

**POPULATION STATUS AND HABITAT UTILIZATION OF COMMON
PEAFOWL (*Pavo cristatus*, Linnaeus, 1758) IN GHAILAGHARI
BUFFER ZONE COMMUNITY FOREST, CHITWAN, NEPAL**



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Science in Zoology** with Special Paper Ecology and Environment

Submitted To

Central Department of Zoology
Institute of Science and Technology
Tribhuvan University
Kirtipur, Kathmandu
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September, 2013

DECLARATION

I hereby declare that the work presented in this thesis entitled “**Population Status and Habitat Utilization of Common Peafowl (*Pavo cristatus*) in Ghailaghari Buffer Zone Community Forest, Chitwan, Nepal**” has been done by myself, and has not been submitted elsewhere for the award of any degree. All the sources of the information have been specifically acknowledged by reference to the author(s) or institution(s).

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This thesis submitted by Mrs. Saphal Pandit entitled “Population Status and Habitat Utilization of Common Peafowl (*Pavo cristatus*) in Ghailaghari Buffer Zone Community Forest, Chitwan, Nepal” has been approved as a partial fulfillment of the requirements for the Degree of Master of Science in Zoology (Ecology).

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ABBREVIATIONS

ANOVA	-	Analysis of Variance
BCN	-	Bird Conservation Nepal
BhS	-	Bhellar-Sissoo
DF	-	Degree of Freedom
DNPWC	-	Department of National Parks and Wildlife Conservation
GBZCF	-	Ghailaghari Buffer Zone Community Forest
GBZCFO	-	Ghailaghari Buffer Zone Community Forest Officer
GPS	-	Global Positioning System
IUCN	-	International Union for Conservation of Nature
VDC	-	Village Development Committee

ABSTRACT

This study aimed to estimate population status, define habitat use and crop loss caused by Common Peafowl. The study was carried out from April 2012 to February 2013. Direct count method was used to estimate population status and habitat preference of Common Peafowl. Crop loss was evaluated by questionnaire survey.

A total of 43 individuals of peafowl were counted through direct count method in four season from three habitat. The population density was 28 individuals per sq km for peafowl. The study area was divided into three habitats, Bhellar-Sissoo (*Trewia-Dalbergia*) dominated, Simal (*Bombax ceiba*) dominated, and Grassland dominated. Observations were based on direct methods. There was no significant difference in number of peafowl in different habitats due to season ($\chi^2=0.65233$, $df=3$, $P=0.603525$). Vegetation of the area was studied categorically applying different quadrat size.

Bhellar-Sissoo (*Trewia-Dalbergia*) habitat was found to be most preferred than Simal (*Bombax ceiba*) and Grassland habitat. Summer season was found to be most preferred and winter least preferred, since more number of peafowl were observed in the Bhellar-Sissoo (*Trewia-Dalbergia*) habitat and this habitat seems to be best for Common Peafowl related to food, space, and water. There was no significant difference in numbers of peafowl in different seasons ($\chi^2=0.6407$, $df=3$, $P=0.6253$) but significant difference was found in numbers of peafowl among different habitats ($\chi^2=8.1023$, $df=2$, $P=0.0244$). A total 11 species of trees, dominated by Bhellar (*Trewia nudiflora*), 23 species of shrubs, dominated by Sisnoo (*Urtica dioica*) and 54 species of herbs, dominated by herbaceous climber Mikania, were found in study area. Study of crop damage found that Rice was lost in high amount (60.7%). Mustard in fewer amounts (1.96%). Evaluation of crop loss from the information given by respondent suggests that lack of food inside the forest were the main cause for crop damage.

1. INTRODUCTION

1.1 General Background

Birds belong to class Aves and Subphylum Vertebrata. The most distinguishing characters of birds are the possession of feather and the forelimbs modified into wings. They are regarded as the symbol of beauty, freedom, wisdom and spirituality (Kotpal 1999). Birds are vertebrate warm-blooded animals and are believed to have sprung from reptilian ancestors (Ali 1964). Nepal's avifauna is highly diverse considering the size of the country (Grimmet et al. 2000). Eight hundred and seventy one species of birds has been recorded in Nepal (BCN 2012). Nepal's strategic position on the global map and the greatest altitudinal variations on the earth's surface are two main features why Nepal has so many species of birds (Inskipp and Inskipp 1991).

Pheasants fall under order Galliformes, family Phasianidae, which are by far the largest and incredibly beautiful. The family characteristics are unfeathered nostrils, absence of inflatable air sacs in the neck, feet naked and clean, which make the family so diverse that it is difficult to divide into natural groups (Ali and Ripley 1983). Pheasants are ornamental birds and true pheasants are clean-legged birds (Shrestha 2003). The pheasant has proven to be a fine game bird readily adaptable to agricultural areas (Black 1954). Nepal, nestling in the mountain ranges of mighty Himalayas, has been rich in pheasants. According to Yonjan and Lelliott (1981-82), there are eight species of pheasants in Nepal, which are listed below:

1. Cheer Pheasant (*Catreus wallichii*)
2. Common Peafowl (*Pavo cristatus*)
3. Himalayan Blood Pheasant (*Ithaginis cruentus*)
4. Impeyan Pheasant (*Lophophorus impejanus*)
5. Nepal Kaliz Pheasant (*Lophura leucomelana*)
6. Nepal Koklass Pheasant (*Pucrasia macrolopha*)
7. Red Jungle fowl (*Gallus gallus*)
8. Satyr Tragopan (*Tragopan satyra*)

1.2 Species Introduction

Largest gallinaceous birds are Peafowl (subfamily Pavoninae) which are very long-legged. There is one genus (*Pavo*) with two species, which are, The Indian Peafowl (*Pavo cristatus*) also known as blue peafowl and The Green Peafowl (*Pavo muticus*) (Grizmek 1972). Linnaeus first recorded *Pavo cristatus* in 1758 from Central Bhabar of India. The Indian peafowl is a resident bird and given special protection. It is included in the Schedule-I of the Wildlife Protection Act 1972, and its subsequent amendment and Appendix I of CITES (Ali and Ripley 1983).

Pavo cristatus is regarded as a jewel of the avian kingdom (Shrestha 2000). It is an ancient bird because “Peacock is considered sacred in Hindu mythology as the vehicle of the god Kartikeya (Kumar), son of Lord Shiva and Parvati” (Ali and Ripley 1983).

The Common Peafowl as, a striking bird, which was already known to ancient Greeks and Romans for thousand years ago (Hanzak and Formanek 1977). Alexander, The Great, introduced them to Greece, and from their they rapidly spread throughout Europe (Rutgers and Norris 1970). Peafowl is probably the oldest known ornamental bird (Grizmek 1972). Peafowl are locally semi-domesticated in villages and cultivation is protected by local people because of religious sentiment (Ali 1964). Peafowl, which are one of the members of pheasant, display their Gaudi brilliance in a spectacular array to delight an advertising man’s heart (Ali and Ripley 1983).

1.2.1 Taxonomy of *Pavo cristatus*

Pavo is genus of subclass- Neornithes, Superorder-Neognathae, Order-Galliformes and Family-Phasianidae (Kotpal 1990-91). It falls under Least Concern in IUCN red list data. They are under genus (*Pavo*) with two species belonging to sub family *Pavoninae*, which are, *Pavo cristatus* and *Pavo muticus*. *Pavo cristatus* is short legged with a marked sex dimorphism, where as *Pavo muticus* has longer legs and sex dimorphism is slight (Grizmek 1972). Common Peafowl was justifiably declared ‘flagship’ value founded on its glorious position in mythology and its wide spread distribution and grandeur (Ramesh and McGowan 2000). Common Peafowl is as fairly Common species found in forest of Tarai and Churia hills. They are found in tall grass areas, sal forest, riverine vegetation type forest and thorny bushes (Yonjan and Lelliott 1981-82).

1.2.2 Morphology

Common Peafowl inhabits dense scrub and deciduous jungle-plain and foothill preferably in the neighborhood of rivers and streams (Ali 1996). They are always excessively shy and alert and slinks away through the undergrowth on its leg (Ali 1964). They are found in wild state (Woodcock 1980).

The male peacock is about the size of a vulture, very gracious and beautifully pigmented (Kotpal 1990-91). The gorgeous ocellated 'tail' of the adult cock, 3 to 4 feet long, is in reality the abnormally lengthened upper tail-coverts (Ali 1964). It has glistening blue neck and breast, crest wire-like and tail that is very long (Woodcock 1980). The male's long and colorful train is not the bird's tail and ornament, composed of some 150 large feathers growing from his lower back. The real tail is short and dull-colored, hidden underneath the train (Greensmith and Harrison 1993). It has back centered coppery disc or eyespots and scapulars and outer surface of wings close barred with black and buff (Ali and Ripley 1983).

