preoid July 1 1999 to June 30, 2000, 2000) and (Budhathoki, 2005). This irrefutable conservation thought led to amendment in National Parks and Wildlife Conservation Act (NPWCA, 1973) in 1993 that had facilitated the legal foundation for biodiversity conservation to establish and manage the buffer zone areas outside the protected areas. In 1996, 750 Km2 of adjacent areas in Chitwan National Park was declared as buffer zone. The concept was to build participatory model between local people, public and government agency for sustainable use and conservation of resources. To complement these, the three tier community based institutional model at settlement, sector and park level (Budhathoki, 2005) were implemented with 50 % revenue sharing mechanism from the parks. Community development activities, conservation program, income generation and skills development program, conservation education program and administrative expense were major form of activities administered to leverage biodiversity conservation as well as societal development in the buffer zone areas.

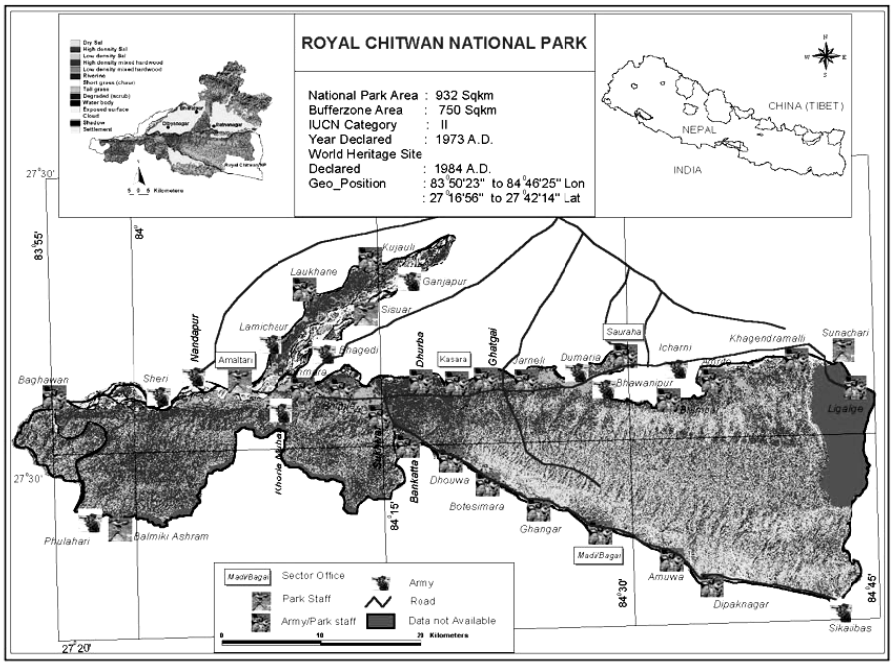


Fig 1.2 Chitwan national park

1.2. Background of the problem

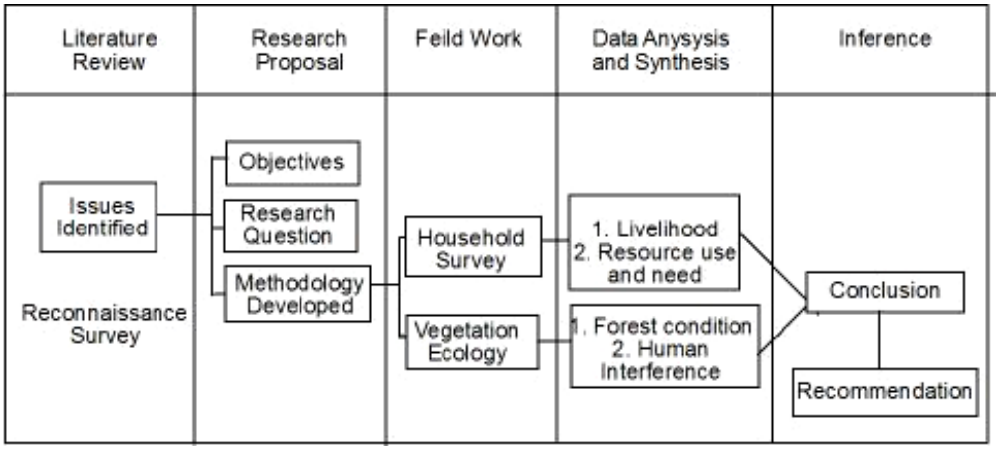
The buffer zone (750 Km^2) of Chitwan National Park (CNP; ESTD: 1973; 932 Km^2) was established in 1996 which encompasses 35 Village Development Committees (C and 2 municipalities that have 510 settlements with 223,260 populations (DNPWC, 2000). The buffer zone area comprises of mosaic of forests, agricultural lands, settlements, cultural heritage areas, village open spaces and many other types of landuse (Budhathoki, 2005). Buffer zone management had influenced appreciable number of community participation; as to date buffer zone was successful at forming 1400 User groups (UGs) at settlement level. Out of which about 47% are women UG's, 21 User Committee (UC) at sector/unit level and at park Buffer Zone Development Management Committee (BZMC) with the chief of the park acting as a member secretary (Budhathoki, 2005). CNP had up to date (2004/05) released the budget of approximately NRs 0.19 billion (approx $ 2.8 million) to buffer zone to facilitate the community based conservation initiatives at settlement, sector and park level (DNPWC, Annual Report, 2004/2005). The five year management plans (2001-2005) of CNP have identified issues, strategies and activities for socio-economic development allied with conservation measures. Despite of these endeavor, the reality had been festering with meager success for biodiversity conservation as well as

community development at large. The nature culture dichotomy fueled by the local community's urgency to illegally use forests in CNP for cattle grazing, thatch and fodder grass cutting, firewood collection, timber cutting, hunting and fishing are the frontline issues to challenge the protected area management through buffer zone management programs (Stræde & Treue, 2006); (Budhathoki, 2005); (Paudel, 2003); (Stræde & Helles, 2000); (Nepal & Weber, 1995) (Poudyal, 2007). Suggesting, the socio-economics of adjacent communities plays vital role in shaping the local cooperation for support and conservation.

1.3 Statement of Research Significance

The crux of conservation is the relationship between people and the landscapes that house biodiversity (Chan, et al., 2007). In the context of wide spread poverty and unemployment among people living around the CNP, the issue of meeting basic survival needs is the single most threat to conservation of the biological diversity (NTNC, Royal Chitwan National Park. An Assessment of Values, Threats and Opportunities., 1996). The buffer zone management paradigms at CNP have passed ten years. There are few questions that need answering to validate this conservation strategy. Have it or have it not met the positive outcomes for dual goals set for conservation and development in the buffer zone landscape? What were the lessons learned and what are the future prospects? In this study, Bandevi Barandavar Buffer zone community forest, of Chitwan National Park (CNP),Bharatpur is examined as a case study to understand the linkages between ecology, economy and social realities. The assessment of community and biophysical resource was major focus to capture the real life experience of changes in ecosystems and human well being. We hypothesize that local social and biophysical contexts shape the viability of the effective buffer zone management. The assessment of multiple variables playing at buffer zone landscape to understand the drivers, their interaction and the consequences of ecosystem services and human well being is crucial to design effective responses (Millennium ecosystem Assessment, 2005). The present study covers four factors associated with buffer zone that have a bearing on park protection. The factors are: buffer zone household well being, buffer zone community forest management, vegetation ecology and human interference in the forest.

Figure 1.3 Conceptual frame work for the study



1.3 Objectives

The broad objective of this study is to understand the inter-linkages between ecology, economy and social context of Bandevi Barandavar Buffer zone community forest, of Bharatpur Municipality (ward No. 8 & 9) of the Chitwan National Park.

Specific Objectives

- To quantify the sustainable yield of the forest resources (fuel wood and fodder) within Bandevi Barandavar BZCF. (supply)
- To quantify the Fuel wood and fodder used by the local people in Bandevi Barandavar BZCF. (demand)
- To access the human pressure created due to demand and supply status of Bandevi Barandavar BZCF.

1.4. Limitation of the study

The establishment of better linkages between ecology, economy and social strata was limited with the consideration of forest measurements and social survey. Faunal species assemblage was ignored. Study on other physical factors such as soil and water was also ignored. Land use change was also not done.

1.5 STUDY AREA

1.5.1 Location

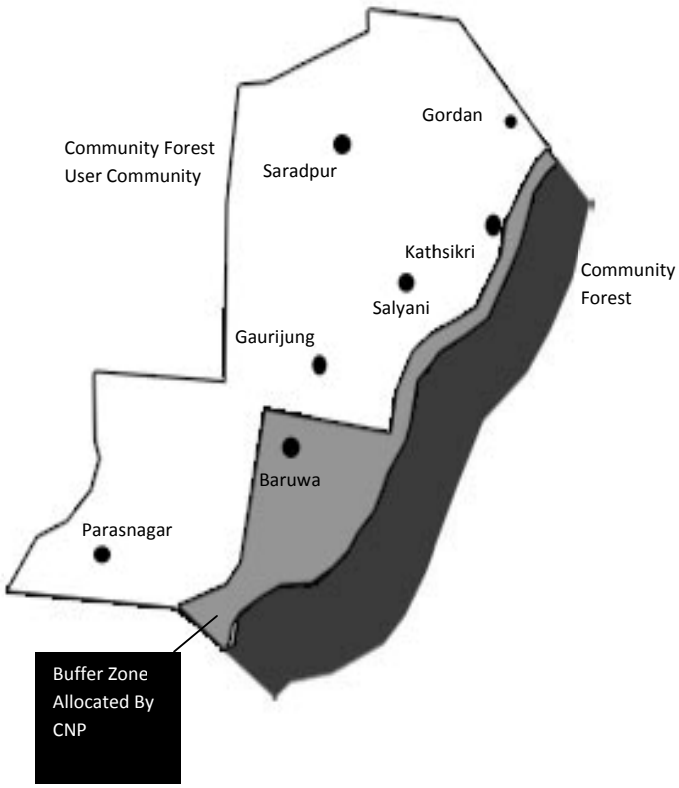


Fig 1.4 Systematic Diagram if Study area including CF, Buffer Zone allocated By CNP ant user Community.

Buffer zone of Barandabhar, Bharatpur Municipality (ward No. 8 & 9) is located in Central Northern side of Chitwan National Park, inner Terai, Chitwan district (27° 39' to 27° 40' E, 84° 24' to 84° 28' N, and avg. altitude. 200 m). Boundaries of Buffer zone of Barandabhar, Bharatpur Municipality (ward No. 8 & 9) are Panchakanya Community Forests Under DFO in the north, Bharandabhar corridor Forest Linking Mahabharat and Chure including Bishajari Tal, a Ramsar site in the east, Navajyoti Community Forest of Gitanagar Buffer Zone Committee in the south and other wards of Bharatpur Municipality in the west. northern Bandevi Buffer zone community forest boundaries entirely touches the East West highway. Buffer zone of Bharatpur Municipality (ward No. 8 & 9)is included under Geetanagar Buffer zone User committee. Only two wards (8&9) uses 168.75 ha of corridor forest as CF being included in the Buffer zone.

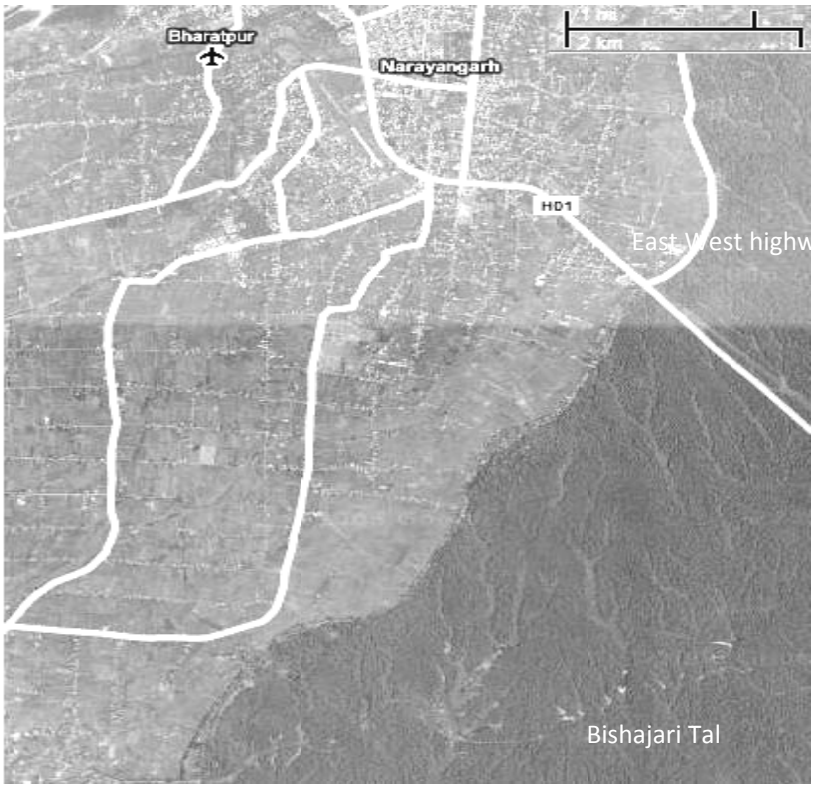


Fig 1.5 Satellite image of the study area.

1.5.2 Climate

The climate is sub tropical (Stræde & Helles, 2000) with mean annual rainfall 1895 mm (Rampur Weather Station, 1994-2003). The rain showers 90 % during summer, from June to September. The average minimum monthly temperature is 8.2°C in January and average maximum monthly temperature is 35.9°C in May (Rampur Weather Station 1994-2003).

1.5.3 Demography and Household characteristics

The population of the study area was 10583 in 1872 households. In Total 10583 household population lives in 7 settlements of 8 and 9 ward of Bharatpur, composed of mixed ethnic groups (mostly representing by Brahmin and Chhetri caste group). Some 26.7 % of the population cannot read and write. Households were predominantly Wage labours (61.3%), Agriculture (25.3 %) and others were in small business(7.1%) and services (24 %) (DNPWC, Royal Chitwan National Park. Resource Profile, 2000). The market access is easy due to Bharatpur-Hetuda highway that runs through the CF.

1.5.4 Buffer zone Community Forest

The forest area were managed by buffer zone community forest user committees (BZCF UC's) namely Bandevi Barandavar Buffer zone Community Forest. The Forest was predominantly Sal forest. The Forest patch consists of Sal (*Shorea robusta*), Saj *(Terminalia tomentosa)*, Sisso (*Dalbergia sisso)* and planted Tectona grandis Different wildlife including *Rhinoceros unicornis, Cervus sps, Axix axis, Panthera pardus, Felis chaus, Sus scorfa,* etc. More than 250 different bird species have been reported from these forests of buffer zone (BES, 2007). The community Forest is adjacent to the Bishajari Tal enlisted Ramsar Site which is the reason behind the high avian diversity. Forest Resources were strictly protected and once a year, collection of timber wood was allowed. For fodder and litter collection members were allowed to enter everyday inside the community forest.

1.6 Literature review

After the establishment of CNP (1973) for the protection and conservation of biodiversity, a lot of research had been carried out. Initially, species level conservation was of primary concern with top-down conservation approach. Fines and fences measures faded with the increased park people conflict and established the notion that local peoples' need and aspiration holds priority for the better conservation of biodiversity. This emerges the habitat conservation model with the buffer zone management and ICDP initiative. Some of the previous researches that are related to contemporary conservation paradigm were reviewed for the study.

Brown (2003) argued that there are three challenges for a real people centered conservation: a more pluralist approach to understanding knowledge and values of different actors, greater deliberation and inclusion in decision making and a remodeling of institutions to support conservation.

Budhathoki (2003) argued that conservation model based on the foundation of strict protection has been found to be insufficient during present political crises as protected areas enjoy no or little public support and suggests some alternative mechanism for long-term conservation of biological resources in Nepal. Budhathoki (2005)'s analysis of conservation policy for buffer zone revealed that there are inconsistencies between the vision of the program and its policies and practice.