The female Peafowl is somewhat smaller similarly crested but without the sweeping train (Ali and Ripley 1983). It has head and hind neck rufous, mantle green; back brown mottled with buff; wing coverts heavily mottled brown, buff, black and other remaining under parts buff (Rutgers and Norris 1970). The chicks are fawn and brown, when they grow much are like their mother without bright color (Dharmakumarsinhji and Lavkumar 1972). The chick in down have no well-defined marking; their back is light brown with dark mottling; the under part of body is radish brown (Rutgers and Norris 1970).

1.2.3 Distribution

Common Peafowl is distributed in Oriental region, Australian region and Neo-tropical region (Edward et al. 1978). In India, it is found all over except Assam (Rutgers and Norris 1970). The bird is also found in Pakistan, Srilanka and feral population is found in North Island, New Zealand (Ripley 1982). It was also introduced into Sindh and in the Port Blair area and elsewhere in the Andaman Island (Ali and Ripley 1983).

Common Peafowl is a Common species found in forest of Tarai and Churia hills of Nepal. They are found in tall grass areas, Sal forest, riverine vegetation type forest and

thorny bushes (Yonjan and Lelliott 1981-82). Peafowl is also found at mid-hills in many places of Nepal especially along the river basins of warmer climate (Chalise 2010). Common Peafowl is found in the wild state in Chitwan National Park, Bardia National Park and Shulkaphanta Wildlife Reserve. Outside the protected area it is found below 1800 m in the hilly as well as foothills region of Parsa, Chitwan, Nawalparasi, Phyuthan, Banke, Bardia, Kailali, Kanchanpur and other Tarai districts of Nepal (Inskipp 1999, Shrestha 2000).

1.2.4 Ecology and Behaviour

Common Peafowl (*Pavo cristatus*) is found in a wild state, this well-known gamebird haunts thick, well-watered jungle in hilly country (Woodcock 1980). The peafowl is usually found in solitary or in small parties. They are found in low-line, hot country, seldom ascending above 3000 ft (Rutgers and Norris 1970). The nature of Common Peafowl is omnivorous and a ground feeder (Khajuria 1963). It usually feeds on seeds, grain, lentils, groundnuts, tender shoots of crops, flower buds, berries and drupes, wildfigs, and animals such as centipedes, scorpions, lizards, small snakes, insects, worms etc. Besides those matters, it is also found entering the agriculture field and destroying crops (Ali and Ripley 1983).

Peafowl's enjoy eating young cobras; as a result, peafowl habituating area will be free of snakes soon. They live polygamous, in small family bands (Grizmek 1972). It usually consists of a cock and 3 to 5 hens (Ali and Ripley 1983).

In India, the mating season of the peafowl coincides with rainy season. During mating cock displays erecting and fanning out his showy train (Ali 1964). After mating, the hens retire from the family group to prepare a nest, incubate and rear their chicks entirely unaided by the cock. Nest consists of a scrap in the ground, sometimes underlined at others roughly built with sticks, grass and lips. Cream-colored Four to Seven eggs are laid and incubation lasts for 28 days. Chicks grow very slowly and the hen has to remain with them for some 7 to 9 weeks before they are able to live without her protection. *Pavo cristatus* is neither a communal nor a solitary rooster bird. Peafowl roosts high above the ground, in the isolated tree from which they can have view of surroundings country (Rutgers and Norris 1970; Ali and Ripley 1983; Trivedi 1993).

The sound produced by peafowl is a loud harsh, screaming may-awe and short gasping shrieks ka-aan, ka-aan repeatedly rapidly six to eight times with a pumping action of head and neck (Ali 1964). It utters an unpleasant wailing cry, especially before rainfall (Hanzak and Formanek 1977). The chicken emit plaintive whistle (Dharmakumarsinjhi and Lavkumar 1972). Peafowl calls frequently warn game animal of the presence of tigers and leopards (Grizmek 1972). Peafowl's are important in many ways they are destroyers of several venomous and injurious creatures such as scorpions and snakes (Kotpal 1990-91).

1.2.5 Threats to Common Peafowl

The Indian peafowl is under threat from quarters that includes the demand for feathers and wild meats, conflict with farmers during cropping season increase use of chemical fertilizers and pesticides and habitat degradation. An adult peacock has about 200 tail feathers, which it sheds from August onwards; fully- developed new feathers appeared in February. The fallen feathers are collected and sold in local markets for making brooms peafowl can be agricultural and urban pests. They are as the nuisance to agriculture and horticulture because they damage crops and consume cultivated fruit. Therefore, they are sometime trapped and killed by local people to protect their crop (Dharmakumarsinjhi and Lavkumar 1972; Sharma 1974; Ali and Ripley 1980).

1.3 Rationale

Pavo cristatus is killed for delicious meat and beautiful wings, quills fan and diverse type of ornaments (Ali and Ripley 1983). Many evidences indicated that peafowl are going decline in number day by day. Thus, it requires intensive study for its better management and conservation. Although the various conservation and research programmes have been conducted on peafowl in Nepal, no any studies have been carried out about peafowl in Ghailaghari Buffer Zone Community Forest (GBZCF). This study extrapolates the population status, habitat utilized and the damage of crop done by these peafowl species. It is hoped that this study will be helpful to prepare guidelines for conservation and management of peafowl regarding Buffer Zone strategy.

1.4 Objectives

The main objectives of this research were to know the status and habitat of Common Peafowl in GBZCF Chitwan, Nepal. The specific objectives of the study were:

- To estimate the population of Common Peafowl in GBZCF.
- To explore the habitat utilized by Common Peafowl in the study area.
- To explore the crop damage by peafowl around the study area.

1.5 Limitation of the study

The present study was based mainly on direct observation in Buffer Zone Community Forest. The study was carried out with limited time. It may have limitation of findings due to concentration in small geographical area. Lack of previous research in this area is another limitation. Data were collected seasonally so it may be representative findings study. Elephant riding and horn produced made difficulty in counting the birds.

2. LITERATURE REVIEW

Navaneethakannan (1984) estimated that the time of beginning of the activity of birds from the roosting trees was related to the time of sunrise, in Nagamalai ridges near Madurai Kamraja University Campus. It was found that the peafowls vocalized while roosting.

Veeramani and Sathyanarayan (1999) estimated 234 individual of peafowl in a study done in Madhumalai Wildlife Sanctuary, in which the density of peafowl was 133 birds per sq km in scrub jungle and six birds per sq km in dry deciduous habitat. It was also found that population of peafowl is influenced by habitat type, food availability and seasonal change.

Yasmin and Yahya (2000) found in Gir forest of Gujarat, India that peafowl were benefited in flock than a solitary, as they were protected from predators living in flock. They also noticed with increase in flock size also increase in feeding rate and decreased in vigilance.

Subramanian and John (2001) found that peafowl were observed to be both solitary and communal roosters but peahens were observed to be only communal roosters, the study done in Tamilnadu, South India. The bird preferred to roost on the highest branches on trees with dense foliage.

Pande (2006) estimated 84 individuals in three sites in the Forest of Ramnagar VDC, Nawalparasi, Nepal. He also reported that individuals especially sub adult and chicken were hard to recognize, However he found that sub adult were slightly larger and colorful within young individuals. The estimated population density of peafowl was 4.83 ± 1.03 individuals per sq km in that area.

Takahashi and Hasegawa (2008) recorded 13,420 calls composed of 31,266 notes produced by Common peafowl in Izu Cactus Park, Shizuoka, Japan. Most of the calls contributed to the male repertoire but only alarm calls were recorded from female. It was reported that “alarm calls” were uttered in response to the appearance of predators such as

red foxes (*Vulpes vulpes*) or stray dogs (*Canis lupus familiaris*) and disturbances by other animals including human.

Das and Sivakumar (2009) estimated 713 Common Peafowl in 429 occasions in the study done at Rajaji National Park of Chilla range, India.

Harihar and Fernandes (2010) observed 129 individuals of peafowl in 68 separate occasions in a total of 205 km of transects, across the four sampling periods in Rajaji National Park. The density of another pheasant, red jungle fowl was estimated 78 individuals on 41 occasions.

Patel et al. (2011) found at Patan district (North Gujarat) that Common Peafowl (*Pavo cristatus*) destroyed a huge amount of crops every year, thus local people being annoyed by grainivorous birds, used various traditional method of crop protection in Gujarat. They also felt that the peafowl repellent methods were very ritualistic. The methods include manchado, flagged bamboos and pitcher-effigy (Scarecrows), hanging crows, drum beating, making a rating sound with the help of plate (Thali). Traditional methods were found effective in scaring and reducing damage by Common Peafowl (*Pavo cristatus*) to crops.

3. MATERIALS AND METHODS

3.1 Study Area

Zoo-geographically, Nepal is situated at the meeting point of Oriental realm in north. Biodiversity conditions observed in Nepal and ecologically low land (Tarai), Midland (Mountain), and Highland (Himalaya) harbors diverse flora and fauna in Nepal. Mountains have comparatively less biodiversity than Tarai plains. The Tarai and Siwalik area, the richest bird diversity areas in Nepal, are also interesting from an anthropological point of view (Fleming et al. 1976).

The study area, Ghailaghari Buffer Zone Community Forest (GBZCF) is located in Jagatpur VDC ward one and two of Chitwan district, Narayani zone, Nepal. It lies at 28°33'05.3"- 27°33'33.5" North latitude and 84°18'50.7"- 84°19'45.6" East Longitude adjacent to the Chitwan National Park at the 150 m height from sea level. GBZCF has occupied 156 hectare of landmass (BZCFO Plan 2011).

3.1.1 Local Inhabitants

The total human inhabitants around Ghailaghari Buffer Zone Community Forest is 4950, in 946 among which the number of female is 2457 and that of male is 2493. These populations composed of many Community people such as Tharu, Darai, Brahimin, Chettri, Newar, Giris living in this area with their own culture and tradition. The main occupation of the people around the community forest is agriculture. Crops like rice, wheat, maize are the major cereal crops grown in the area. The potatoes, vegetables, fruits and pulses are grown seasonally. Among fruits, banana is grown and is most favourable cash crop. Animal husbandry is the second major agriculture related profession after crops. Major livestock are cow, buffalo, goat, chicken, pigs and are reared for the dairy and meat products (BZCFO Plan 2011).

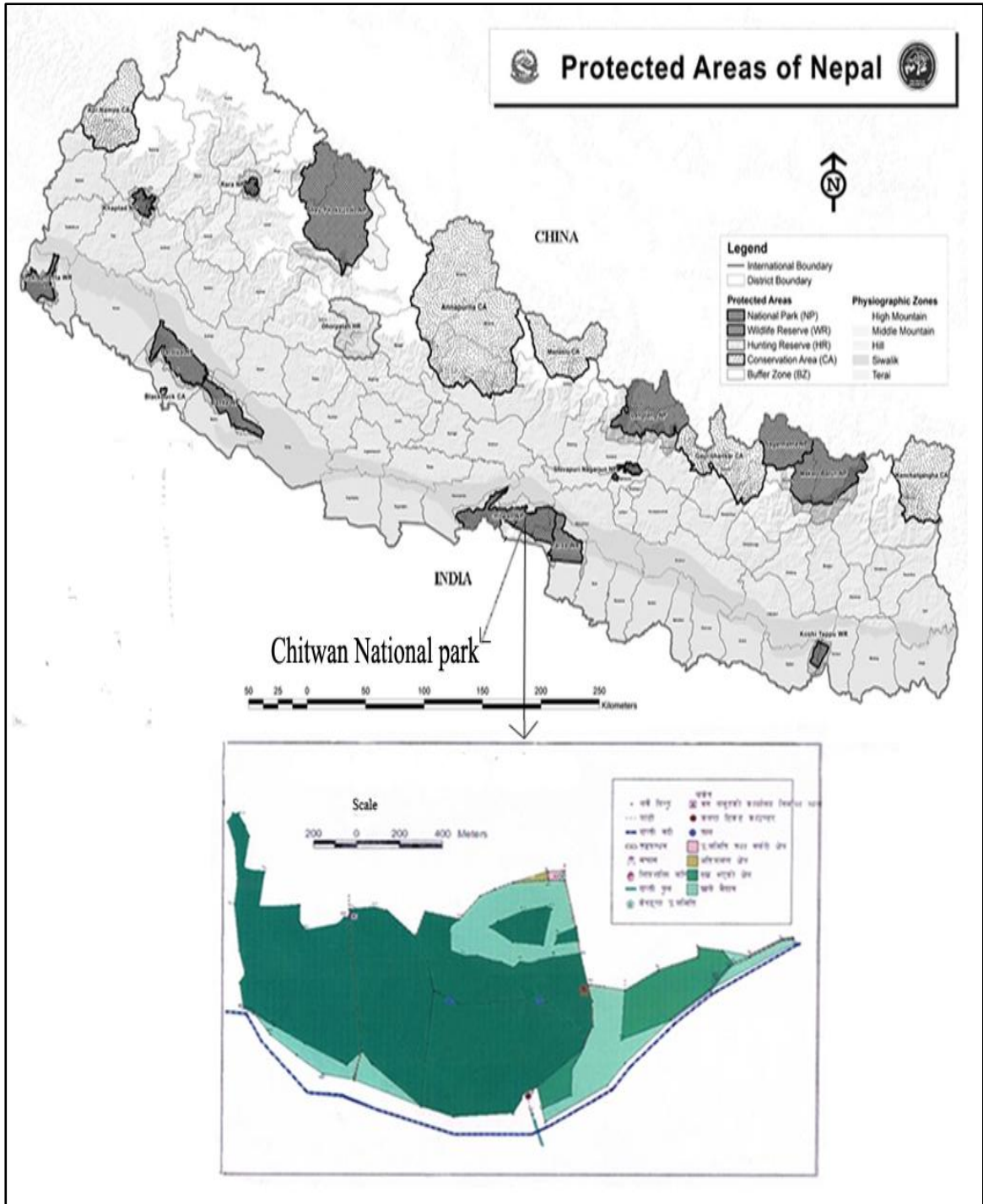


Figure 1: Map of Ghailaghari Community Forest, Chitwan National Park, Nepal.

Source (BZCFO Plan 2011).

3.1.2 Flora and Fauna

The Ghailaghari Buffer Zone Community Forest (GBZCF) consists of diverse wild as well as planted trees and floras. It consist of mainly trees like Bakaina (*Melia azedarach*), Simal (*Bombax ceiba*), Sissoo (*Dalbergia sissoo*), Bhellar (*Triwia nudiflora*), Banbhogate (*Citrus maxima*), Bar (*Ficus benghalensis*), Chattiwan (*Alstonia scholaris*), Kalikath (*Aporusa octondra*), Karam (*Adina cordifolia*), Kutmero (*Litsea monopetala*), Pipal (*Ficus religiosa*). The shrubs recorded in the study area were more than 23 species some of them are Dattiu (*Achyranthes aspera*), Patti (*Artemisia dubia*), Dhursilo (*Colebrookea oppositifolia*), Banmara (*Eupatorium odoratum*), Rudhilo (*Pogostemon benghalensis*), Sisnoo (*Urtica dioica*), Bayar (*Zizyphus mauritiana*) etc.

The herbs observed in this area seem to be more than tree and shrub species. Altogether 54 species of herbs were recorded so far. Herbs like Nilogandhe (*Ageratum houstonianum*), Kande lunder (*Amaranthera spinosus*), Bansoo (*Digitaria sanguinalis*), Mothe (*Cyperus rotundus*), Dubo (*Cynodon doctylon*), Ghode dubo (*Hemarthria compressa*), etc are found in the study area (BZCFO Plan 2011).

The Ghailaghari Buffer Zone Community Forest consists of significantly presence of larger fauna such as Elephant (*Elephas maximus*), Tiger (*Panthera tigris*), Rhino (*Rhinoceros unicornis*), Wild boar (*Sus scrofa*), Hog deer (*Axis porcinus*), Barking deer (*Muntiacus muntjak*), etc. Birds like Pigeon (*Collumba livia*), Parrot (*Psittacula cyanocephala*), Red Jungle fowl (*Gallus gallus*), Common Peafowl (*Pavo cristatus*), Dove (*Streptopelia senegalensis*), etc are found in this area. It has also records of reptiles like Common python (*Python molurus*), Gharial (*Gavialis gangeticus*), Mugger (*Crocodilus palustris*) and others in its wetland (BZCFO Plan 2011).

3.1.3 Climate

In case of Chitwan district, climate is subtropical with a summer monsoon from mid June to late September and relatively dry winter. The average maximum temperature was 35.41°C in April and the average minimum temperature with 8.5°C in January. The maximum temperature was found to be decreased till January, and later on it is found to be increased from February till May (Figure 2 and Appendix1).