Dangol (2007) urges that social capital is losing its cohesive quality to bind and bond the diverse stakeholders that are the premium of community participation. Hence, these flaws demand the restructuring of the contemporary conservation initiatives in Bacchauli VDC of CNP.

Dr Bajracharya (2004) highlighted on community-based conservation in an interview on FM radio 102.4 MHz. There are essentially four aspects to the management plan we're developing: 1) biodiversity conservation; 2) village tourism development; 3) whether it is possible to take conservation and community development hand in hand; and 4) institutionalization of delegation of responsibility to local communities through capacity building or their relocation and seeing how they can benefit from conservation - whether through exposure tours or provision of related education to enhance their organizing capability.

Heinen & Mehta (2000) raised the questions on participatory rights handed over to citizens, whether the managerial and research capacities exist to monitor buffer zones for their effectiveness in both conservation and development purpose and make several recommendations to improve implementation.

Joshi (1999) detailed the socio-economic characteristics of CNP buffer zone residents and concluded that buffer zone residents heavily rely on national park and surrounding forests to meet their basic needs.

Mulepati (2009) addresses that Resource demand of local people of Baghauda BZ VDC of CNP was not met by CF, especially, for those people who were living farther from CF. Thus, people near to NP sneak into NP in order to meet their requirements.

Nepal and Weber (1995) have identified five major causes of park-people conflicts prevailing in the park including illegal transactions of forest products, livestock grazing, illegal hunting and fishing, crop damage, and threats to human from wild animals. The technical report on buffer zone policy analysis NTNC (1998) suggests sixteen point guidelines regarding institutional and managerial aspects of the buffer zones. Likewise, Shrestha (1994) studied on the resource conflict between park conservation and adjoining settlements and found serious threat to the survival of

endangered animals and plants because of poaching and illegal use of park resource. Crop damage, livestock toll and harassment to the people were other major problems. Bordering area was listed as the most affected location, suffering 28.80% loss in its total production.

Paudyal (2008) demonstrates that the communities in which user groups function are diverse and internally differentiated. It is argued that economic and political structures and social institutions set the context for individual and group behaviour. How economic and social groups act and behave is shaped in large part by local-level structures and institutions that are characterized by exploitation, exclusion and unequal access to resources, opportunities and voices.

Poudyal (2007): All buffer zone households irrespective of their land holding size need forest product for fodder and fuel wood. The concept of natural regeneration and rehabilitation of degraded forests as a mean to establish forests with a high compatibility with villagers demand have not yet been sustainable despite the restoration to present forest size. Estimates of annual forest yield and household demand for forest products do not match in Piple. So, deficits are met through park resources and other community forests outside buffer zone. As a result of this, Piple buffer zone community forest was degraded and both tree and leaf biomasses are subjected to greater harvest pressure. The inadequate forest area to supply forest product to villagers further aggravates the dire situations.

Pradhan (1995) proposes an inner buffer zone forest and outer buffer zone forest concept in order to meet the demands of the local villagers and to improve habitats of wild animals. It is assumed that inner buffer zone forest will supply timber materials and provide habitat to wild life whereas the outer will provide daily needs for fuelwood, small poles and grasses.

Regmi (1999) insisted that people of the CF had a resource pressure on national forest and National Park and also argued that people began to have negative impression on park officers and armies. This arouse due to the lack of understanding and harassment from the armies and forest officers.

Sharma (1991) discussed the potential solutions which emphasize the need for the CNP to accept the responsibility of meeting subsistent needs to firewood and fodder of people living in an 'impact zone' by initiating community forestry programmes and by promoting ways and devices to increase the efficient use of available resources.

Straede and Trene, (2005) demonstrated the economic importance of forest product of CNP to livelihood of people in Bandevi CF and also revealed the pressure correlated with the economic value of product. The research indicates national forest (Tectona grandisauli forest) as open access which is more important to people of Bandevi than the park and much more important to the landless and land-poor than the CF.

Wells, Bradon, & Hennah (1992) contented the integrated approach because of growing populations, unsustainable land use practices, local fuel wood deficiency, illegal grazing and lack of alternatives and unfounded economic benefit through tourism.

CHAPTER 2
Methodology
2.1. Area estimation of the BZCF and User Group
The boundary of the Bandevi Barandavar BZCF was obtained from the office of the Community forest. The local people helped to identify the boundaries of the User Group of Bharatpur. GPS(Garmin e-trex) recorder was used to allocate the boundaries. The GPS data obtained were used to generate the random sample plots in digital FINNIDA landuse map to design the vegetation measurements with the help of ArcGIS. The study was carried out from September 2007 to February 2008.

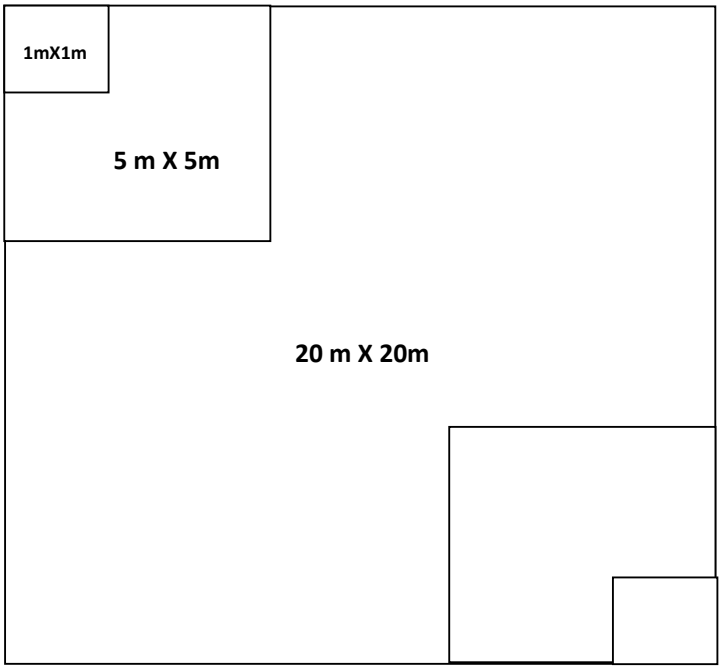
2.2. Inventory
The inventory method used in this study was adapted from the method used by the forest survey and statistical division of ministry of forest and soil Conservation (FSSD, 1991).

2.2.1 Survey Design
Digital FINNIDA land use map (1992) scaled at 1:25000 was used for vegetation survey by using random sampling method. Random points were fixed on the digital map of Bandevi CF by using GIS. These random points were found in the field with help of GPS (Garmin e-trex). Vegetation survey was conducted only on those points, which were inside the forest boundary or in vegetation zones of buffer zone community forest. Vegetation plots are attached in Annex D1 and D2

2.2.2. Sample size
Random points were generated using GIS software by creating gridlines in each 30'' difference on the Bandevi CF digital map of FINNIDA land use map (1992) and in each such grid, random numbers were plugged. 25 random points within the Bandevi buffer zone CF were taken. For the analysis of 3 points, the grid was extended within the Bandevi CF maintaining the same longitude to 50 m away from the swamps.

2.2.3 Vegetation Plot Design
In each sampling a quadrate plot of 20x20 m^2 was laid to study tree species. Within the tree plot, plots of 5x5 m^2 were laid to study shrub species at two opposite corner (south east and North West corner). Similarly, quadrate plots of 1x1 m^2 were laid to study herbs within each shrub plots (nested). All the tree species taller than breast height were taken into account within 20x20 m^2 plot. DBH and height of trees were measured with the help of DBH tape and clinometers respectively.

Fig: Plot Design (Nested quadrate plot) in meter.



Height and number of all shrubs and saplings of trees with height greater than 10 cm and shorter than breast height were measured within quadrate of 5x5 m^2. Similarly, the number of all herb species, shrub and tree seedlings with height less than 10 cm were studied in 1x1 m^2 plot. Number of cut stump of tree species with height and circumference at top, ocular estimation of tree coverage percentage, fire evidence and foot trails passages were noted in 20x20 m^2 plot to quantify human interference, grazing pressure and management practices.

2.2.4. Classification of forest

2.2.4.1 Forest Type

The BZCF of the central northern side of the Chitwan National Park, the corridor forest, is Sal Forest.

2.2.4.2 Stand size

The following stand size classes as used by Forest Inventory Division (FSSD, 1991) were adopted into the study area.

Stand size classification

Symbol	Stand Size	DBH (cm)
1	Sapling	<12.5
2	Poles	12.5 – 25
3	Small saw timber	25 – 50
4	Large saw timber	> 50

2.2.4.3 Stocking

Determination of stocking is based on forest density, i.e. crown cover percentage (FRSC, 1995), Classes of stocking were as follows.

Stocking of trees

Symbol	Description	% Crown Closure
1	Poorly stocked	10--39
2	Medium	40-69
3	Well stocked	70 or more

2.2.4.4 Quantitative and qualitative analysis

Quantitative and qualitative analysis of vegetation within the plots were carried out. This included calculation of density, relative density, frequency, relative frequency, basal area, relative basal area, important value index (IVI), and species diversity, species evenness, species richness and dominance. (Annex C1)

2.2.5 Measurement of the Forest Resources (Fodder and Fuelwood)

Forestry Sector Master Plan, 1988 developed by the Forest Inventory Section, Ministry of Forest and Soil Conservation, Nepal (FSSD, 1991)was used for the calculation of resources of the Bandevi Barandabhar Buffer zone community forest. The parameters and procedures specified by the master plan were used to estimate the volume of each individual tree. The volume parameters were obtained from the study carried out by Forest Survey and Statistical Division (FSSD, 1991).

2.2.5.1. Diameter and Height of tree

Inside each plot, the diameter of all living trees taller than breast height was measured using diameter tape with accuracy of one millimeter. If the breast height point is deformed, the diameter both above and below the deformation was measured and the average of the two measurements was recorded. Where butt-swells extended above breast height, the diameter was measured 0.5 m above the termination of the pronounced swell. A forked tree was recorded as one if the base of fork was above the

breast height (1.3m). Otherwise, a fork tree was recorded as two or more separate trees and the diameter of each trunk was recorded at the breast height.

The angle of all the trees within the quadrate was measured with the help of clinometers from a fixed distance of 6m from base of tree. Then the height was calculated using trigonometry. For leaning trees, the base distance of the tree tip was measured to get the true length of the stem.

2.2.6 Calculation Methodology

The computerized calculation was adopted using widely accepted and used spreadsheet and statistical software for the Bandevi Barandavar BZCF.

2.2.6.1 Volume Calculation (FSSD, 1991)

The system estimates for computing the total volume of the whole stem is

Ln (V) = a + b x Ln(d) + c x Ln (h)

Where, Ln refers to logarithm

V = total stem volume with bark

d = Diameter at breast height

h = Total height

a, b and c are the volume parameters, which are constant for each species but different for different species.

2.2.6.2 Biomass of stems, branches and foliage

Stem biomass is obtained by multiplying the stem volume by wood density. Wood density was obtained from Forestry Sector Master Plan, 1988 (HMG, 1988 a). For obtaining the biomass of branches (fuel wood) and foliage (fodder), ratio of branch to stem biomass and foliage to stem biomass was applied for various species (HMG, 1988 a).

2.2.6.3 Estimates of Annual Yield

The Master Plan for the forestry sector of Nepal (MPFSN) has estimated the annual yield of different forest types of Terai for the Central Development Region. The annual yield percentage estimated by Master Plan in similar forest types of Central Development Region were used to estimate the annual yields of Buffer zone forest in the study area. The annual yield of the Terai with mixed hardwood forest was used for the annual yield of tree species. Although MPFSN had classified the Siwaliks (of which Chitwan valley is a part) as an area having little fuel wood deficit, the situation

for villages adjoining the park should be no different from the Terai region, which suffers from a major shortage (Sharma, 1991). And the major thing is that almost all the Siwaliks area has been protected as National Park and the study area lies in the inner Terai having almost similar type of climatic condition. So, the annual yield was calculated on the basis of similar forest types of Terai of the Central Development region. Defining sustainable wood harvest as the sum of stem and branch growth, and stem and branch mortality with only 15 % of stem growth allocated for timber and rest (85 %) for fuel wood assuming recovery factor for Terai is 90 % (GoN, 1988a). The annual accumulation of dead wood is 4.9 % of the annual yield. (GoN, 1988a)Hence, 4.9 % of total wood was considered as fuel wood for the calculation of fuel wood from dead wood. Growing stock and annual yield (tons/ha) in the natural forest of Terai regions of Central Development Region, Nepal (GoN, 1988a) is given below.

Forest Type	Percentage Yield		
	Stem	Branch .	Leaf
TMH	4.88	4.92	5.41
KS	5.13	5.13	5.41

TMH = Terai Mixed Hardwood forest, KS= Khair Sissoo Forest

The yield from leaf biomass can be used as fodder if the tree is fodder species. Similarly, fodder yield from buffer zone forest was calculated on the basis of Total Digestible Nutrient (TDN) yields for various categories of land as follows.

Fodder yield from various land categories (GoN, 1988b)

Land Category	TDN Yield (t/ha/yr)
Hardwood forest, grazing	0.34
Conifer forest, grazing	0.1
Mixed forest, grazing	0.15 - 0.2
Forest plantation/hand cutting	1.44
Shrubs/ burnt forest grazing	0.77
Waste land/ over grazed land, grazing	0.24
Flat land, grazing	0.58

2.2.7 Anthropogenic pressure on buffer zone community forest

2.2.7.1 Cut stump

The total number of cut stump of tree species was counted within the tree plots by measuring the girth of each cut stump (cm). The girth size was categorized into five classes according to Silori (2001). These girth classes are:

(i) < 20 cm,

(ii) (ii) 20-40 cm,

(iii) (iii) 41-60 cm,

(iv) (iv) 61-80 18 cm, and

(v) (v) > 80 cm.

Density of each girth category was calculated for each species and buffer zone community forest.

2.2.7.2 Grazing and Foot trails

Grazing and foot trails were observed and reported during the survey.

2.3. Household Survey

The stratified random sampling was applied for the survey on the basis of the settlement size with two parameters: a) population size and b) land holding size. The sample size (n) for 1872 households of the study area was determined at 95% confidence level (Arkin & Colton, 1963; cited in Poudyal, 2007).

$$n = \frac{NZ^2P(1-P)}{Nd^2 + Z^2P(1-P)}$$

where,
n=sample size

N= total number of households

Z= confidence level (at 95% level Z=1.96)

P = estimate population proportion (0.05, this maximize the sample size)

d = error limit of 5% (0.05)

2.3.1. Survey design and Sample size

For household socioeconomic survey of Bandevi CF, nine wards of the CF were represented. Stratified random sampling method was applied for the survey on the

basis of settlement size, which was based on (DNPWC/PPP, 2001)landholding of household with five categories.

Land holding categories

Symbol	**Land holding**	**Land holding in ha**
1	Landless	LL
2	0-10 Kattha	.34-.68
3	10-20 Kattha	.68-1.36
4	1- 4 Bigha	1.36-2.72
5	> 4 Bigha	>2.72

The sample size was calculated i.e. 71 households. These 71 households were chosen on the basis of settlement size and land holding. Random stratified sampling method with replacement was used for equal number of sample size distribution in each settlement and land holding categories with equal probability. Each sample was drawn through lottery method. The lottery was drawn randomly at a time from both categories for 71 times and then the sample size distribution (Table 2.1) in each settlement with land categories was determined. Data on landholding settlement size of User Group was gathered from the office of Bandevi Barandavar BZCF . From these data, required number of sample size of each land categories in every ward and settlement was selected randomly and survey was conducted. Before conducting the formal questionnaire survey, the questionnaire was initially tested in some household and some modifications were made later to make the questions more understandable to the respondents and the flow of subject matter more smooth. Three member research team (classmates) was involved in survey.