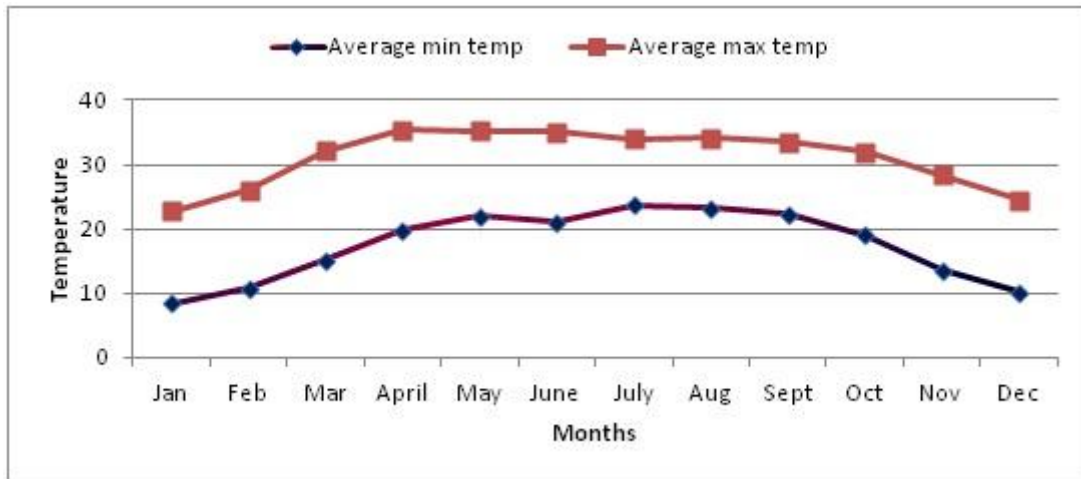


Figure 2: Average Monthly Temperature Recorded at Chitwan District (2001-2010).

In Chitwan average monthly relative humidity ranged from 79.45 in April to 96.93 in January. The relative humidity was maximum in January and minimum in April. (Figure 3 and Appendix 1).

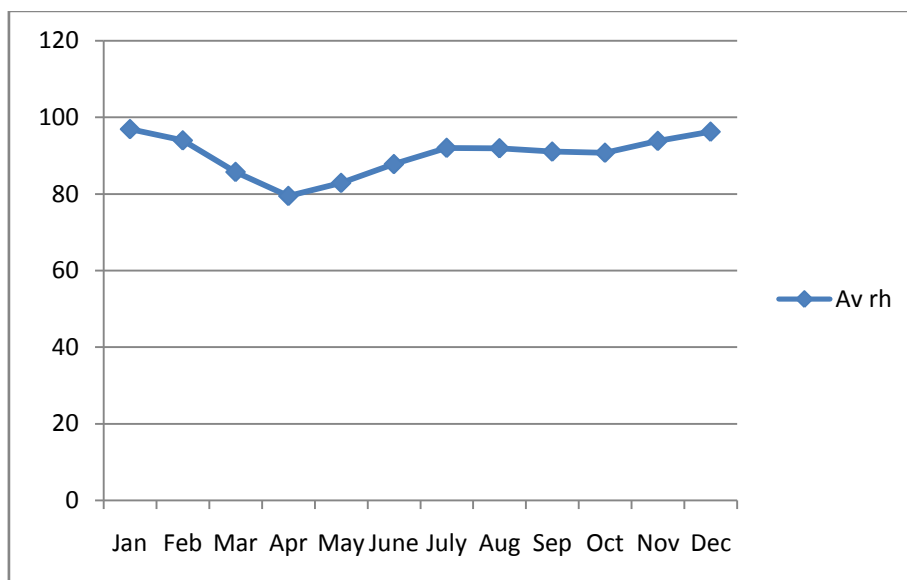


Figure 3: Average Monthly Relative Humidity Recorded at Chitwan District (2001-2010).

The average monthly rainfall ranged from 3.8 mm in December to 489.4 mm in August in Chitwan District. The maximum rainfall was in the month of July and minimum was

recorded in December. There was less rainfall or no any trace of rain from the month of October to March. (Figure 4 and Appendix 1).

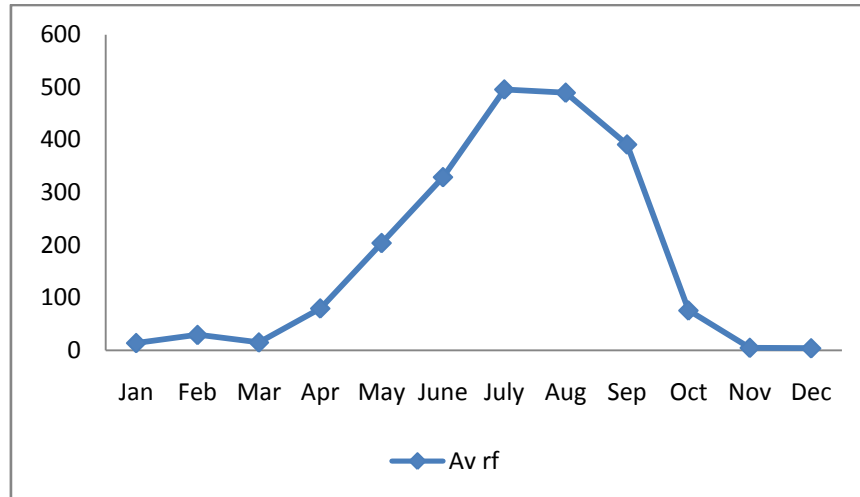


Figure 4: Average Monthly Rainfall Recorded at Chitwan District (2001-2010).

3.2 Materials

Equipments such as Binocular (Bushnell 10X50), Camera (Canon 40X), Quadrates, Measuring Tapes, GPS (Garmin Etrex 7), Pen, Diary, etc were used during the study.

3.3 Methods of Data Collection

Population status and habitat preference of the Common Peafowl was studied from 2012 to 2013 by direct observation. Questionnaires survey was done to find out crop damage caused by Common Peafowl in the nearby village and wards covering the Buffer Zone.

3.3.1 Reconnaissance Survey

A reconnaissance survey was carried out to identify the sampling sites covering different vegetation types and to assess the feasibility inside the forest. A preliminary field survey was made from 11 to 15 April 2012 to select sampling sites. The survey process included

field observation and interaction with the local people, wood collectors, fodder collector and people with regular forest visitors.

After the reconnaissance survey, the study area was divided into three sites according to habitat based on vegetation, i.e. Bhellar-Sissoo (*Trewia-Dalbergia*) dominated habitat (Site-1), Grassland dominated habitat (Site-2), Simal (*Bombax ceiba*) dominated habitat (Site-3). The adequate possibilities were made for observing peafowl and their activities in different habitat in different sites.

3.3.2 Field Study

The field study was carried out in different four seasons from April 2012 for summer season, July 2012 for rainy season, November 2012 for spring season and February 2013 for winter season to gather data on population and habitat preference of Common Peafowl.

3.3.2.1 Population Status

3.3.2.1.1 Population Count

The population of peafowl was counted in four seasons in 2012 to 2013. Population was counted according to habitat undertaking multiple observations. Counting was done on the basis of age and sex differentiation in the field walking along the forest trail using it as transect line. The population counting was done at the time of early morning approximately 6:30 am to 9:30 am and in the evening approximately 3 pm to 6 pm. Visual records were included for calculation and a care was taken to avoid for duplication of that particular habitat. During the total count, the exact total numbers were different at same place in different replicates. Multiple observations were taken to reduce biasness. The total population was estimated by using statistical theorem as given by (Quenouilli 1956, cited in Parajuli 2007). The Population (N) of Common Peafowl was found as:

$$N=2n_k - n_{k-1}$$

Where,

N= estimated population.

n_k = highest Value of observed Population

n_{k-1} = second highest value of observed Population

One-way ANOVA was used to determine whether the individuals of the Common Peafowl were distributed according to the availability of habitat types in different seasons.

3.3.2.1.2 Density

Density was calculated as:

Population density was calculated by using following formula (Krebs 1994).

Population density (D): $\frac{n_i}{A}$

Standard error (e) = $D \pm t_{\alpha(n-1)} \sqrt{\frac{D}{n}}$

Probability level at 5%

Where,

n_i = total number of individuals in defined area

A = total area of study sites.

D = population density of defined area.

t_α = t-value at α probability level and (n-1) degree of freedom.

n = number of observation.

N = total number of individuals of defined area.

H_0 : There is no significant different on numbers of peafowl in different habitat due to season.

H_1 : There is significant different in numbers of peafowl in different habitat due to season.

The hypothesis was tested at 5 % level of significance.