Table 2.1 Distribution of settlement by population

Land Category	Settlement Size	Location of Survey: Katsikari	Salyani	Gaurigung	Baruwa	Parasnagar	Saradpur	Godran	Total	%
Landless	Small	1	0	0	0	0	0	1	2	3
	Medium	0	0	0	1	0	0	1	2	3
	Big	0	3	3	0	1	0	0	7	10
	Total	1	3	3	1	1	0	2	11	15
Small	Small	1	0	0	0	0	0	1	2	3
	Medium	0	0	0	6	0	0	2	8	11
	Big	0	2	4	0	5	5	1	17	24
	Total	1	2	4	6	5	5	4	27	38
Medium	Small	1	0	0	0	0	0	0	1	1
	Medium	0	0	0	2	0	0	0	2	3
	Big	0	1	1	0	2	1	0	5	7
	Total	1	1	1	2	2	1	0	8	11
Large	Small	1	0	0	0	0	0	0	1	1
	Medium	0	0	0	1	0	0	2	3	4
	Big	0	2	7	0	3	9	0	21	30
	Total	1	2	7	1	3	9	2	25	35
Very large	Small	0	0	0	0	0	0	0	0	0
	Medium	0	0	0	0	0	0	0	0	0
	Big	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0
Grand Total		4	8	15	10	11	15	8	71	100
%		5.6	11.3	21.1	14.1	15.5	21.1	11.3		

2.3.2. Questionnaire survey

Seventy-one households representing different wards and land holding categories were interviewed and the structured and semi structured questionnaire with some close ended land some open-ended questions were filled during the survey. Questionnaires were developed with two major parts (Annex E1), which includes information about household and buffer zone community forest with management activities and issues.

2.3.2.1. Household information

This part mainly focusses on the household information to identify the livelihood supporting activities through occupation of respondent and family members, land

holding, crop types and its production, livestock holding and their access, energy use and consumption pattern.

2.3.2.2. Buffer zone related issues

This part is related with buffer zone community forest and buffer zone management issues. It was designed to obtain the information about condition of buffer zone forest, types of resources extraction, pressure on community forest, resources allocation system, land categorization within community forest, problems within the community forest, suggestions/recommendation for better management and resources utilization of community forest, budget sufficiency and its transparency and household level participation in Buffer zone management. The management plan of the community forest was studied and the problems were identified.

2.1.3.2. Farm size

Actual farm size (landholding) of each sampled households was noted in local unit (Kattha) and converted into hectare (ha) by using the conversion factors as mentioned below.

Farm size conversion factor

Farm size in Katha	**Conversion factor**
1 Biga (20 kattha)	=0.68 ha.
1 Kattha	=0.034 ha.

2.1.3.3. Livestock Holding

Livestock of sampled households were listed in number and type in field and they were converted into the standard unit called livestock Unit, by using the conversion factors as mention below.

Livestock conversion factor.

Livestock Type	**Conversion Factor**
Cow	0.81
Buffalo	0.65
Goat	0.18

2.1.3.4 Estimation of Annual Resources (fuel wood and fodder) Need.

The terms need and demand refers to the annual consumption of fuel wood and fodder resources. Resource demand of sampled households and their access from different sources (buffer zone community forest, National Park, Own land and other

community forest outside buffer zone) were noted in local unit (Bhari). And weight of the Bhari was converted into Kilogram (Kg) according to respondent perception and experience as far as possible.

Conversion unit for local resource unit into standard unit (Nepal & Weber, 1995)

Local unit	**Standard unit (Kg)**
1 Bhari Fodder	= 50
1 Bhari Fuelwood	= 40

The fodder demand obtained in kilogram was converted into TDN value by multiplying the factor 0.25 (NTNC, 1996)

Chapter 3
RESULTS

3.1 Buffer Zone Community Forest

3.1.1 Location and Area of BZCF

Buffer zone of Barandabhar, Bharatpur Municipality (ward No. 8 & 9) is located in Central Northern side of Chitwan National Park, inner Terai, Chitwan district (27° 39' to 27° 40' E, 84° 24' to 84° 28' N, and avg. altitude. 200 m). Boundaries of Buffer zone of Barandabhar, Bharatpur Municipality (ward No. 8 & 9) are Panchakanya Community Forests Under DFO in the north, Bharandavar corridor Forest Linking Mahabharat and Chure including Bishajari Tal, a Ramsar site in the east, Navajyoti Community Forest of Gitanagar Buffer Zone Committee in the south and other wards of Bharatpur Municipality in the west. northern Bandevi Buffer zone community forest boundaries entirely touches the East West highway. Buffer zone of Bharatpur Municipality (ward No. 8 & 9) is included under Geetanagar Buffer zone User committee. 168.75 ha of the Barandavar corridor forest has been handed over to the people as Bandevi CF.

3.1.2. Diversity Index, Evenness 3.1.1 Area and distribution of BZCF

3.1.2. Diversity Index, Evenness Index, dominance and species Richness, IVI and regeneration of BZCF

Shannon diversity index, dominance and evenness and species richness of buffer zone community forests is presented in Table 3.1 and Figure 3.1. In total, the diversity of trees, shrubs and herbs were 0.39, 1.23 and 0.88 respectively. This result shows that the diversity is very low in the forest dominated by a species. The IVI index has shown that *Terminalia tomentosa* and *Shorea robusta* are the dominant species (Table3.3). Their dominannce is justified as trees have 0.46 of dominance. The species richness is thus low for trees (0.97). Shrubs are rather more diverse than trees but their diversity (0.87) is also low and dominance of any species is high. Herbs are comparatively more diversified (1.23) and have dominance lower among them. Species Richness of the herbs is high (14.49). Thus, Bandevi Barandavar BZCF is dominated by trees with the highest diversity and species richness of herbs.

Table 3.1 Shannon Diversity Index , Evenness index, Species Richness and Dominance of the plant Strata

	Species Diversity	Evenness Index	Species Richness	Dominance
Trees	0.3879	0.0970	1.0192	0.4594
Herbs	1.2279	0.0232	14.4903	0.1101
Shrubs	0.8761	0.0398	5.5644	0.1794

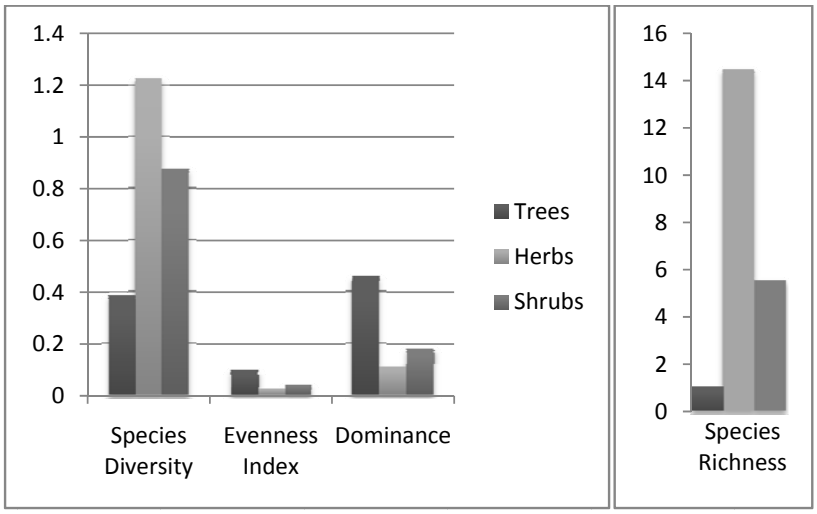


Fig 3.1 Species diversity, evenness, dominance and richness.

The diameters of trees range from 6 cm to 102 cm with a total density of 87.80/ha. The density, frequency, basal area and IVI value of tree species is presented in Tables3.2 and 3.3. *Shorea robusta* and *Terminalia tomentosa* were relatively dense compared to other species. Among them, the highest density was of *Terminalia tomentosa. Shorea robusta* and *Terminalia tomentosa* has higher frequency compared to other species. Among them, the highest frequency was of *Shorea robusta*. *Shorea robusta* and *Terminalia tomentosa* had relatively larger Basal area compared to other species. *Shorea robusta* had the largest basal area of 18.36 square meter per hector . *Terminalia tomentosa* was also present significantly with 10.51 square meters per hector of basal area. Thus, the study shows that *Shorea robusta* and *Terminalia tomentosa* were the dominant species of the Bandevi BZCF with the highest density, frequency and basal area. *Terminalia tomentosa* had highest density and frequency as the newly growing saplings and poles contribute the higher number

in every quadrate. *Shorea robusta* has highest basal area because there are a lot of larger and older trees of the species scattered in the forest patch.

Table 3.2 Density, Frequency and Basal area of the trees

Tree Species	Total Number	Density/ha	Frequency	Basal Area
Shorea robusta (Sal)	360	36	92	18.36
Terminalia tomentosa (Saj)	452	45.2	48	10.51
D*albergia sisso (Sisso)*	5	0.5	4	0.93
Tectona grandis (Tik/Teak)	61	6.1	4	0.17
Total	878	87.8	148	29.96

The IVI value showed that *Shorea robusta* is the most dominant species in the study area. *Terminalia tomentosa* is also relatively more common species in newly generating areas of forest. *Tectona grandis* and *Dalbergia sisso* were present in very few numbers in few plots occupying only the least share in IVI. Thus, the inventory suggests that the Bandevi Barandavar BZCF is predominantly sal forest with the dominance of

Shorea robusta followed by *Terminalia tomentosa*. Relative Density of *Terminalia tomentosa* is highest because the number of sapling and poles of the species was highest but the larger timber class tree of this species were absent. However, *Shorea robust* was present in all the stand sizes. *Shorea robust* is the only species present in Bandevi Barandavar BZCF with stand size of timber.

Table 3.3 Important Value Index (IVI) of the species in tree strata

Tree Species	Relative Basal Area	Relative Density	Relative Frequency	IVI
Shorea robusta	61.28	41	62.16	164.45
Terminalia tomentosa	35.06	51.48	32.43	118.97
D*albergia sisso*	3.1	0.57	2.7	6.37
(Tectona grandis)	0.56	6.95	2.7	10.21
Total	100	100	100	300

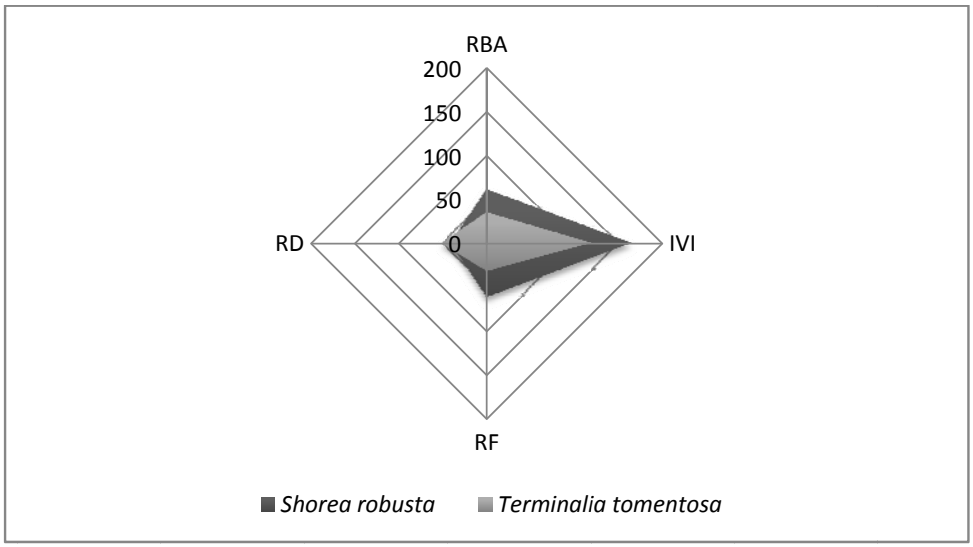


Fig3.2 IVI of *Shorea robusta and Terminalia tomentosa*

From the stand size classification (fig 3.3) of observed trees, there were high percentages of saplings (82.8 %) in the sampled plot. Timber sized stand contributes only a few numbers. There are very less poles as well. The very high saplings suggest the recent regeneration of the forest and the increasing density. It is the good news that the saplings are increasing suggesting more trees with fodder, fuelwood and timber in future. It may be helpful in fulfilling the demands of locals from the Community Forest. This also show the success story of the Bandevi Barandavar BZCF and the forest is regenerating after it has been handed over to them in 2059 BS.

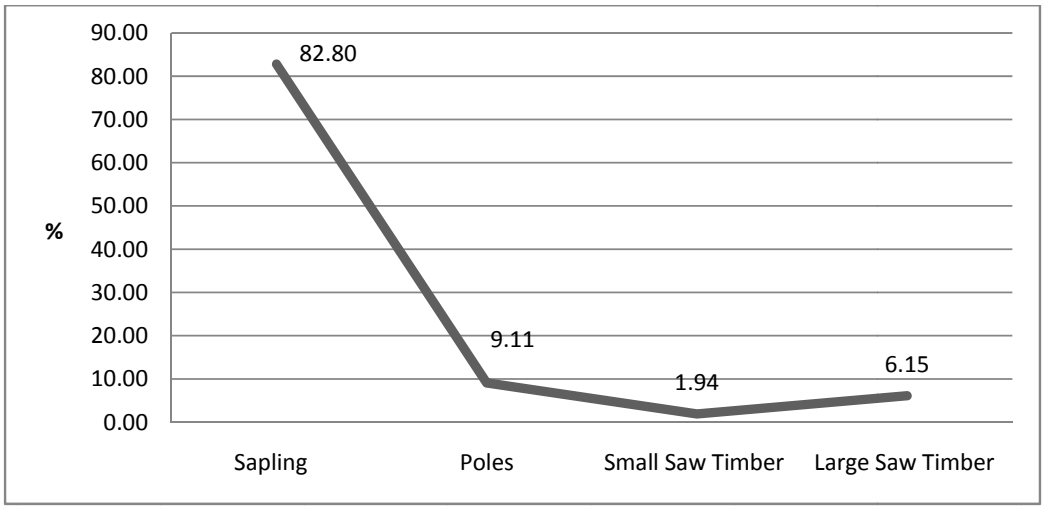


Fig 3.3 Stand Size of trees.

From the coverage study, the Bandevi Barandavar BZCF was found to be medium stocked with coverage of 33.38% per ha. The highest crown cover was of 90% and that of least was 0% of the sampled plot.

A total of 3878 individuals from 53 different plant species were found in the herb plot. The density and frequency of ground vegetation is presented in Table 3.4. *Imperata cylindrica* was the most dense species and most frequent compared to other observed species. The total density of herb was 77560/ha. Among them, *Imperata cylindrica* have highest density (21620/ha) and frequency (30.8).