3.3.2.1.3 Age and Sex Ratio

The ratio of male, female, and young was also calculated:

$$\text{Ratio of male and female} = \frac{\text{male}}{\text{female}}$$

$$\text{Ratio of young to adult} = \frac{\text{young}}{\text{male+female}}$$

$$\text{Ratio of young to females} = \frac{\text{young}}{\text{female}}$$

$$\text{Percentage of male} = \frac{\text{male}}{\text{Total population}} \times 100 \%$$

$$\text{Percentage of female} = \frac{\text{female}}{\text{Total population}} \times 100 \%$$

$$\text{Percentage of young} = \frac{\text{young}}{\text{Total population}} \times 100 \%$$

3.3.2.2 Habitat Utilization

While walking through the forest trial by using it as transect line the habitat used by Common Peafowl for summer, rainy, winter and spring season along with their activities were recorded by observation. Total number of Common Peafowl observed during study was taken as habitat used. Preferred habitat was concluded in which highest number of peafowl observed doing activities like foraging, roosting and abundance of chickens found during study periods.

3.3.2.2.1 Habitat Preference

The habitat preference for peafowl were recorded by regular visit in three different habitats in four different seasons. Records were noted in each sighting along with their activities.

R-software (R console version 2.15.2) was used for the statistical analysis. It is free and widely used software program designed by different experts. One-way ANOVA was used to test the significance difference in population (distribution) of Indian peafowl (*Pavo cristatus*) in different habitat and seasons.

Hence, Hypothesis setting

H_0 : There is no significant difference on numbers of peafowl in different habitat.

H_0 : There is no significant difference in numbers of peafowl in different habitat due to season.

3.3.2.3 Vegetation of Study Area

Plants of study area were recorded through transect walk. The difference between two quadrates was laid down in 50 m difference, with 10 m right and left alternatively. For tree, a quadrate of 20mx20m was laid, for shrub 5mx5m and for herbs 1mx1m. Altogether 147 quadrates of size (20mx20m) were laid for tree. The 157 quadrates of size 5mx5m for shrub and 1mx1m for herbs were laid down in the study area. Thus, the total quadrates were recorded covering the whole study area. The circumference of tree above 12 cm was recorded. The local name and their number were recorded, so that it could be further easy for identification and analysis of vegetation. The common names of plant species were collected locally and unidentified species were made herbarium and identified at National Herbarium and Botanical Laboratory, Lalitpur, Nepal.

Vegetations are analyzed by using the following methods.

a. Density

Density was calculated by using formula, followed by (Krebs 1994).

$$D = \frac{\text{Total number of species}}{\text{Quadrat in which species have occurred} \times \text{Quadrat Area}} \times 100$$

b. Relative Density

The relative density of each species was calculated by using following formula, followed by (Krebs 1994).

$$RD = \frac{\text{Total number of species}}{\text{Quadrat in which species have occurred} \times \text{Quadrat Area}} \times 100$$

- c. **Frequency (f)** of observed plant was calculated by using the formula followed by Zobel et al. (1987).

$$\text{Frequency (f)} = \frac{\text{Total number of quadrat in which species have occurred}}{\text{Total number of quadrat studied}} \times 100$$

- d. **Relative Frequency (RF)** of observed plant was calculated by using the formula followed by Zobel et al. (1987).

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of individual species}}{\text{Total frequency of all species}} \times 100$$

e. **Basal area** = $\frac{c^2}{4\pi}$

f. **Relative Basal Area** = $\frac{\text{Basal area of species}}{\text{Total basal area of all species}} \times 100$

3.3.3 Questionnaire Survey with Local People

Questionnaire survey was carried out among the local people and officer of GBZCF Chitwan to know their opinion towards Common Peafowl. Questionnaires deal about the crop damage caused by Common Peafowl, their view about the bird and methods they used to protect their crops and so on (Appendix 6). The questionnaire survey was conducted in February 2013. Total household surrounding the Buffer Zone were 946, out of which 100 household were questionaired which was more than 10%. The households were selected randomly that represent all population of the Village Development Committee. In most of the cases, the head of family was interviewed. In absence of head of household, the person next to head was interviewed and to reduce any bias door to door visit of respondent was done.

After conducting questionnaire survey, data were quantitatively analyzed by using various statistical tools. For calculated total crop loss, following formula has been used (Bajracharya 2009).

Total crop loss = Expected yield before crop loss - Actual yield after crop loss.

Total economics loss (Rs) = Price of Crop (Rs) × Total Crop loss.

4. RESULTS

4.1 Population Status

4.1.1 Population Count

A total of 43 individuals of Common Peafowl were counted from three habitat in 2012 to 2013. Among which, highest number of Common Peafowl was observed in Bhellar-Sisoo habitat (25) i.e. 58.13 % and lowest in Grassland habitat (7) i.e. 16.27 % (Table 1).

Table 1: Population Status of Common Peafowl in Different Habitats of GBZCF in 2012-13.

S.N.	Habitat	Population of Peafowl Observed		Estimated population $N = 2n_k - n_{k-1}$
		Maximum (n_k)	Second Maximum (n_{k-1})	
1.	Bhellar-Sisoo	25	18	32
2.	Simal	11	9	13
3.	Grassland	7	6	8
Total		43	33	53

The calculated F-ratio is 0.65233 (tab.F value=4.066181, $df=3$, $\alpha = 5\%$). Thus as calculated value is less than tabulated value, null hypothesis is accepted. This means there is no significant difference in number of peafowl in different habitat due to season.

It was not difficult to recognize sex wise, as male had beautiful trail and crest but female were dull colored which lacked long trail and crest, Similarly chicks were small and dull. Thus, as categorizing peafowl of age-wise, it was found that there were 10 adult male, 15 adult female and 18 young. The estimated population density of Common Peafowl was 28 individual per sq km. During the study period, Common Peafowl were observed in single, pair or groups.

The ratio of male to female was found to be 1:1.5, young to adult was 1:1.38 and young to female was also found to be 1:0.83. On calculation, the percentage of male was 21.42, percentage of female was 35.71 and of young was 42.85. Thus, on the basis of percentage it was found that, youngs were more in number and males were least in number in three habitat.

4.2 Habitat Utilization

4.2.1 Habitat Types

Vegetation of the study area were studied with the help of different size of quadrates within transect. Altogether, of 54 species of herbs, 23 species of shrubs and 11 species of trees were recorded in the study area. In tree, *Trewia nudiflora* (IVI- 75.82) was dominated tree followed by Simal, *Bombax ceiba* (IVI- 58.91) and Sissoo, *Dalbergia sissoo* (IVI- 47.23). (Appendix 3).

In shrub, *Urtica dioica* (36.77) had high relative density, which was followed by *Pogostemon benghalensis* (13.69) and *Eupatorium odoratum* (11.12). In case of relative frequency, *Pogostemon benghalensis* (16.78) had highest relative frequency followed by *Urtica dioica* (16.38) and *Callicarpa macrophylla* (16.06). (Appendix 3). In herb, *Imperata cylindrical* (33.83) had high relative density followed by *Micania micrantha* (10.13) and *Saccharum spontaneum* (6.15) and *Thelypteris sp* (5.79). (Appendix 3). Among, herbs, shrubs and trees, few species of trees were found in the study area due to lack of plantation. (Appendix 3).

4.2.2 Habitat Preference

Peafowl were observed in three-sites of different habitat types in all four seasons during the study period. Out of which highest number of peafowl were observed in summer season. The lowest number of individuals were observed in spring season. The most preferred habitat was found to be Bhellar-Sissoo (*Trewia-Dalbergia*) forest. There was counting of 71 peafowl in this habitat which is true in all season (Table 2). This habitat seems to be preferred because of many trees to roost with large number. It also seems to be feeding ground of adults and a place for young to do activity. The young were found with large number in the same habitat. The nest was observed in the same habitat. (Appendix 6). The least preferred habitat was found to be Grassland. The maximum number of peafowl were found in rainy season and least in spring season in this habitat.

Table 2 : Number of peafowl in different habitat according to seasonal change.

S.No	Habitat	Seasons				Total
		Summer	Rainy	Spring	Winter	Observed
1	Bhellar-Sissoo	25	18	11	17	71
2	Simal	11	9	5	9	34
3	Grassland	6	7	3	5	21
Total		42	34	19	31	126

4.2.2.1 Population of Peafowl Observed in Different Seasons and Habitats

One-way ANOVA rebuild that there was no significant difference ($P > 0.05, \alpha = 0.05, df = 3$) in population of peafowl in different seasons (Table 2). Using R software it was found that P value is greater than 0.05, which means null hypothesis is accepted. Thus, there was no significant difference in the population of peafowl in different seasons but significant difference ($P < 0.05, \alpha = 0.05, df = 2$) as found in population of peafowl in different habitat (Figure 5).

Table 3: One-way ANOVA table between population of Peafowl in different habitats and seasons.