Table 3.4 Herbs identified at the CF

Name Of Species	Total Number	Density	RD	Frequency	RF
Ageratum conyzoides Linnaeus	319	6380	8.23	17	4.62
Hemiphragma heterophyllum Wallich	190	3800	4.90	10	2.72
Imperata cylindrica (Linnaeus) Palisot De Beavios	1081	21620	27.88	36	9.78
Hedyotis lineata Roxburg	294	5880	7.58	22	5.98
Cypreus distans Linnaeus Fil	40	800	1.03	6	1.63
Phyllanthus parvifolius Buchanan-Hamilton Ex D. Don	214	4280	5.52	12	3.26
Desmodium multiflorum Buchanan-Hamilton Ex D. Don	4	80	0.10	1	0.27
Evolvulus nummularius (Linneaus) Linnaeus	130	2600	3.35	16	4.35
Desmodium laxiflorum De Candolle	6	120	0.15	1	0.27
Dioscorea bulbifera Linnaeus	21	420	0.54	8	2.17
Shorea robusta Gaertner	144	2880	3.71	31	8.42
Clerodendrum vicosum Ventenat	140	2800	3.61	28	7.61
Erysimum hieraciifolium Linnaeus	2	40	0.05	1	0.27
Catunaregam spinosa (Thunberg) Tirvengadum	3	60	0.08	2	0.54
Cyperus rotundus Linnaeus	35	700	0.90	12	3.26
Arisaema tortuosum (Wallish) Schott	13	260	0.34	4	1.09
Vigna mungo (Linneaus) Hepper	138	2760	3.56	23	6.25
Trifolium repens Linneaus	188	3760	4.85	17	4.62
Eupatorium adenophorum Sprengel	49	980	1.26	18	4.89
Achyranthes aspera Linnaeus	4	80	0.10	1	0.27
Desmodium multiflorum De Candolle	8	160	0.21	1	0.27
Digitaria ciliaris (Retzius) Koeler-Gram	219	4380	5.65	10	2.72
Cynodon dactylon Linneaus Persoon	181	3620	4.67	6	1.63
Brachiaria romosa (Linneaus) Stapf	21	420	0.54	1	0.27
Commelina benghalensis Linneaus	100	2000	2.58	17	4.62
Murrayana koenigii (Linnaeus) Sprengle	3	60	0.08	1	0.27
Labiateae	4	80	0.10	1	0.27
Equisetum Sps	15	300	0.39	1	0.27
Gonostegia Sps	13	260	0.34	2	0.54
Oxalis latifolia Kunth	13	260	0.34	1	0.27

Ophioglossium reticulatum Linneaus	8	160	0.21	2	0.54
Costus speciosus (Koeing) Smith	3	60	0.08	2	0.54
Cissampelos pareira Linneaus	13	260	0.34	7	1.90
Holorrhea Pubescens	12	240	0.31	3	0.82
Stephania japonica (Thunberg) Miers	16	320	0.41	5	1.36
Clerodendrum vicosum Ventenat	11	220	0.28	3	0.82
Torinea cordifolia Roxburg	3	60	0.08	1	0.27
Rungia parviflora (Retzius) Nees	12	240	0.31	2	0.54
Hedyotis scandens Roxburg	3	60	0.08	1	0.27
Borreria alata (Aublet) De Candolle	60	1200	1.55	3	0.82
Solena Heterophylla Loureiro	11	220	0.28	7	1.90
Viola pilosa Blume	13	260	0.34	2	0.54
Canjanus scarabaeoide (Linneaus) Thouars	7	140	0.18	2	0.54
Bidens pilosa Linneaus Var Minor (Blume) Sherff	6	120	0.15	1	0.27
Sporobolous fertilis (Steudel) W . D. Clayton	11	220	0.28	3	0.82
Elsholtzia stachodes (Link) Raizada And Saxena	16	320	0.41	3	0.82
Stellaaria vestita Kurz	15	300	0.39	1	0.27
Fern	3	60	0.08	1	0.27
Saccharum spontaneum	10	200	0.26	1	0.27
Compositae	11	220	0.28	4	1.09
Saussurea Sps	13	260	0.34	3	0.82
Hemigraphis hista (Vahl) T. Anderson	25	500	0.64	1	0.27
Triumfetta rhomboides Jacquin	4	80	0.10	3	0.82
		77560	100	368	100

A total of 5943 individual species from 22 different plant species were found in the shrub plot. The density and frequency of shrub species are presented in Table 3.5. *Eupatorium adenophorum*, *Shorea robusta* and *Clerodendrum vicosum* were relatively more dense and most frequent species. The total density of species in shrub plot was 4754.4/ha. Among them, the highest individual density was observed in *Eupatorium adenophorum* (1481/ha) and the frequency of Occurrence was highest in *Eupatorium adenophorum* (19.46).

Table 3.5 Shrubs identified at the CF

Name Of Species	Total No.	Density	RD	Frequency	RF
Elsholtzia stachodes (Link) Raizada And Saxena	269	215.2	4.53	8	2.16
Eupatorium adenophorum Sprengel	1481	1184.8	24.92	72	19.46
Clerodendrum vicosum Ventenat	1112	889.6	18.71	64	17.30
Shorea robusta Gaertner	1463	1170.4	24.62	70	18.92
Imperata cylindrica (Linnaeus) Palisot De Beavios	783	626.4	13.18	12	3.24

Helicteres isora Linnaeus	118	94.4	1.99	26	7.03
Arisaema tortuosum (Wallish) Schott	166	132.8	2.79	28	7.57
Holarrhea pubescens (Buchaan-Hamilton)	4	3.2	0.07	2	0.54
Murrayana koenigii (Linnaeus) Sprengle	19	15.2	0.32	12	3.24
Dalbergia Dalbergia sisso Roxburgh Roxburgh	15	12	0.25	6	1.62
Urena lobuta Linnaeus	37	29.6	0.62	8	2.16
Achyranthes aspera Linnaeus	31	24.8	0.52	4	1.08
Desmodium Multiflorum De Candolle	1	0.8	0.02	2	0.54
Eugenia formosa Wallich	90	72	1.51	10	2.70
Phyllanthus parviflora Buchanan-Hamilton Ex D. Don	3	2.4	0.05	4	1.08
Cirsium verutum (D Don) Sprengel	17	13.6	0.29	4	1.08
Saccharum spontaneum	75	60	1.26	2	0.54
Costus speciosus (Koeing) Smith	72	57.6	1.21	14	3.78
Flemingia marcophylla Willtenow Merrill	120	96	2.02	10	2.70
Ipomea sps	52	41.6	0.87	8	2.16
Chenopodium sps	14	11.2	0.24	2	0.54
Uncaria sps	1	0.8	0.02	2	0.54
		4754.4	100	370	100

3.1.3 Volume, Biomass and annual yield of BZCF

Standing volume of the Bandevi Barandavar BZCF was estimated to be 41.11 cubic meter per hector. Almost all of the Biomass and Standing Volume of the forest is contributed by the two species only (*Terminalia tomentosa* and *Shorea robusta)*. *Shorea robusta* is the species with the highest standing volume (20.22 cubic meters per hector). It holds 49.2% of the standing volume of the tree species reported. *Terminalia tomentosa* shares 48.08 % of standing volume (19.**7** cubic meters per hector). Biomass estimates were derived on the basis of stem volumes. The total biomass per hector was estimated 43.50 tones. *Terminalia tomentosa* and *Shorea robusta* are the major contributors of the biomass (18.04 ton/ha and 24.24 ton/ha resp.) holding 48.08 and 49.2 percentage of the total biomass. (figure 3.4). The total branch biomass of the forest was 9585.22 kg/ha and foliage biomass is 1989.23 kg/ha. 97.1% of the total biomass of the forest is contributed by only two species of trees.

Table 3.6 Total volume and biomass of the species in tree

	Standing Volume	Stem Biomass	Branch Biomass	Foliage Biomass	Total Biomass	% Vol	% Biomass
Shorea robusta	20.22	17.8	5339.21	1103.43	24.24	49.2	55.73
Dalbergia sisso	0.11	0.11	37.69	7.07	0.15	0.27	0.35
Tectona grandis	1.01	0.78	235.32	48.63	1.07	2.45	2.46
Terminalia tomentosa	19.77	13.24	3973.01	821.08	18.04	48.08	41.47
Total	41.11	31.93	9585.22	1980.23	43.5	100	100

During the field survey, the corridor forest was observed to be more degraded than the BZCF, mainly due to the spillover pressure of demand towards it and the restriction of over harvest from community forest. The corridor forest is open access as well as least guarded area for fuel wood and fodder extraction than Community forest. The growing stock is considered the best indicator of the forest condition. The Total annual yield of the stem or timber is 1.56 ton/ha/yr, branches is 471.13kg/ha/yr and leaves 107.13 kg/ha/yr of Bandevi Barandavar BZCF. The sustainable harvest of fuel wood of 1664.24 kg/ha/yr and that of 95.35 kg/ha/yr of fodder can be done from the BZCF.

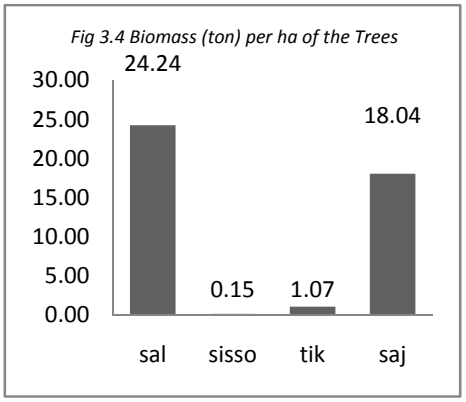


Table 3.7 Sustainable Yield and biomass of the species in tree

	Annual Stem Yield (ton/ha/yr)	Annual Branch Biomass (kg/ha/yr)	Annual Foliage Biomass (ton/ha/yr)	Sustainable Fuelwood Yield (kg/ha/yr)	Sustainable Fodder Yield (ton/ha/yr)
Shorea robusta	0.87	262.69	59.7	927.47	53.12
Dalbergia sisso	0.01	1.85	0.38	5.74	0.34
Tectona grandis	0.04	11.58	2.63	40.88	2.34
Terminalia tomentosa	0.65	195.47	44.42	690.15	39.53
Total	1.56	471.59	107.13	1664.24	95.35

3.1.4 Household Resource dependency

In this section, the consumption of fodder, fuel wood and livestock holding of respondents are dealt. Almost all the respondents were somehow indulged with

livestock either by direct ownership or paid by others for looking after them. Demand of the fuelwood and fodder were estimated from the HH social survey. The data of demand per month obtained and livestock unit were converted to standard units with the help of conversion factors. (Annex B4 and B5)

3.1.4.1. Livestock Holding and Fodder Demand

In rural farming system, fodder is one of the important forest resources. It is important to keep the livestock and develop manure for sustainable farming. 3 major types of livestock i.e. cattle, buffalo and goat were found along with chickens and ducks. The mean of cattle, buffalo and goat were 8.34, 5.68 and 6.46 respectively. Pigs were also reported in few households. Very few household were taking poultry as the major occupation as well, but direct respondent involved in poultry was not dealt during the survey. 69% livestock were stall fed. Only 1.4% of livestock were grazed.

Table 3.8 Livestock Holding

Livestock	Total No of LS	Minimum	Maximum	Mean	SD
Cow and Ox	32	1	10	8.34	3.29
Buffalo	63	1	10	5.68	4.24
Goat and Sheep	119	1	10	6.46	3.62

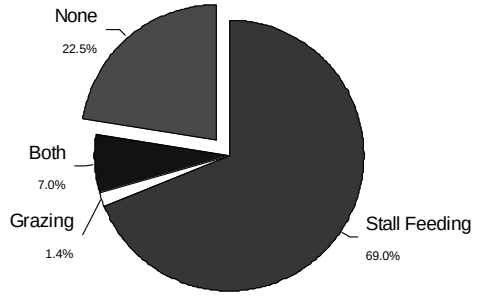


Fig3.5 : Livestock feeding

69% livestock were stall feed. 22.5 % do not have any livestock. 7% of the livestock were stall fed as well as grazed. Only 1.4% of the livestock were reared by grazing only. The poor households usually do not have livestock. If they posses any livestock, they rather graze them than stall feed. Respondents with large farms and good economy were found to stall feed their livestock. Thus Economy plays a vital role in Household Resource Dependency.

The average fodder demand in study area was estimated to be 17.50 metric ton per household per year and 14.91 kg per day. The highest fodder demand was found for medium size i.e. 49.53ton/yr and lowest for landless i.e. 1.95 ton/yr. That is because

livestock unit per house hold was highest for medium farm size (8.64) and least for the landless (3.01). The average livestock unit (LSU) per household of study area was 3.51. The value was highest for medium farm i.e. 8.64 and was least for small farm i.e. 1.38. It was also observed that fodder demand increased with the increase of LSU per household. Medium sized farm holds the highest number of livestock and demands the highest fodder. They have limited land to feed the livestock from their farms and they depend on BZCF to fulfill the demands.

Table 3.9. Fodder demand characterized by farm size

	Landless	Small	Medium	Large	Average
Fodder U per month(Kg)	16250	145850	412750	169050	143712.75
Fodder Demand per Year (metric ton)	1.95	17.50	49.53	20.29	17.50
Total live stock unit (LU)	15.05	30.35	34.54	47.35	20.24
LU per HH	3.01	1.38	8.64	1.97	3.51
Average Fodder Demand per year (Kg) Per LSU	1295.68	5766.72	14339.90	4284.27	5350.82
Average Fodder Demand per day (Kg) per LSU	3.55	15.80	39.29	11.74	14.91

3.1.4.2 Fuel wood Demand

In average, fuel wood demand per household was 0.92 Metric ton per year for study area. The highest fuel wood demand was for large farm size (1.764 Metric ton per year). The average demand of fuel wood per day is 1.44 kg per HH.

Table 3.10. Fuel wood demand characterized by farm size

	Farm Size				
	Landless	Small	Medium	Large	Average
Fuel Wood Demand Per Month (Kg)	3260	9240	3300	14700	7625.00
Demand Metric Ton Per Year	0.3912	1.1088	0.396	1.764	0.92
Demand Per HH per kg/year	391.2	482.09	495	735	525.82
Demand Per HH per kg/day	1.07	1.32	1.36	2.01	1.44

3.1.5 Supply and demand of Resources.

Table 3.11 Demand supply of the forest products.

	Demand	Supply	Deficit
Fuel wood ton/year	920	281	639.16
Fodder ton/year	17500	16090	1409.7

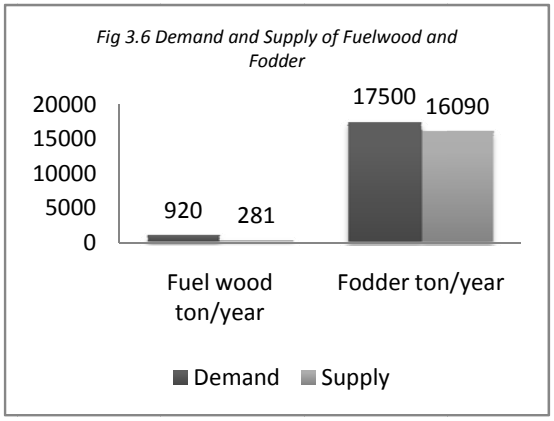


Fig 3.6 Demand and Supply of Fuelwood and Fodder

920 ton/year of fuelwood and 17500 ton/year of the fodder is demanded by the local people. But the forest can sustainably supply only 281 ton/year of fuelwood and 16090 ton/year of fodder. There is a deficit of 639.16 ton/year/ha and 1409.7 ton/year/ha of the fuelwood and fodder respectively. The deficit is met by the products of their own farm and buying from others. Half of the deficit is managed from the farms. But the respondents hesitate to identify the source from whom they buy the deficits. Few said that the deficit is sold after getting it illegally out of BZCF and Corridor forest by the landless and poor locals.

3.1.6 Human Interference on BZCF

The girth class classification of cut trees in buffer zone community forest is presented in Table 3.12. The density of the cut stem was higher for the girth class >20 cm. The maximum cut stump were recorded for *Tectona grandis* and minimum density was recorded for *Dalbergia sisso*. The cut stem of Tectona grandis were more than the living plants. The maximum cut stem density was found in girth class >20 cm of *Terminalia tomentosa*. *Terminalia tomentosa* had the largest number of cut stems.

However, *Shorea robusta* had lesser cut stems. This is because of penalty for felling the *Shorea robusta* declared by the Park as well as the BZCF.

Table 3.12 Girth classification of cut stump

Tree species	Girth of cut stem >20	20-40	41-60	61- 80	> 80	Total	Cut Stem Density/ha
Shorea robusta	30	0	0	2	1	33	3.3
Terminalia tomentosa	47	0	0	0	0	47	4.7
Tectona grandis	7	0	0	0	0	7	0.7
Dalbergia sisso	0	0	0	0	0	0	0
Total	84	0	0	2	1	87	8.7

A total of four types of woody species were recorded from the study area. The total density of cut stumps was 8.7/ha. *Terminalia tomentosa* was the most common cut stump species having density of 4.7/ha in total. Other less common species was *Tectona grandis* . The *Dalbergia sisso* was the species with no cut stem. The ratio of cut stem is very high for *Tectona grandis* (140%) in comparison to others.

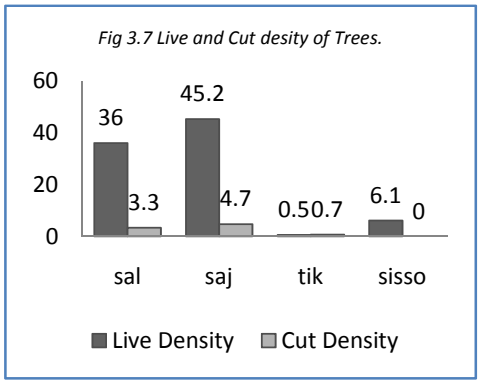


Table 3.13 comparison of live tree density and cut stem density

Tree species	Density of live tree	Density of cut stem	% of Cut stump compared to Live tree
Shorea robusta	36	3.3	9.17
Terminalia tomentosa	45.2	4.7	10.40
Tectona grandis	0.5	0.7	140.00
Dalbergia sisso	6.1	0	0.00
Total	87.80	8.7	9.91

From the field observation 24% (N=6 out of 25) of the sampling plots were found to be grazed and linked with foot trails, most of them being near the boundary line and the settlement areas. The inner places were less susceptible to grazing and frequent travelling.

3.1.7 Issues of Bandevi Barandavar Community forest based on their work plan of 2006

Bandevi Barandavar Community forest is the forest under the jurisdiction of Buffer zone of Barandavar, Bharatpur Municipality (ward No. 8 & 9) is located under the jurisdiction of the western Sauraha sector of Chitwan National Park and and allocated site of biodiversity conservation center, NTNC chitwan. The forest is a part of corridor between the hills and the mountains for the migration of wildlife. To protect the increasing encroachment, illegal harvest of resources and poaching, CNP has designated the 300m from eastern and western side of the Barandavar forest as different community forests. Bandevi Barandavar community forest lies in the western part including the ward no. 8 and 9 of Bharatpur Municipality. It was handed over to the people in 2058BS. Till now, it has been managed by the bandevi Barandarvar community forest management committee under Barandavar Buffer zone user group. For the management of the forest the management went through the inventory of the forest to find out the supply demand status of the forest. The issues raised by the management to make the forest sustainable are discussed in this section. (Source: Chitwan National Park, Barandavar Bufferzone User Group, Bandevi Barandavar Bufferzone Community Forest User Group, Forestry Office, Bharatpur, Chitwan, 2006 AD)

3.9.1 Issues identified in work plan

The total population of the user group is 10583 in 1872 households to use and manage 168.75 ha of community forest. Out of this, 1400 are the registered members. It includes the parts of Bharatapur Ward no 8 and 9 including 5664 and 4919 of population and excludes the farther parts of the wards also. 21 different user committees are formed to distribute the resources. The annual demand and supply is tabulated below as table 3.30.

Table3.18 Annual demand of the Bandevi Community Forest user group.

	Demand	Supply	Deficit
Timber (Cubic Feet)	17400	3125	14275
Fuel wood (Bhari)	73992	3780	70212
ton per year	2959.68	151.2	2808.48
ton per day	8.11	0.41	7.69
Fodder (Bhari)	215820	24525	191295
ton per year	10791	1226.25	9564.75
ton per day	29.56	3.36	26.20

Haris, Dade Kath (Number)	100	58	42
Coal (Quintel)	90	37	53
Khar (Bhari)	43390	Negliable	43390

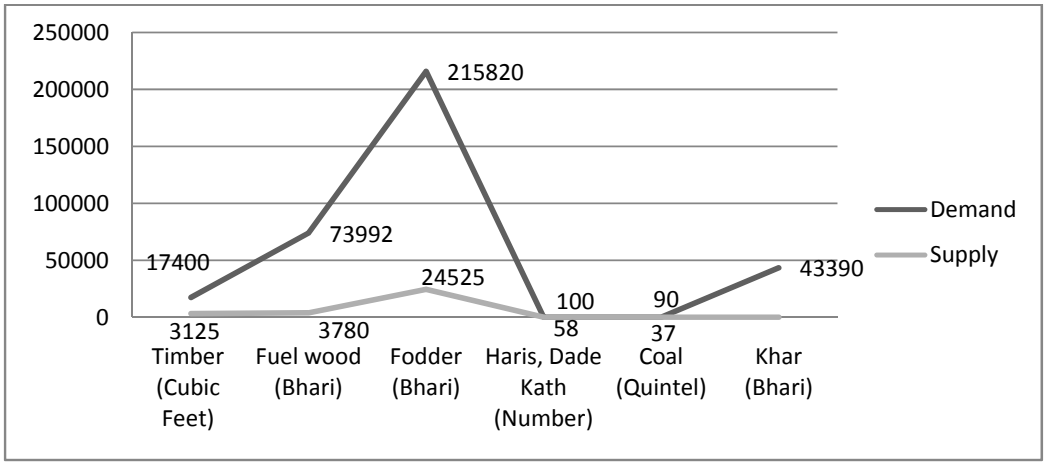


Fig 3.19 Demand supply of the Bandevi CF

The supply is very low in comparison to the demand. This is the demand of the people included in the user group. Larger part of the population of Bharatpur Municipality is not included which posses pressure over the forest too. This has created the conflict among the users too. The prime conflict is the illegal encroachment on the forest by the people of non user group. As only 300m of the forest from boundary comes under the jurisdiction of the management, it has made the encroacher easy to slip away from the punishment claiming that it is not their duty to obstruct them, it's the part that should be played by CNP itself. This has created the pressure in the region outside the jurisdiction of the CFs. Although the forest managed by the user groups are regenerating and sustainable harvest is done, the other part is depleting and the older and much of newer sapling and poles are illegally extracted away every day.

The increasing demand which is unable to be met by the supply of forest, the increasing encroachment, illegal harvest and improper allocation of the forest to users have raised the conflict of resource sharing and maintaining. The work plan have addressed the following requirements to pacify the issues.

- CNP has handed over the 300m of forest from the boundaries with the view of creating the barrier to the corridor forest to the users. This has to be changed and the allocation must be done on the basis of the resource requirements.
- The area of the forest must be extended; the total forest must be divided into two sections and handed over to eastern and western sector Community forest user groups. It will finish the gap between the CFs and the illegal encroachers cannot slip away just claiming that it is not under their jurisdiction.
- The people relying on the forest must be included in the user group, besides the few people living near the forest.
- The authorities to control the poachers and encroachers must be intensified and decentralized to the CFs user so that they can take action over it immediately. Decentralization of authority is the key point in controlling the illegal activities.

3.1.8 Issues of BZCF

Bramin and Chettries are the most dominant for the involvement in the community forest. The involvement of Tharus, Janajatis is more than that of half of their population. But more than half of the population of the Dalits is still not involved in the bufferzone management. The involvement of marginalized people in the working is lacking suggesting that the management is governed by the rich and power members of society. The inclusion of the marginalized is the priority of the BZCF management.

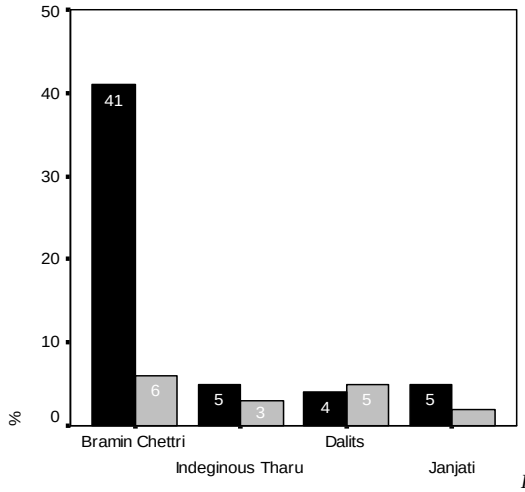


Fig 3.8 Involvement in BZ

Fig 3.9 indicates that the condition of the BZCF have improved than past. Respondents have noticed that the condition have been better than past in community forest. 55% said that it was good and 25 reported satisfactory condition with the present forest. Only 15% respondents found the condition turned out to be bad. 4% of the respondents were ignorant about the condition of BZCF.

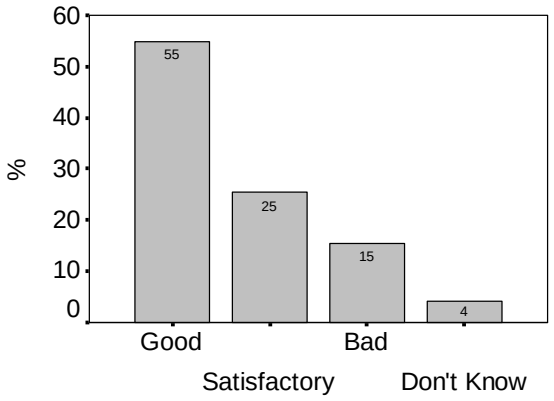


Fig 3.9 Condition of forest compared to past

23% respondents felt that there is no deficiency in resources from CF but the remaining declared the deficiency. 48% of the people buy their deficit from other sources like saw mills, local markets and even from the landless people who illegally get it from the Bharandavar Corridor forest and even the BZCF. 27% people get their deficit from their own farms. Only 1% of the people fulfill their deficit from their farm as well as from local market. 1% of the respondents do not use the forest resources. Thus, the forest resources are very important in the study area as only 1% of respondents do not need it. 48% of people buy or borrow it which concludes that the deficiency is very high and people get the deficit the other way. The usual sellers are the landless who get the resources illegally from corridor forest or the BZCF.

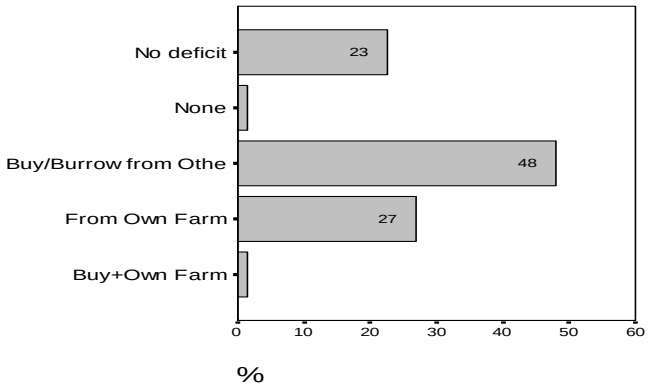


Fig 3.10 Management of Deficiency of resources

The major problem created in the community forest has been identified as the insufficient resource (16.9) and crop damaged by wildlife (15.5). Guarding problems (12.7) has also been raised by the respondents. Discrimination among the users and mismanagement has also been reported. 19.7% of the people find that the CF forest has no problems. 14.1% of people are indifferent about the problems if BZCF.

Table 3.14 Problems in your CF

	Frequency	Percent
Crop Damage by Wild Animals	11	15.5
Illegal Cutting Of Plants	5	7.0
Discrimination Among users	5	7.0
Problems In Guarding	9	12.7
Not Sufficient Resources	12	16.9
Distance From Home	1	1.4
Management Problems	4	5.6
Don't Know	10	14.1
No Problems	14	19.7

There are problems in the community forest. For the betterment of the BZCF, 29.58% people suggested for better guarding against theft of resources and poaching, 18.31 % for extension of the area of the forest to meet the demand and 11.7 % for better management plan. Controlling Timber piracy, Awareness programs, better fencing and forestation programs are other suggestions from the respondents.

Table 3.15 Suggestions for betterment of forest

Suggestions for better CF	Frequency	Percent
Better Guarding against theft/poaching	21	29.58
Prevent Kath Taskari	3	4.23
Awareness	1	1.41
Strict restriction	1	1.41
Awareness, Fencing and employment	3	4.23
Extension of CF	13	18.31
Better Fencing	7	9.86
Afforestation	7	9.86
Easily Accessibility	1	1.41
Better Management plan	8	11.27
Don't Know	4	5.63
As it is	2	2.82

3.2 Energy use – Biogas

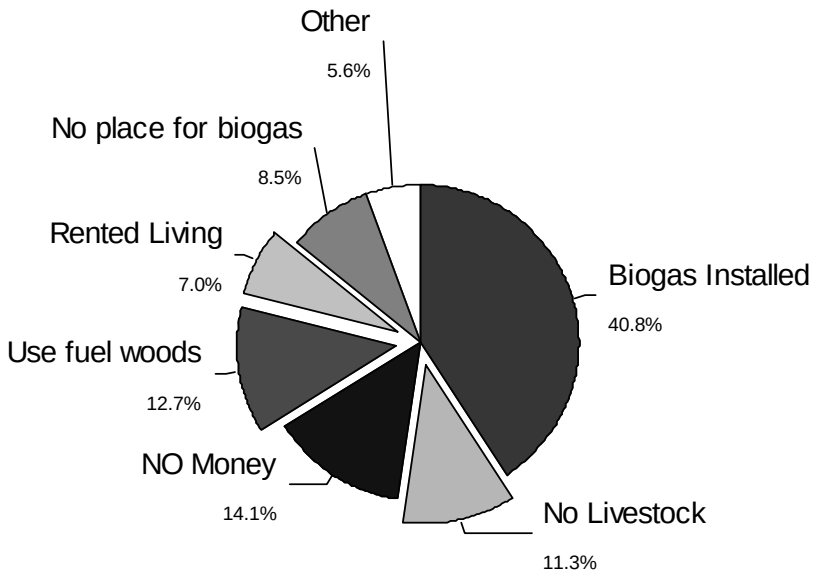


Fig 3.11 Biogas Plants and reasons for not having Biogas

40.8% of the respondents have biogas plants installed. 12.7% get their energy from the fuel wood. So, they are not using the biogas. Respondents living in rent and poor respondents were not able to install the biogas (7%). 8.5% of respondents even do not have place or land to make the biogas plant.11.3% respondents do not have live stock for biogas. 14.1% respondents reported that they want to have biogas but they do not have enough money. 5.6% of the people only use other source of energy.

Out of 40.8% of the biogas holders only 11.45 respondents get it made on their own. BSP supported 23.9% of the biogas installation. Other organizations like Heifer Nepal, BZ Management committee also help to build the biogas plants (5.6%).

Table 3.16 Biogas Installation support

Biogas Plant				Total
		Installed	Not Installed	
Installation	With Self Money	11.3	0.0	11.3
	With Support from BSP	23.9	0.0	23.9
	With support from Other Org	5.6	0.0	5.6
	None	0.0	59.2	59.2
Total		40.8	59.2	100.0

Use of energy like kerosene, electricity and LPG gas is common in the study area irrespective of Bio-gas installation. 47.9 % of respondents use the electricity. 1.4% of respondents use solar and LPG. LPG is used by the users who have access to either electricity or solar. The respondent using the LPG were observed to lack the bio-gas plants. Fuel wood, Kerosene and LPG are used as the alternative of Biogas. Kerosene is also a common form of the energy used among landless and even the small and medium farm size. 2.8% of the people entirely depend upon fuel wood for energy.

Table 3.17 Energy consumption pattern

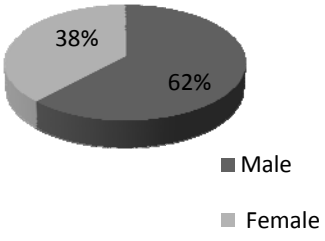
	Farm Size				Total
	Landless	Small	Medium	Large	
Kerosene	7.0	4.2	2.8	0.0	14.1
Electricity	1.4	23.9	7.0	15.5	47.9
Electricity and LPG	4.2	9.9	0.0	19.7	33.8
Solar and LPG	0.0	0.0	1.4	0.0	1.4
Fuel wood only	1.7	1.1	0.0	0.0	2.8

3.3 Social Status of User Group

The total population of 10583 in 1872 house hold are included in Bandevi Barandavar community forest user group.(Source: Five year Management plan, Bandevi Barandavar Community forest, 2006) The user group includes ward No. 8 with population of 5664 and ward No. 9 with population of 4919 of Bharatpur municipality. 71 Households were sampled and the distribution of sample household of the study area according to gender, age group, caste, occupation and education is summarized in tables and charts. (Annex A.1)

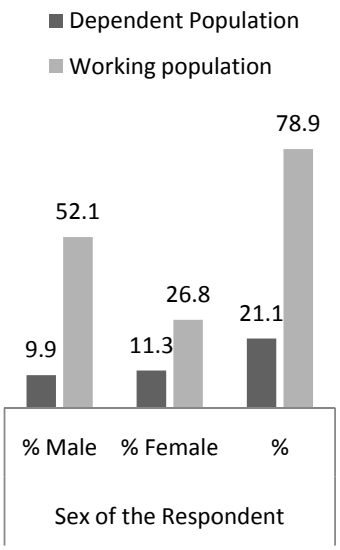
Fig 3.12: Sex Ratio of respondent

38% of the respondent were female and 62% of the respondent were male.