Variables	F-value	df	p-value	Remarks
Habitat	8.1023	2	0.0244	Significant
Season	0.6407	3	0.6253	No Significant

More number of peafowl was found in Bhellar-Sissoo (*Trewia-Dalbergia*) followed by Simal (*Bombax ceiba*) and least in Grassland. As value of P is less than 0.05, alternate hypothesis was accepted and null hypothesis was rejected. Thus, there was significant difference in the population of peafowl in different habitats. Habitats also affected the distribution of Peafowl and the number of Peafowl varied according to the preferred habitats. Thus, most preferred habitat was found to be Bhellar-Sissoo (*Trewia - Dalbergia*).

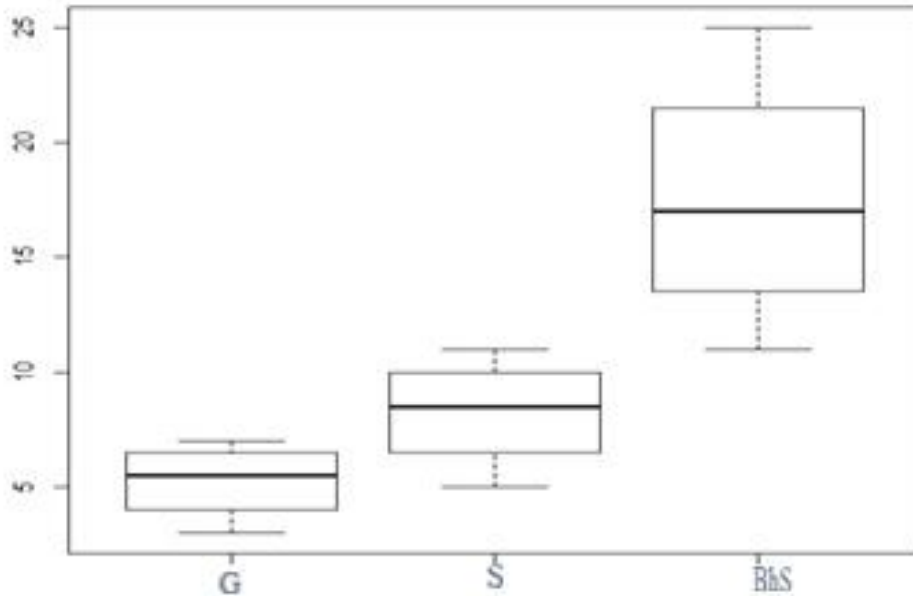


Figure 5: Boxplot showing population of Peafowl in different habitat, G = Grassland, S=Simal and BhS=Bhellar-Sissoo (*Trewia-Dalbergia*). Dark line in the box plot represents the median or mid value and its arm represents the quartile value of population.

4.3 Crop Loss by Common Peafowl

Common Peafowl is becoming nuisance causing considerable damage to the agricultural crops of local inhabitants around Ghailaghari Buffer Zone area. Out of 956 households, 100 households were asked questions on peafowl and their crop depreddation pattern. Out of total surveyed houses, 80% reflected suffered from crop loss and 20% did not suffer from Common Peafowl. The high amount of cross loss was found because the study area included two wards, one and two, which were very near from Buffer area. 20 % of households did not suffer from crop loss as those households had their farm far away (500m) from Buffer area and few were landless who did not have land to grow. Altogether, there were four villages in ward number one and two.

In ward number one, there were three villages, Ghailaghari, Hittan bargaicha and Madyaworti chowk. Most crop damage was found in Ghailaghari, as it was very near (100 m) to Buffer Zone forest area. Ward number two included only Khadgauli chowk basically a local market place. Hence, more crop loss was found in ward number one. Also 10 % of sample was taken from Saraswoti chowk, which was not affected by crop

loss. The purpose of questionnaire was to know the view of villagers regarding damage caused by peafowl and also their activities around the village.

Among four villages, Ghailaghari suffered much and Hittan bargaicha suffered least from crop loss caused by Common Peafowl. The crop loss in four villages Ghailaghari, Khadgauli, Madhyabarti chowk and Hittan bargaicha was 83.83 quintals, 59.88 quintals, 47.91 quintals and 29.95 quintals respectively (Figure 6).

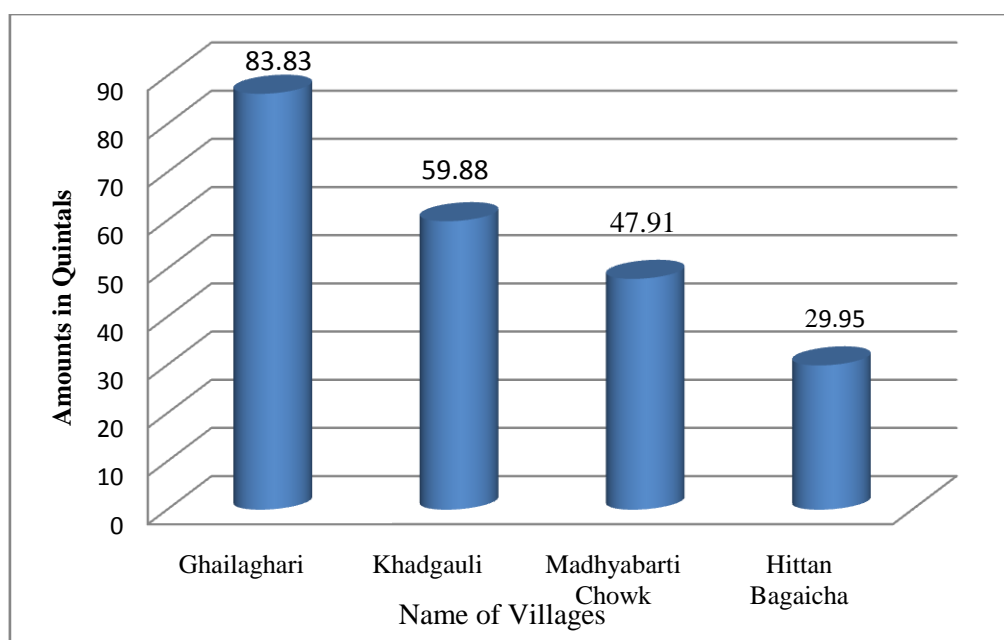


Figure 6: Crop loss by Common Peafowl in Villages of GBZCF

The methods used to get rid of Common Peafowl were very simple initiated by villagers. They were making noise by shouting 47.29 %, making scarecrow in the crop field 28.35 %, chasing from own field 12.33%, guarding fields whole day 9.64 % and making noise by beating drums (Tins) 2.39 %.

Rice, wheat, maize and mustard were crops destroyed by Common Peafowl, according to local people. Rice was lost about most while wheat and maize few and mustard was least (Figure 7).

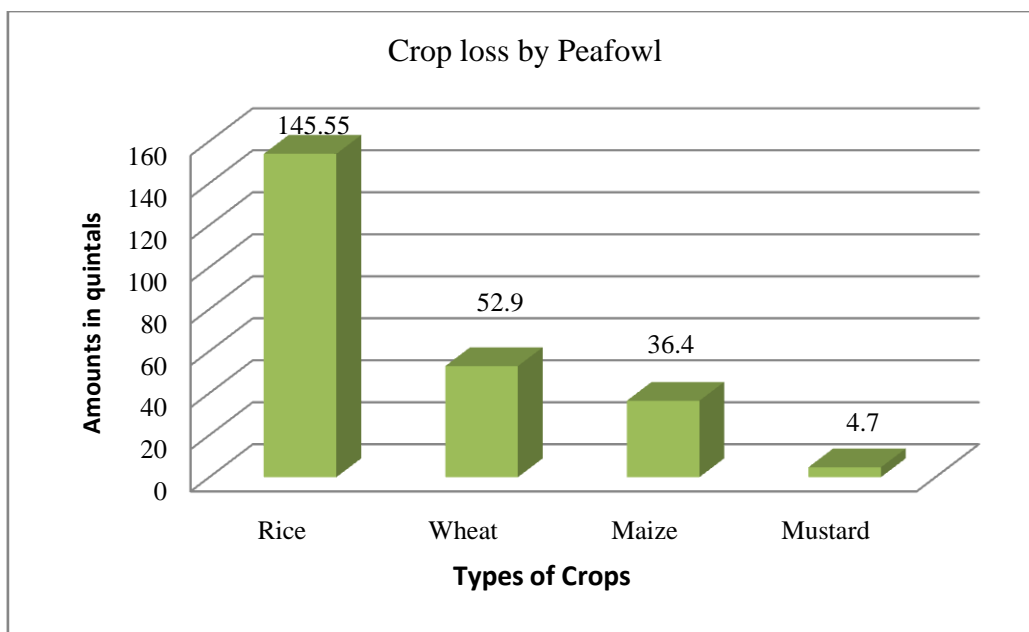


Figure 7: Types and amount of crop loss by Common Peafowl in GBZCF.