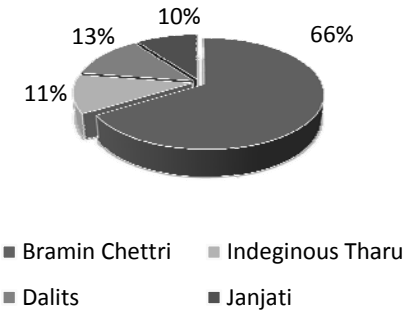
Majority of the population is working population. 21.1% of the population is depending population of the community and 78.9% of population is working. 9.9% of male population is dependent where as 13.3% of female Population is dependent. The study shows that the female population is more dependent whereas the majority of the male population works.

Fig3.13 Dependency of population



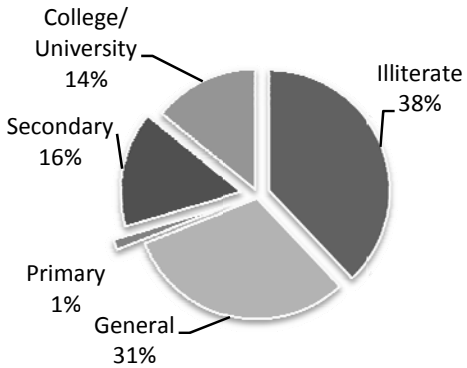
Bramins-Chettri and Tharus have coexisted here for long. Dalits and Janjati are the recent dwellers. Brahmin-Chettri occupy the majority of the land, Livestocks and consumes the highet amount of fodder and energy. They occupy the largest share in biogas installation also. Tharus have quite less livestocks and consumes very little fodder and energy. Dalits are the ones without land, but with only a handful of livestocks and very little access to energy and biogas. Janajati also share very small portion of land , energy and forest products (Annes A.4). 66% of the respondent are Bramin-Chettri, 11% Tharus, 13% Dalits and 10% Janajati.

Figure 3.16 Households by ethnic groups



38 % of the respondents are illiterate. 16% have completed the secondary level. 31% can read and write but lack formal degree. 14% have done the graduation. Only 1% of the population have completed the primary level only. Highest literacy is of Bharmin-Chettri. Tharus, Dalits and Janajati rarely reach the Universities. Nuclear families have higher educational status and income source than the joints. The higher

Fig: 3.15 Education status of the respondents



the land owned i.e. wealthier the person, the higher the educational status is. 66.2 % of the Bramin-Chettri is educated occupying the highest rank and the Janajati are the least educated. The respondents with the large farm size hold the second place where as the respondents of small farm size have the highest educational status. (AnnexA.5)

3.4 Economic Status of User Group

The main occupation of the community is agriculture (36.6%). Being very near to the central market of bharatpur and government offices, people involved in services share 14.1%. 23.9% of the people have adopted business as their earning source.7% are wage labours.7% have taken business along with agriculture to earn the living. Remaining people are students, housewives, politicians etc. (Annex A.2)

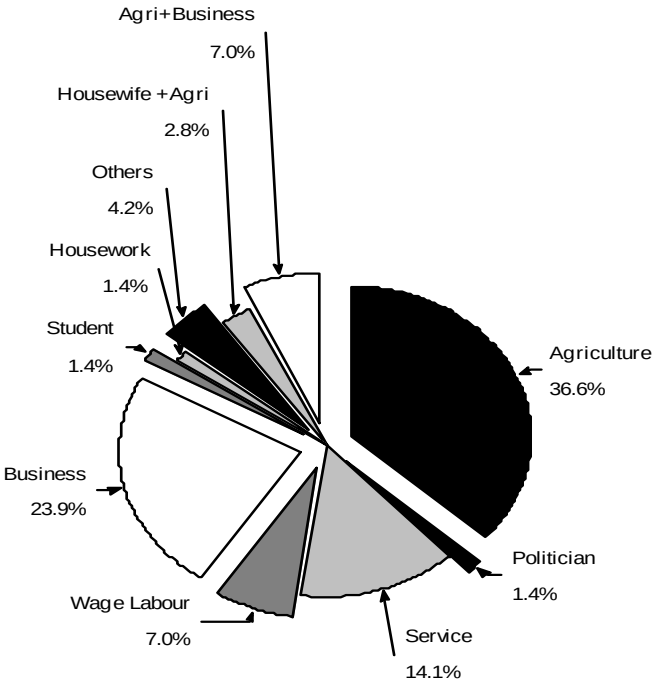


Fig3.14 Occupation of population

15.5 % of the people are landless, 35.2% of people have medium sized farms. 38% have small farm and 35.2% have large farms. None of the respondents have big farms as the land has been disintegrated during the handover generation after generation. Land selling has grown exponentially in recent years thereby disintegrating the big farms.

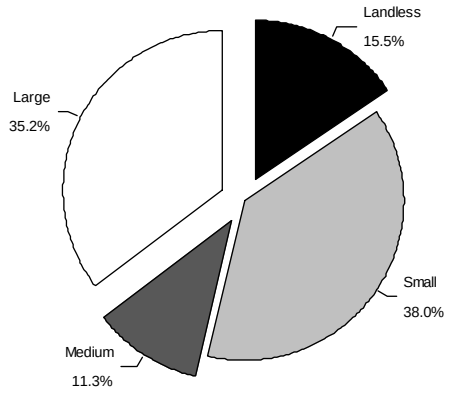


Figure 3.17 Farm size

The overall summary of food crops deficit of household based on land holding. 26.8% of the respondents have the surplus of production. 57.7 % face the deficiency and 15.5 % have the balanced yield. Landless and small farm size respondent basically produces paddy and maize and suffer the severe deficiency of crops, whereas the respondents with medium and big farm size have balanced and surplus harvest. Usually the deficiency period is short for very few respondents; either it is longer than 3 months or there is no deficiency. Large farms earn the most with agriculture, livestock and business. Landless are more dependent upon the wage labour. (Annex A.3)

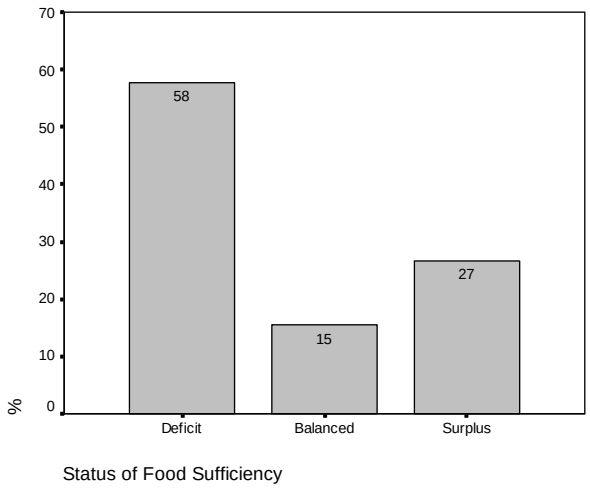


Figure 3.18 Food Sufficiency

Chapter 4
DISCUSSION

Bandevi Barandavar CF Use group was mixed community of the livelihood depending everyday on resources of the CF and indifferent peoples who earn their living by other means. The urbanization proliferating everyday has shifted the resource dependency on the CF; On the other hand the marginal people who cannot meet the challenge of shifting are becoming more and more dependent on the CF. So, with the Development, even though few population become indifferent towards resources of adjoining CF, it becomes prior to majority of marginal people. Social advocates contest over three reasons that had influenced livelihood of the local communities by the establishment of the protected areas. First, they argue that only those initiatives focusing on root cause of environmental destruction will in reality lead to successful biodiversity conservation (Wilkie, Demmer, Starley, Telfer, & Steil, 2006). Second, protected area drags unjustly the property and rights of local people. Third the role of parks in local development has been negligible as the distribution of benefit has always been skewed against poor people. In this study, the household socio-economic relationship with natural resources extraction had been found to be playing the major role in shaping conservation measure obliged at the buffer zone areas. Buffer zone comprises populations from various ethnic groups and social status having different economic status and well being in the community. Brahamin/Chettris were dominant followed by dalits groups. Brahamin/Chettri's were hill migrants who have settled in study area and in average holds more farm lands than others. There are seven distinct settlements within the 500 m distance from the forest edge and it encompasses 1872 households. The household were dominantly from small to medium farm households representing all ethnic groups. Households were Farmers, Wage labour and small business persons. A few were service holders and social workers. Having market access to the Bharatpur, households have adopted modern farming system by practicing new varieties of seeds and there has been a shift from manual tilling to use of tractors. All farmlands had irrigation facilities. Households own an average of 3.51 livestock unit with fodder consumption on an average of 5350.80 Kg/yr/LSU i.e. 14.91 Kg/day/LSU but the supply is 44.08 ton per day(16090 ton/year) i.e. 14.22 kg per day per LSU from the CF. Most of the households were practising stall feeding to their livestock. However, few households

were grazing their livestocks in buffer zone community forest boundaries. Buffer zone households on an average need 552.82kg/ household per year i.e. 1.4 kg per day per household of fuel wood but the supply of the community forest is 0.77 ton per day (281 ton/year) i.e. 0.41 kg per day per HH. From the analysis of results based on the household land holding, livestock unit per household and green fodder and fuel wood supply options, the household's needs for green fodder and fuel wood have not been supplied sufficiently from buffer zone community forest. Household with big farm required more green fodder as they had comparatively large number of livestocks than those of small farm households. Small farm households were more dependent on fuel wood as they have less access to biogas, electricity, kerosene and liquefied petroleum gas. Though big farm household, usually lives near the Bharatpur- Hetauda highway and away from the buffer zone community forest, have options to use their own land, the bulk of local communities had alternative sources other than CNP, household practically derive all the needed forest produce from the corridor forest. The data suggests that none of the forest resource supplied is fulfilling the demands. An earlier study reported that 37.1 % of fuel wood and 55.5 % of fodder were collected from National Park (DNPWC, 2000). The amount of forest product supplied to support household's livelihood and the amount of land they own play vital role in accelerating environmental degradation at the buffer zone. The pressing needs were evident in the poorer household who dwell near the buffer zone community forest and adjacent park and fulfill their green fodder and fuel wood demand from the CF or corridor forest either legally or illegally. Others get their insufficient supply through these people. Also the disputes arise over land ownerships as there were three types of land ownership among the households, which include Government land, rented land and own land. Of these poorer households most of them had rented or government land.

The buffer zone community forest allocated to Bandevi Barandavar community Forest is 168.75. The forest resources were shared by 1872 households from Bharatpur 8 and 9 and adjoining wards. 1400 households were the member of buffer zone community forest. At management level the household from Brahmin/Chettri were more seen active than the other ethnic groups. The representation of dalits was very poor. The local communities admitted that the forest has become better after being handed over to the community in 2006. Even so, the local communities who were bound to protect and use buffer zone community forest were facing several problems like, limitation of

resources, stealing and illegal collection, open boundary and crop damage by wildlife. Among villagers conservation was not first priority. 300m of forest from the boundary was allocated to user group, so the limited area of the forest was unable to fulfill the demand of timber, fodder, fuelwood, other woods and khar. This has created the pressure in Barandavar corridor forest. The increasing pressure on corridor forest has compromised the conservation. So, it must be addressed and alternatives must be developed. The reserves must be kept safe. Even though, the extension of the forest was the major priority felt by the locals, the study suggests that the reserves must be kept untouched for biodiversity and wildlife conservation. Biogas program, Agro-forestry, efficient resource use can be other measures to reduce the conflicts.

The present study identified 65 plant species is the buffer zone community forest of Bandevi Barandavar Community Forest. The present study show higher density/ha of *horea robusta* (sal) and *Terminalia tomentosa* (saj). Very small number of (Tectona grandis) and *Dalbergia sisso* (Sisso*)* were present in few of the sampling plots. The IVI values of *Shorea robusta* and *Terminalia tomentosa* was found to be 164.45 and 118.97 respectively dominating the area. Only 6 .15 % of stands are of timber category and others stand of tree are largely saplings constituting 82.8 %. Most of the trees were below 10 m in height. A total of 22 different species were reported in shrub study with a total density of 4754.4 /ha. Of these the frequency of *Eupatorium adenophorum* Sprengel was found to be highest among other species. However locals have argued that after 1990's this species has started colonizing in the forest and has been harming to the health of the forest. More significantly, this species is not palatable to livestocks. A total of 53 different species were reported in herb study with a total density of 77560/ha. NTNC (2000) study has shown *Salvia* sp, *oxalis corniculata*, and *Ageratum conyzoides* among others species to be the most frequent herb species. However present study did not report *Salvia* species. In addition, species like *Imperata cylindrica* and *Saccharum spontaneum* preferred by both household and wildlife were observed during the study. 67 previous studies NTNC (2000) had reported *Imperata cylindrica* only having very low frequency. This could be due to invasion by exotic species.

A total standing volume and total standing biomass of trees was obtained to be 41.11 m3/ha and 43.50 ton/ha respectively. The forest can sustainably supply 16090

ton/year of fodder and 281 ton/year of fodder. But 920 ton/year/ha of fuelwood and 17500 ton/year/ha of the fodder is demanded by the local people. Thus, based on potential resources supply and household demand of forest product from the buffer zone community forest, the status of forest was found to be degraded and subjected to greater harvest. The data suggest that there is annual deficit of 639.16 ton/year of fuel wood and 1409.7 ton/year of green fodder at Bandevi Barandavar CF User Group. Locals were dependent on either their own farm or corridor forest for their traditional dependency of the NTFP's and timber. The deficit is met by the products of their own farm and buying from others. Half of the deficit is managed from the farms. The fuel wood deficiency has been subsidized with the use of electricity, biogas, solar and kerosene 40.8 % people have biogas and 47.9 uses electricity whereas 33.8% use electricity along with the LPG. The extensive use of alternatives of fuelwood had partly compensated for the deficiency of fuelwood. Still the demand is not completely met and people get the deficit from farms and market. But the respondents hesitate to identify the source from whom they buy the deficits. Few said that the deficit is sold after getting it illegally out of BZCF and Corridor forest by the landless and poor locals. The forest was found to be medium stocked. In general, stocking varies with the area of forest. The well stocking of trees was found higher in plantation areas. The anthropogenic pressure on buffer zone community forest was prominent. The total density of cut stump was 87.80/ha. *Terminalia tomentosa* and *Shorea robusta* were the most common cut stump species among other species. Households fodder and fuel wood need may have fulfilled by this.. The diversity index for herbs was highest in the forest compared to trees and shrubs. *Terminalia tomentosa* and *Shorea robusta* are most dominating tree species and herbs have the highest species richness.

Chapter 5

5.1 Conclusion

Socioeconomic status of local communities in Bandevi Bharandavar Community Forest is the driving force for biodiversity conservation and management in the buffer zone resources. All buffer zone households irrespective of their land holding size need forest product for fodder and fuel wood. The concept of natural regeneration and rehabilitation of degraded forests as a means to establish forests with a high compatibility with villagers demand have not yet been sustainable. But, the study shows the forest condition has improved than previous. 920 ton/year of fuelwood and 17500 ton/year of the fodder is demanded by the local people. But the forest can sustainably supply only 281 ton/year of fuelwood and 16090 ton/year of fodder. There is a deficit of 639.16 ton/year and 1409.7 ton/year of the fuelwood and fodder respectively. The deficit is met by the products of their own farm and buying from others. Half of the deficit is managed from the farms. But the respondents hesitate to identify the source from whom they buy the deficits. Few said that the deficit is sold after getting it illegally out of BZCF and Corridor forest by the landless and poor locals. This has created a spillover pressure to corridor forest which has compromised the conservation. It must be addressed and alternatives must be developed. The reserves must be kept safe. Even though, the extension of the forest was the major priority felt by the locals, the study suggests that the reserves must be kept untouched for biodiversity and wildlife conservation. Biogas program, Agro-forestry, efficient resource use and other measures must be intensified be to reduce the conflicts. Effective guarding of the corridor forest along with alternatives to address the socio-economic conflicts with the parks can help sustain the conservation in Bandevi Barandavar BZCF.