In four villages of ward one and two, the crop loss was 88.83 quintals, 59.88 quintals, 47.90 quintals and 29.95 quintals. Altogether, the crop loss by Common Peafowl was estimated to be 221.57 quintals, which amount to be Nrs.5, 61,651 (Table 4).

Table 4: Crop loss in the User Communities of GBZCF

User communities	Total expected yield (quintals)	Total observed yield (quintals)	Crop loss in quintals	Crop loss in Nrs.
Ghailaghari	477.57	393.73	83.83	2,12,494
Khadgauli	341.125	281.23	59.88	1,51,795
Madyawarti	272.9	224.99	47.91	1,21,440
Hittan Bagaicha	136.45	112.49	29.95	75,922
Total	1228.05	1012.44	221.57	5,61,651

5. DISCUSSION

5.1 Population

A total of 43 individuals of peafowl were observed in the overall study area in three habitat sites. Thus, 25 individuals were reported from the habitat Bhellar-Sissoo (*Trewia nudiflora-Dalbergia sissoo*), which were the highest population. This result may be due to availability of food, water, roosting trees in this habitat. Similarly, the lowest population was found in Grassland habitat. It might be due to the lack of trees and human disturbances.

The estimated population density of Common Peafowl was found to be 28 individuals per sq km. This high density of peafowl in this study area might be due to the multiple observation, small area and direct count method. Similar research was done by Veeramani and Sathyanarayanan (1999) in Madhumalai Wildlife Sanctuary of Tamilnadu who estimated 234 individuals of peafowl in which the density of peafowl was 133 per sq km in scrub jungle and six per sq km in dry deciduous forest as favoured by habitat. The study conducted by Harihar and Fernandes (2010) recorded 129 individuals of peafowl in 68 occasions. They estimated 78 individuals in 41 occasions of another pheasant, Red Jungle Fowl on same study area, which had similar habitat as that of Common Peafowl in the dry and wet seasons in the deciduous forests of Chilla range. In contrast, this study was based on four seasons in riverine forest of GBZCF Chitwan, Nepal.

The population density of peafowl fluctuates with seasons. Population Count of Peafowl was done in four seasons, summer, rainy, spring and winter. The maximum number was found in summer season and least in spring, it might be due to breeding season. Based on census method Pande (2006) counted 84 individuals of peafowl in Ramnagar VDC in summer season.

In this study ratio of male to female was found to be 1:1.5, young to adult was 1:1.38 and young to female was also found to be 1:0.83. The percentage of male, female and young was found to be 21.42, 35.71 and 42.85 respectively. Thus, on the basis of percentage it was found that in three habitats, youngs were more in number and males were least in number.

Das and Sivakumar (2009) estimated density of peafowl as 88.24 per sq km in Chilla range of Rajaji National Park, India which was good as compared to this study as temperature was quite favourable for peafowl living in Rajaji National Park. They also estimated sex ratio of male to female as 1:1. In comparison with this study, it was found that there were more number of female than male.

During this study, calls of peafowl were heard frequently during breeding seasons. The calls made by female and male were different. The study carried out by Takahashi and Hasegawa (2008) recorded 13,420 calls composed of 31,266 notes in Shizuoka, Japan. During this study much calls produced by peafowl could not recorded as calls were not sharp unlike Takahashi and Hasegawa, who were able to record calls in such large numbers.

5.2 Habitat Utilization

Vegetation study was mainly done to explore the habitat and habitat preferred area by Common Peafowl. Total 11 species of trees 23 species of shrubs and 54 species of herbs were observed in the study area (Appendix-3). In case of tree, Bhellar (*Trewia nudiflora*) with IVI- 75.82 was dominance followed by *Bombax ceiba*, and *Dalbergia sissoo* and others. *Ficus religiosa* with IVI- 0.08 rarely occurred in the study area because relative density was low (Appendix-3). Shrub was dominated by *Urtica dioica* having high relative density followed by *Pogostemon benghalensis*, *Eupatorium odoratum*. Herb was dominated by *Micania mikrantha* with high relative frequency followed by *Saccharum spontaneum* and *Thelypteris sp.* High density of Bhellar (*Trewia nudiflora*) were sufficient for Common Peafowl to roost but *Micania mikrantha* with high relative frequency were spread throughout the study area which did not allow the other new plants to grow and was becoming burden to the Buffer Zone.

In the present study area, habitat was divided into, Bhellar-Sissoo (*Trewia-Dalbergia*) habitat, grassland habitat and Simal (*Bombax ceiba*) habitat. The total study area was of 156 hectare, of which Bhellar-Sissoo (*Trewia nudiflora-Dalbergia sissoo*) consisted of 94.8 hectare, Simal (*Bombax ceiba*) 38.25 hectare and grassland only 22.95 hectare. Out of total individuals of Common Peafowl, maximum individuals found in Bhellar-Sissoo (*Trewia-Dalbergia*) and minimum in Grassland habitat. Thus, Bhellar-Sissoo (*Trewia-Dalbergia*) can be claimed as preferred habitat than Simal (*Bombax ceiba*) dominated and

grassland dominated habitat as more number of peafowl were found in this habitat during the study period. Similar type of study done by Ramachandran and Vijayan (1994) observed Sarus Crane preferred in moderately wet grassland, which might be as unlike peafowl, Sarus Crane are found in wetland habitat.

Null hypothesis was set as, habitat utilization by peafowl in different habitat was insignificant. From the calculation, χ^2 value was greater than tabulated one. Thus null hypothesis was rejected, it means all habitat were not equally preferred. This result corroborates with Pande (2006) who concluded that habitat was insignificant for utilization. He divided habitat as hilly and riverine but in this study habitat was classified according to vegetation types.

During the season, a nest was found in Bhellar-Sissoo (*Trewia-Dalbergia*) forest with four eggs, nest was made up of grass, bamboo leaves, etc. Common Peafowl was found using mostly trees to roost at day and night. Similar type of study done by Dodia (2011) in Gujarat, found that among 23 trees species, Common Peafowl used 14 species of tree to roost. They also found that peafowl select roosting trees near feeding ground. During this study, it was found that Common Peafowl used less trees species to roost which might be due to lack of diversity of tree species.

More number of peafowl was found foraging in grassland during this study period. Peafowls scratched ground and ate black ants, ground beetles, termites, grasshoppers and even lizards. Ali and Ripley (1983) mentioned peafowl scratched bushes of lowland hill. During the study period, peafowls were found to be living mostly in groups. Yasmin and Yahya (2000) also observed that peafowl were safe and benefitted in flock, as they were protected from enemies living in-group. Similar result was also found in this study, as most of peafowl preferred living in groups being benefitted by availability of food, protection from enemy, also care, and love in groups.

5.3 Crop Loss

The agricultural land surrounding the GBZCF were affected by crop damaged by Common Peafowl. It might be the result of lack of food inside a small habitat or the preference of crops grown by people. The crops preferred by Common Peafowl were,

rice, wheat, maize, mustard and other. Among the four villages in ward one and two. The most crop loss was found in Ghailaghari followed by Khadgauli, Madyabarti chowk and Hittan bargaicha. It might be, as Ghailaghari was 100 m near from the study area and Hittan bargaicha was 500 m far from study area. Crop loss by Common Peafowl was estimated to be NRs.5, 61,651. It was found that rice was lost in huge amount and mustard in least amount, so rice seems to be preferred crop by Common Peafowl.

The local people adopted various methods like shouting, guarding field, making noise by beating drums and making scarecrows for chasing to get rid from Common Peafowl. Out of those methods, shouting was highly used i.e. 47.29%. Similar, type of study was done by Patel et al. (2011) on Patan district (North Gujarat, India) found that local people of Gujarat being annoyed by damage caused by granivorous birds, used traditional methods like manchado, flagged bamboos, scarecrows, hanging crows, drum beating etc to get rid of Common Peafowl and to protect their crops. They found that drum beating method was mostly used to get rid of granivorous birds, as it was easier to chase birds. The sound effect seems to be effective atleast to drive away the peafowl temporarily. Therefore, there is yet to discover new technique for farmers who use traditional method in that region.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Common Peafowl is found in Tarai region of Nepal. This study revealed 43 individuals of peafowl Small Buffer Forest area. The ratio of male to female was found to be 1:1.5, young to adult was 1:1.38 and young to female was also found to be 1:0.83. The estimated population density of Common Peafowl was 28 individual per sq km. From vegetation analysis, a total of 11 species of trees, 23 species of shrubs and 54 species of herbs were recorded from study area, GBZCF. The habitat and floral composition reflect the GBZCF is newly established subtropical forest patch where wild animals and birds were attracted.