5.2 Recommendations

Recommendations have been made based on the research findings discussed in the previous chapters. Implementation of these recommendations can improve the relations of the CNP, local people and CF management providing a basis for sustainable development and conservation of natural resources.

- Spillover pressure created to corridor forest must be addressed and alternatives must be developed. Biogas program, Agro-forestry, efficient resource use must be intensified to address the spillover pressure. Further research for the alternatives must be carried out.
- The reserves must be kept safe. Even though, the extension of the forest was the major priority felt by the locals, the study suggests that the reserves must be kept untouched for biodiversity and wildlife conservation.
- Effective Community mobilization and delegation of Authorities must be done to CF to control the illegal encroachment, harvest of forest and poaching activities.
- Conservation policies, rules and regulation should be developed with involvement of local people in order to create a feeling of ownership rather than imposing strict regulation.
- Effective guarding of the corridor forest along with alternatives is required to address the socio-economic conflicts with the parks.

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Annexes

A.1 General Characteristics of Respondent in the Study Area

		Sex			
		Male	Female	Total	**%**
Age	14-25	3	8	11	**15.5**
	26-39	10	14	24	**33.8**
	40-59	27	5	32	**45.1**
	=>60	4	0	4	**5.6**
Total		44	27	71	**100.0**
Caste/Ethnicity	Bramin Chettri	25	22	47	66.2
	Tharu	4	4	8	11.3
	Dalits	9	0	9	12.7
	Janjati	6	1	7	9.9
Total		44	27	71	100.0
Education	Illiterate	18	9	27	38.0
	General	15	7	22	**31.0**
	Primary	1	0	1	**1.4**
	Secondary	5	6	11	**15.5**
	College/University	5	5	10	**14.1**
Total		44	27	71	**100.0**
Occupation	Agriculture	17	9	26	**36.6**
	Politician	1	0	1	**1.4**
	Service	5	5	10	**14.1**
	Wage Labour	5	0	5	**7.0**
	Business	9	8	17	**23.9**
	Student	1	0	1	**1.4**
	Housework	0	1	1	**1.4**
	Others	3	0	3	**4.2**
	Housewife +Agriculture	0	2	2	**2.8**
	Agri+Business	3	2	5	**7.0**
Total		44	27	71	**100.0**

Residence Period	Generations	16	14	30	**42.3**
	Early Settlers	10	1	11	**15.5**
	Middle Settlers 5-30yrs	8	9	17	**23.9**
	Late Settlers	10	3	13	**18.3**
Total		44	27	71	**100.0**
Flooring material	Earth, Mud , dung	18	7	25	**35.2**
	Linoleum/carpet	5	4	9	**12.7**
	Cement	21	16	37	**52.1**
Total		44	27	71	**100.0**
Sanitation Facilities	Open/indiscriminate	8	5	13	**18.3**
	simple pan latrine	31	18	49	**69.0**
	pour flush latrine	5	4	9	**12.7**
Total		44	27	71	**100.0**
water supply system for HH use	Indoor Piped	3	2	5	**7.0**
	Piped in yard	4	3	7	**9.9**
	Ground water	37	22	59	**83.1**
Total		44	27	71	**100.0**
Solid Waste Management	Open Indiscriminate	15	5	20	**28.2**
	Open dump	13	12	25	**35.2**
	HH collection	5	4	9	**12.7**
	Burning In Yard	11	6	17	**23.9**
Total		44	27	71	**100.0**
Source of Income	Agriculture	3	2	5	**7.0**
	Busi+Remi	1	2	3	**4.2**
	Agri+LS+Remi	2	2	4	**5.6**
	Agri+Remi	0	2	2	**2.8**
	Service	3	0	3	**4.2**
	Agri+Ser+LS	1	3	4	**5.6**
	Agri+LS+Busi	10	6	16	**22.5**
	Agri+labour	4	5	9	**12.7**
	Agri+Buss+Remi	2	1	3	**4.2**

	LS+Ser+Remi	2	0	2	**2.8**
	Agri+buss+Service	2	1	3	**4.2**
	Business	4	2	6	**8.5**
	Wage Labour	10	1	11	**15.5**
Total		44	27	71	**100.0**
Farm Size	Landless	10	1	11	**15.5**
	Small	12	15	27	**38.0**
	Medium	4	4	8	**11.3**
	Large	18	7	25	**35.2**
Total		44	27	71	**100.0**
Land Holding Type	Own	26	19	45	**63.4**
	Rented in/out	8	1	9	**12.7**
	Own+Rented in/out	8	7	15	**21.1**
	Gov land	2	0	2	**2.8**
Total		44	27	71	**100.0**

Note: Agri: Agriculture; LS: Livestock: Busi: Business: Remi: Remittance; Ser: Service

Annex A.2 Distribution of population by occupation

		Agriculture	Politician	Service	Wage Labour	Business	Student	Housewife	Others	Housewife +Agriculture	Agri+ Business	**Total**
Land holding	Own	29.6	0.0	18.3	0.0	25.4	0.0	0.0	1.4	4.2	9.9	88.7
	Rented in/out	1.4	0.0	1.4	8.5	5.6	0.0	0.0	0.0	0.0	0.0	18.3
	Own+Rented in/out	19.7	0.0	0.0	1.4	1.4	0.0	1.4	4.2	0.0	0.0	29.6
	Gov land	0.0	1.4	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	4.2
Ethnic group	Bramin Chettri	28.2	1.4	19.7	0.0	28.2	0.0	1.4	0.0	5.6	9.9	93.0
	Tharu	15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.5
	Dalits	1.4	0.0	0.0	5.6	1.4	1.4	0.0	5.6	0.0	0.0	18.3

	Janjati	5.6	0.0	0.0	4.2	4.2	0.0	0.0	0.0	0.0	0.0	14.1
	Illiterate	23.9	0.0	0.0	4.2	18.3	0.0	1.4	5.6	0.0	0.0	53.5
	General	18.3	1.4	8.5	5.6	0.0	1.4	0.0	0.0	4.2	4.2	43.7
Educatio	Primary	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	1.4
n	Secondary	8.5	0.0	4.2	0.0	8.5	0.0	0.0	0.0	0.0	1.4	21.1
	College /University	1.4	0.0	8.5	0.0	5.6	0.0	0.0	0.0	0.0	4.2	19.7
	Total	52.1	1.4	21.1	9.9	33.8	1.4	1.4	5.6	4.2	9.9	

Annex A.3 Distribution of households by farm size

		Farm size					
		Landless	**Small**	**Medium**	**Large**	**Total**	NA
Land Holding Type	Own	0.0	26.8	5.6	31.0	**63.4**	
	Rented	12.7	0.0	0.0	0.0	**12.7**	
	Own+Rented	0.0	11.3	5.6	4.2	**21.1**	
	Gov land	2.8	0.0	0.0	0.0	**2.8**	
Food Crops Produced	Paddy	1.4	4.2	0.0	0.0	**5.6**	
	Maize	1.4	1.4	0.0	0.0	**2.8**	
	Wheat+Paddy	0.0	2.8	0.0	0.0	**2.8**	
	Wheat+Maize	0.0	2.8	0.0	0.0	**2.8**	
	Paddy+Maize	1.4	12.7	7.0	18.3	**39.4**	
	All	2.8	5.6	4.2	16.9	**29.6**	
	None	8.5	8.5	0.0	0.0	**16.9**	
Status of Food Sufficiency	Deficit	15.5	36.6	5.6	0.0	**57.7**	
	Balanced	0.0	0.0	2.8	12.7	**15.5**	
	Surplus	0.0	1.4	2.8	22.5	**26.8**	
Annual Saving	-ve	2.8	5.6	2.8	0.0	**11.3**	
	zero	2.8	8.5	4.2	7.0	**22.5**	
	upto 10,000/yr	4.2	11.3	0.0	7.0	**22.5**	
	upto 25,000/yr	2.8	7.0	1.4	9.9	**21.1**	
	upto 50,000/yr	2.8	5.6	2.8	7.0	**18.3**	
	above 50,000/yr	0.0	0.0	0.0	4.2	**4.2**	
Source of	Agriculture	0.0	0.0	0.0	7.0	**7.0**	

Income	Busi+Remi	1.4	1.4	0.0	1.4	**4.2**	
	Agri+LS+Remi	0.0	4.2	0.0	1.4	**5.6**	
	Agri+Remi	0.0	1.4	0.0	1.4	**2.8**	
	Service	0.0	2.8	0.0	1.4	**4.2**	
	Agri+Ser+LS	0.0	1.4	2.8	1.4	**5.6**	
	Agri+LS+Busi	0.0	7.0	2.8	12.7	**22.5**	
	Agri+labour	1.4	7.0	2.8	1.4	**12.7**	
	Agri+Buss+Remm	0.0	4.2	0.0	0.0	**4.2**	
	LS+SER+REMM	2.8	0.0	0.0	0.0	**2.8**	
	Agri+buss+Service	0.0	0.0	0.0	4.2	**4.2**	
	Business	2.8	2.8	0.0	2.8	**8.5**	
	Wage Labour	7.0	5.6	2.8	0.0	**15.5**	
Alternative Energy	Kerosene	7.0	4.2	2.8	0.0	**14.1**	
	Electricity	1.4	23.9	7.0	15.5	**47.9**	
	Electricity+LPG	4.2	9.9	0.0	19.7	**33.8**	
	Solar+LPG	0.0	0.0	1.4	0.0	**1.4**	
	None	2.8	0.0	0.0	0.0	**2.8**	
Biogas Plant	Yes	1.4	14.1	2.8	22.5	**40.8**	
	No	14.1	23.9	8.5	12.7	**59.2**	
Average Livestock	None	0.0	7.0	7.0	5.6	**1.4**	
	1 to 3	8.5	4.2	16.9	2.8	**12.7**	
	4 to 6	21.1	1.4	11.3	1.4	**16.9**	
	7 to 9	33.8	1.4	1.4	2.8	**2.8**	
	10 or more	0.0	1.4	0.0	1.4	**2.8**	
Fodder (kg/ month)	>=1000	1.4	15.5	1.4	5.6	**23.9**	
	1000-5000	4.2	12.7	1.4	19.7	**38.0**	
	5000-10000	1.4	1.4	2.8	1.4	**7.0**	
	<=5000	0.0	1.4	0.0	7.0	**8.5**	
	Total	7.0	31.0	5.6	33.8	**77.5**	22.5
Fuel Wood (kg/ month)	>=500	12.7	28.2	8.5	18.3	**67.6**	
	500-1000	5.6	1.4	4.2	2.8	**14.1**	
	1000-1500	1.4	0.0	0.0	0.0	**1.4**	
	<=1500	0.0	0.0	0.0	0.0	**0.0**	

A.4 Distribution of household population by education status

		% Education of the Respondent					**Total**
		Illiterate	General	Primary	Secondary	College/ University	
Ethnicity	Bramin-Chettri	16.9	21.1	1.4	12.7	14.1	**66.2**
	Tharu	8.5	1.4	0.0	1.4	0.0	**11.3**
	Dalits	8.5	4.2	0.0	0.0	0.0	**12.7**
	Janjati	4.2	4.2	0.0	1.4	0.0	**9.9**
Family Structure	Nuclear	29.6	26.8	1.4	12.7	14.1	**84.5**
	Joint	8.5	4.2	0.0	2.8	0.0	**15.5**
Farm Size	Landless	7.0	8.5	0.0	0.0	0.0	**15.5**
	Small	15.5	9.9	1.4	5.6	5.6	**38.0**
	Medium	7.0	0.0	0.0	1.4	2.8	**11.3**
	Large	8.5	12.7	0.0	8.5	5.6	**35.2**

A.5 Selected Household characteristics by ethnicity in the Study area

		Caste/Ethnicity of the Respondent				**Total**
		Bramin Chettri	Tharu	Dalits	Janjati	
Residence Period	Generations	29.6	11.3	0.0	1.4	42.3
	Early Settlers	12.7	0.0	1.4	1.4	15.5
	Middle Settlers 5-30yrs	16.9	0.0	2.8	4.2	23.9
	Late Settlers	7.0	0.0	8.5	2.8	18.3
Farm Size	Landless	4.2	0.0	8.5	2.8	15.5
	Small	25.4	7.0	1.4	4.2	38.0
	Medium	5.6	2.8	2.8	0.0	11.3
	Large	31.0	1.4	0.0	2.8	35.2
	>4 B	0.0	0.0	0.0	0.0	0.0
Average Livestock per	None	0.0	0.0	0.0	1.4	1.4
	1 to 3	7.0	0.0	1.4	2.8	11.3
	4 to 6	14.1	7.0	0.0	1.4	22.5

Household	7 to 9	11.3	0.0	0.0	0.0	11.3
	10 or more	14.1	0.0	0.0	0.0	14.1
Biogas Plant	Yes	31.0	7.0	0.0	2.8	40.8
	No	35.2	4.2	12.7	7.0	59.2
Alternative Energy	Kerosene	0.0	4.2	8.5	1.4	14.1
	Electricity	33.8	7.0	0.0	7.0	47.9
	Electricity+LPG	31.0	0.0	1.4	1.4	33.8
	Solar+LPG	1.4	0.0	0.0	0.0	1.4
	None	0.0	0.0	2.8	0.0	2.8
Fodder Quantity in kg	>=1000	9.9	7.0	1.4	5.6	23.9
	1000-5000	35.2	0.0	2.8	0.0	38.0
	5000-10000	5.6	0.0	1.4	0.0	7.0
	<=5000	8.5	0.0	0.0	0.0	8.5
Total		66.2	11.3	12.7	9.9	100.0

Annex B.1 Land holding Categorization

Symbol	Land Holding Size	Land Holding in ha
Landless	Landless	0
Small Farm	0-10 Kattha	0-0.34
Medium Farm	10-20 Kattha	0.34-0.68
Big Farm	1-4 Bigha	0.68-2.72
Large Farm	>4 Bigha	>2.72

Annex B.2 Unit Conversions by Crop Types

Crop Type	Local Unit (Muri)	Standard Unit (Kg)
Paddy	1=	50
Maize	1=	60
Wheat	1=	69
Oil Seed	1=	57

Source: Nepal & Weber, 1993

Annex B.3Local Market Prices by Crop Types (Oct./Nov. 2008)

Crop Type	Price (Rs)/ 100Kg
Paddy	1300-1500
Maize	1500
Wheat	1650
Oil Seeds	4800

Source: Local Whole Seller

Annex B.4 Unit Conversions of Resources

Resources	Local Unit (Bhari)	Standard Unit (Kg)
Fodder	1=	50
Fuel Wood	1=	40

Source: Nepal & Weber, 1993

Annex B.5 Livestock Units Conversion Factor

Livestock	Units
Buffalos	0.81
Cattle (Cows/Ox)	0.65
Goat/ Sheep	0.18

Source: Paudyal, 2000

Annex C.1 Formulas for Vegetation Data Calculation

$$Density(No./ha) = \frac{Tota\ln umberofplantspecie\sin studyarea}{StudyArea} X1000$$

$$Re lativeDensity(\%) = \frac{DensityofSpecies}{SumofDensityofallspecies} X100$$

$$Frequency(\%) = \frac{Numberofquadrat\sin whichaspeciesoccured}{Tota\ln umberofquadratsstudied} X100$$

$$Re lativeFrequency(\%) = \frac{Frequencyofspecies}{SumofFrequencyofallspecies} X100$$

$$BasalArea(m^2) = \frac{\pi d^2}{4}$$

.diameter of tree species at breast height=where d

$$Re lativeBasalArea = \frac{BasalAreaofaspecies}{Sumofbasalareasofallspecies}$$

$$Im\ por\tan t'ValueIndex = Re lativeDensity + Re lativeFrequency + Re lativeBasalArea.$$

$$ShannonDiversityIndex(\overline{H}) = -\sum (n_i / N)\log(n_i / N)$$

importance value for each species =ni ,where

.Importance Value for all species = N

$$EvenessIndex(e) = -\frac{\overline{H}}{\log S}$$

.Shannon Diversity Index =H ;Total number of species =S ,where

$$Do\min ance(D) = \sum (\frac{n_i}{N})^2$$

$$SpeciesRichness(R) = \frac{S-1}{\log N}$$

.Total number of individual species =N ;Total number of species =S ,where

VOLUME COMPUTATION (FSSD, 1991)

The system estimates for computing the total volume of the whole stem is

Ln (V) = a + b x Ln(d) + c x Ln (h)

Where, Ln refers to logarithm

V = total stem volume with bark

d = Diameter at breast height

h = Total height

a, b and c are the volume parameters, which are constant for each species but different between species.

Annex C.2 Species Reported

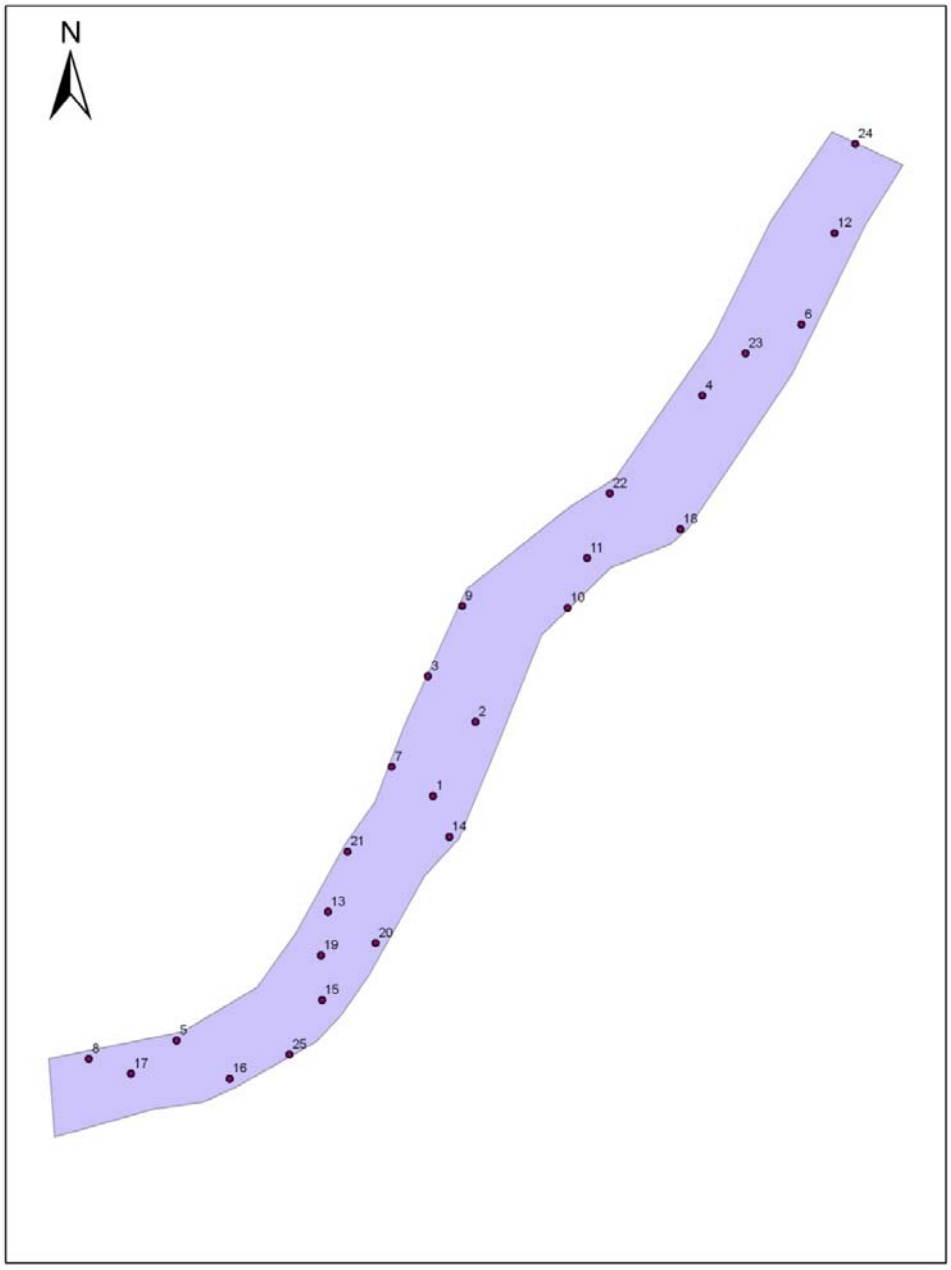
SN	Name Of Species	Family
1	*Achyranthes Aspera* Linnaeus	Amaranthaceae
2	*Adina cordifolia*(Willdenow Ex Roxburgh) Entham and Hooker Filer Brandis	Rubiaceae
3	*Ageratum conyzoides* Linnaeus	Compositae
4	*Arisaema tortuosum* (Wallish) Schott	Araceae
5	*Bidens pilosa* Linneaus Var Minor (Blume) Sherff	Compositae
6	*Borreria alata* (Aublet) De Candolle	Rubiaceae
7	*Brachiaria romosa* (Linneaus) Stapf	Graminea
8	*Canjanus scarabaeoide* (Linneaus) Thouars	
9	*Catunaregam spinosa* (Thunberg) Tirvengadum	Rubiaceae
10	*Chenopodium sps*	Chenopodiaceae
11	*Cirsium verutum* (D Don) Sprengel	Compositae
12	*Cissampelos pareira* Linneaus	Menispermaceae
13	*Clerodendrum vicosum* Ventenat	Labiatae
14	*Commelina benghalensis* Linneaus	Commelinaceae
15	Compositae	Compositae
16	*Costus speciosus* (Koeing) Smith	Zingiberaceae
17	Gramanie	Graminae
18	*Cynodon dactylon* Linneaus Persoon	Graminea
19	*Cyperus rotundus* Linnaeus	Cypraceae
20	*Cypreus distans* Linnaeus Fil	Cypraceae
21	*Dalbergia sisso* Roxburgh	Leguminosae
22	*Dalbergia sisso* Roxburgh	Leguminosae
23	*Desmodium laxiflorum* De Candolle	Leguminosae
24	*Desmodium multiflorum* Buchanan- Hamilton Ex D. Don	Leguminosae
25	*Digitaria ciliaris* (Retzius) Koeler-Gram	Graminea
26	*Dioscorea bulbifera* Linnaeus	Dioscoreaceae
27	*Elsholtzia stachodes* (Link) Raizada And Saxena	
28	*Equisetum Sps*	
29	*Erysimum hieraciifolium* Linnaeus	Cruciferae
30	*Eugenia formosa* Wallich	Myrtaceae
31	*Eupatorium adenophorum* Sprengel	Leguminosae
32	*Evolvulus nummularius* (Linneaus) Linnaeus	Convolvulaceae
33	Fern	
34	*Flemingia marcophylla* Willtenow Merrill	Leguminosea
35	*Gonostegia Sps*	
36	*Hedyotis lineata* Roxburg	Rubiaceae
37	*Hedyotis scandens* Roxburg	Rubiaceae
38	*Helicteres isora* Linnaeus	Sterculiaceae
39	*Hemigraphis hista* (Vahl) T. Anderson	Acanthaceae
40	*Hemiphragma heterophyllum* Wallich	Sacrophulariaceae
41	*Holarrhea pubescens* (Buchaan-Hamilton)	Apocynaceae

42	*Holorrhea pubescens*	
43	*Imperata cylindrica* (Linnaeus) Palisot De Beavios	Graminea
44	*Ipomea sps*	Convoluvlaceae
45	Labiateae	Labiateae
46	*Murrayana koenigii* (Linnaeus) Sprengle	Rutaceae
47	*Ophioglossium reticulatum* Linneaus	Ophioglossaceae
48	Ox*alis latifolia* Kunth	Oxalidaceae
49	*Phyllanthus parvifolius* Buchanan- Hamilton Ex D. Don	Leguminosae
50	*Rungia parviflora* (Retzius) Nees	Acanthaceae
51	*Saccharum spontaneum*	Graminea
52	*Saussurea Sps*	
53	*Shorea robusta* Gaertner	Dipterocarpaceae
54	*Solena heterophylla* Loureiro	Cucurbitaceae
55	*Sporobolous fertilis* (Steudel) W . D. Clayton	Graminea
56	*Stellaaria vestita* Kurz	Caryophyllaceae
57	*Stephania japonica* (Thunberg) Miers	
58	*Terminalia alata* Heyne Ex Roth	Combretaceae
59	*Torinea cordifolia* Roxburg	Acrophulariaceae
60	*Trifolium repens* Linneaus	Leguminosae
61	*Triumfetta rhomboides* Jacquin	Tiliaceae
62	*Uncaria Sps*	Rubiaceae
63	*Urena lobuta* Linnaeus	Malvaceae
64	*Vigna mungo* (Linneaus) Hepper	Leguminosae
65	*Viola pilosa* Blume	Violaceae

Annex D.1 Sample Points of GPS for Vegetation Analysis.

Id	E	N
1	84.43956146240	27.63559036010
2	84.44107119570	27.63822079880
3	84.43937798070	27.63984870890
4	84.44914974530	27.64986506340
5	84.43042390040	27.62686284800
6	84.45269095610	27.65239986710
7	84.43808505070	27.63662763020
8	84.42729273980	27.62621207570
9	84.44059364190	27.64236085580
10	84.44436089780	27.64229266470
11	84.44504482200	27.64406800830
12	84.45386667250	27.65566188990
13	84.43581119640	27.63145488010
14	84.44013604600	27.63413139820
15	84.43560058200	27.62831055680
16	84.43230620280	27.62550584070
17	84.42879439030	27.62567896210
18	84.44837878210	27.64510066240
19	84.43556526360	27.62989937700
20	84.43751656150	27.63034007460
21	84.43651066620	27.63360050430
22	84.44586201250	27.64637336490
23	84.45069758710	27.65136618310
24	84.45460758240	27.65884239220
25	84.43443654120	27.62636470470

Annex D.2 Map of Sample Points of GPS for Vegetation Analysis



Annex E.1 Sample form of Questionnaire form.

Questionnaire for the socio-economic analysis of Buffer Zone community of Chitwan National Park (2007)

Name of Data Collector::..... Date: .....

HOUSEHOLD SURVEY

A. **Household Information**

GPS Position : .....
Respondent Name : .....
Caste/Ethnic Group : .....
Sex : .....
Age : .....
Education : .....
Occupation : .....
Current Address
(VDC/Ward) : .....
Residence period : .....
Family structure : a) Nuclear b) Joint

B. Family Members

Full Name of Individual	Relation to Respondent	Sex	Age (yrs)	Marital Status (M/U)	Occupation			Education
					I	II	III	

C. Main material of floor

a. Earth, Mud, Dung B. Wood Planks C. Linoleum/ Carpet D. Ceramics, Tiles, Marbles
E. Cement F. Others (Specify) .....

D. Does Your Household Have

a. Electricity B. Radio C. Television D. Telephone E. Bicycle
F. Motor Vehicles G. Computers H. Others (Specify).....

E. A. Sanitation Facilities

a. Open/Indiscriminate B. Simple Latrine C. Pour Flush Latrine D. Septic Tank

B. Water Supply System

A. Lake B. Streams C. Indoor Piped Water D. Piped Water in Yard E. Public Tap

F. Ground Water G. Bottled Water H. Others (Specify).....

F. Solid Waste Disposal

a. Open and Indiscriminate Collection B. Open Dump C. Public Container D. Household
E. Burning In Yard F. Bury In Yard G. Others.....

G. Annual Income and Expenditure

1. How much is your annual income in terms of money?

Source	Amount	
	Calculated	Rectified
Agriculture		
Service		
Livestock		
Business		
Tourism		
Off-farm employment		
Others		
Total		

Remarks:

....
....

2. How much is your annual expenditure in terms of money?

Item	Amount	
	Calculated	Rectified
Education		
Health		

Maintenance		
Agriculture		
Livestock Poultry maintenance		
Loss of livestock		
Loss of crops		
Others ……		
Total		

Remarks:

…… ……

…… ……

3. From the above tables the saved amount becomes Rs …… Do you save this much annually?

A) Yes b) No

H. Farm Size/Production

Land Type	Area			Parti / Ailani
	Bigha	Kattha	Dhur	
Land Owned				
Shared Tenant				

1. What type of Crop do you grow?

Crop Type		Area			Production		Consumption (Kg)	Surplus (Kg)	Deficit (Kg)	Deficit Period
		Bigha	Kattha	Dhur	Mann	Kg				
Food Crops	Wheat									
	Paddy									
	Maize									
Pulses										
Cash Crop	Vegetables									
	Oil Seeds									
	Others (specify)									

2. How will you manage for the deficit months?

Buy/ Burrow/ Barter/ Wage Labor/ Others (specify).....

3. If surplus what do you do with the surplus crops?

Store/ Sale/ Others (specify).....

I. Livestock Type and Holding

Types of Animal	Numbers	Stall Feeding	Grazing	Both

1. Nutritional Status of Livestock's (Observed) using Rinney's Index

Livestock Type	Number	Observation	Remark
		Body Line Round	Good
		Body Line Angular	Intermediate
		Body Line Angular, Rib Cage Visible	Poor

J. Fodder/Fuel Wood/ Timber

Season/Month	Fodder			
	Species	Quantity	Access	Both
	Fuel Wood			

Timber				

K. Alternative Energy

Fill in the information on use of fuel and how it is obtained (Record use for each month, liter of kerosene, no. of cylinder for gas and Bhari for firewood) (1 Bhari = ... Kg)

Type of Energy used	Amount	Expenditure	Season	Source
Kerosene				
Electricity				
Solar				
LP Gas				
Battery				
Other				

1. Do you have Biogas Plant in your house?

A) Yes *B) No*

1.1 If Yes,

Installed Date	Biogas	
	Capacity (cb.m)	Expenditure

1.2 Have you installed plant on your own or did you received any support from others?

....

....

1.3 How much Livestock are needed to operate your biogas plant?

....

....

1.4 How much fodder is required for livestock?

....

....

1.5 If you don't have biogas plants, what is the reason behind it?

....

....

1.6 Do you have any plans to install biogas plants?

a)Yes *b) No*

<u>Buffer Zone Community Forest, Household participation and Issues</u>

1. Have you been involved in Buffer Zone management?

a) Yes *b) No*

2. If yes, what is/was your status (position) in Buffer Zone management council, UC, UG?

Date	Group	Status	If any other member of family (relation with respondent)

3. Which BZ CF do you use?

....

4. What type of resources do you bring from your BZ CF?

....

5. What do you say about your BZ CF status?

a) Very Good *b) Good* *c) Satisfactory* *d) Bad*

6. What was the condition of your BZ CF in past/Present?

a) Very Good *b) Good* *c) Satisfactory* *d) Bad*

7. Are available resources in your community forest fulfilling your demand?

a) Yes *b) No*

Resources	Demand (Bhari/Kg)	Supplied (Bhari/Kg)	Deficit (Bhari/Kg)

8. If No, How do you manage for your demand?
   a) Buy from BZ CF b) Buy from other CF c) From CNP d) Others (Specify).....
9. Are there any kinds of resources allocation system in your BZ CF?
   a) Yes b) No
10. If yes, on what basis?
    a) Well being b) population c) No. of livestock d) Professions e) Others.....
11. Are there any land categorizations for different purposes in your BZ CF?
    a) Yes b) No
12. If **Yes,**
    a) Pasture land b) recreation c) habitat management d) fodder e) fuel wood
    f) Others (specify).....
13. What sort of problems do you find in your CF?
    ....
    ....
14. What needs to be done for better management of your CF resources utilization and conservation? Any suggestion/recommendation
    ....
    ....
15. Is budget allocated by CNP for BZ is enough?
    a. Enough b. Not Enough c. Not Needed d. Others (specify) ……