Most preferred habitat was found to be Bhellar-Sissoo (*Trewia-Dalbergia*) habitat than Simal (*Bombax ceiba*), habitat and Grassland habitat. This habitat was preferred as they spent sufficient time with larger number for food, space and water. Least preferred habitat was found to be Grassland habitat, where peafowl were found mostly foraging and had not roosting trees and could not spent their much time.

The total amount of crop loss by peafowl in four villages, Ghailaghari, Khadgauli, Hittan bargaicha and Madyaworti chowk was Nrs.5,61,651. Among various methods used to chase peafowl, local preferred to chase peafowl by shouting. It was also found that local people of GBZCF had positive response towards Common Peafowl, even though they suffered crop loss annually.

6.2 Recommendations

On the basis of this study. Following recommendation can be suggested.

1. There is no specific information of population status and habitat utilization of Common Peafowl from different parts of Nepal. Therefore, it is necessary to conduct research more on Common Peafowl around Chitwan National Park and Buffer Zone.
2. Elephant riding has disturbed the habitat preferred by Common Peafowl, so it should be managed.
3. Vehicles should be prohibited to blow horn while going through the protected areas.
4. Plantation should be done in some areas, so that there will be enough tree for the peafowl to roost.
5. Proper management of Mikania or uprooting should be done to develop better habitat for peafowl.

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Appendices

Appendix 1: Meteorological data

Monthly Average Maximum Temperature (°C) and Average Minimum Temperature (°C) of Chitwan District (2001-2010).

Month	Temp	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	Average
Jan	Max	24.5	22.8	DNA	22.6	22.8	DNA	21.4	22.0	24.5	21.0	181.6	22.7
	Min	7.5	8.8	DNA	9.7	5.5	DNA	7.8	9.0	10.5	9.5	68.3	8.5
Feb	Max	26.3	26.5	DNA	26.3	25	DNA	23.9	25.2	29.6	25.8	208.6	26.07
	Min	10.9	12.2	DNA	11.2	6.7	DNA	12.2	9.2	11.9	11.0	85.3	10.6
Mar	Max	32.4	31.5	DNA	33.7	31.5	DNA	29.7	31.9	32.8	32.8	256.3	32.03
	Min	14.4	16.3	DNA	14.2	12.1	DNA	14.7	15.9	15.5	17.9	121.0	15.12
April	Max	35.6	34.1	35.3	34.0	33.4	DNA	34.9	36.3	37.5	37.6	318.7	35.41
	Min	20.0	21.1	22.0	14.2	15.4	DNA	21.3	19.7	21.7	22.2	177.6	19.7
May	Max	33.8	33.6	35.8	37.1	35.5	DNA	35.8	35.5	35.5	35.8	318.4	35.3
	Min	23.0	23.3	22.2	17.7	19.4	DNA	23.6	23.0	22.5	23.5	198.2	22.02
June	Max	33.8	34.8	33.8	34.4	38.1	35.0	34.2	34.1	36.1	35.8	350.1	35.01
	Min	24.8	24.8	24.3	17.0	20.9	18.0	24.7	25.0	25.0	4.6	209.1	20.9
July	Max	34.4	33.2	33.6	35.0	36.6	34.1	31.7	34.1	34.0	33.5	340.2	34.02
	Min	25.5	25.4	25.2	18.0	20.1	20.4	25.0	25.5	25.9	25.5	236.5	23.65
Aug	Max	34.0	33.5	34.1	35.6	36.9	33.8	33.4	33.8	33.0	32.7	340.8	34.08
	Min	25.1	25.2	25.3	19.2	19.7	19.0	24.8	25.3	25.2	24.2	233	23.3
Sept	Max	33.1	33.2	33.1	34.4	35.6	32.7	31.9	34.1	34.3	32.7	335.1	33.51
	Min	24	23.7	24.3	18.2	18.5	17.3	23.5	24.2	24.6	24.2	222.5	22.25
Oct	Max	32.4	32.0	32.3	32.2	31.4	31.6	31.0	32.8	31.7	31.5	318.9	31.89
	Min	21.4	19.9	20.7	16.1	14.4	14.5	21.4	20.0	20.5	20.8	189.7	18.97
Nov	Max	28.1	28.7	28.2	29.0	27.9	29.3	28.3	29.1	27.5	28.1	284.2	28.42
	Min	15.4	14.7	15.0	9.2	9.1	10.9	15.6	14.7	14.6	16.5	135.7	13.57
Dec	Max	22.9	24.1	25.4	25.9	DNA	DNA	23.2	25.3	DNA	24.3	171.1	24.44
	Min	9.7	10.8	11.2	7.1	DNA	DNA	9.8	12.3	DNA	9.2	70.1	10.01

Source: Department of Hydrology and Meteorology, Nepal Government.

Relative Humidity of Chitwan district (2001-2010) at 8:45 AM.

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
2001	97.2	99.8	100.0	100.0	100.0	100.0	99.7	100.0	100.0	100.0	100	99.9
2002	100.0	98.8	99.8	87.4	81.0	87.4	95.6	92.3	91.5	92.8	97.6	98.6
2003	DNA	DNA	DNA	90.6	85.8	90.9	93.1	93.9	95.6	96.7	96.0	99.4
2004	98.9	97.8	96.0	94.3	95.1	97.8	97.1	95.5	91.3	88.0	96.4	94.3
2005	97.7	97.7	97.9	91.5	93.0	88.3	89.2	89.0	89.6	93.7	97.7	DNA
2006	DNA	DNA	DNA	DNA	DNA	97.4	95.2	95.1	91.9	96.2	95.1	DNA
2007	93.9	92.5	87.2	73.4	77.8	83.4	89.6	90.4	90.8	88.4	86.3	93.3
2008	94.8	89	71.6	65.2	70.2	82.5	86.9	87.7	84.9	81.9	86.7	95.8
2009	97.1	88.1	63.0	53.5	70.4	76.2	86.8	85.1	84.6	85.3	90.5	DNA
2010	95.9	88.2	70.4	59.2	72.5	73.9	87.1	90.2	90.2	84.5	92.1	92.5
Total	775.5	751.9	685.9	715.1	745.8	877.8	920.3	919.2	910.4	907.5	938.4	673.8
Average	96.93	93.98	85.73	79.45	82.86	87.78	92.03	91.92	91.04	90.75	93.84	96.25

Monthly Rainfall (MM) in Chitwan district (2001-2010) at 8:45 AM.

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2001	DNA	6.8	0.0	113.3	283.4	380.9	DNA	DNA	293.7	DNA	23	0.0
2002	0.0	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2003	0.0	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2004	58.8	DNA	9	184.4	145.8	603.7	336.3	293.4	443.9	92.9	9.1	DNA
2005	41.7	6.0	24.1	24	218.9	215.6	479	532.2	115.5	192.7	0	DNA
2006	DNA	DNA	DNA	DNA	DNA	DNA	436.5	429.0	643.7	DNA	5.5	19
2007	0	141.5	27.5	155.5	228.4	408.4	635	576.4	1002.3	60.4	0.0	0.0
2008	4.6	2.8	43.6	23.3	122.9	267.4	422.9	374.2	179.0	44.5	0.0	0.0
2009	0.0	0.0	0.0	0	172.7	144.1	454.5	736.6	107.0	0.0	0.0	DNA
2010	5	18	0.0	55.9	254.7	282.6	704.3	484	342.5	63.1	0.0	0.0
Total	110.1	175.1	104.2	556.4	1426.8	2302.7	3468.5	3425.8	3127.6	453.6	37.6	19.0
Avg	13.76	29.18	14.88	79.48	203.82	328.95	495.5	489.4	390.95	75.60	4.70	3.80

DNA=Data Not Available

Source: Department of Hydrology and Meteorology, Nepal Government.

Appendix 2: GPS Points of Study Area

Transect with starting and ending point (UTM)

S N	Habitat	Transect	Starting point of Transect(UTM)		Ending point of Transect(UTM)	
			Easting	Northing	Easting	Northing
1	Bhellar-Sissoo	T1	0236534	3050403	0236600	3050241
		T2	0236385	3050346	0236471	3050146
		T3	0236269	3050299	0236386	3050079
		T4	0236166	3050238	0236257	3049992
		T5	0236098	3050255	0236046	3049996
		T6	0235956	3049970	0236019	3049830
		T7	0235841	3049875	0235925	3049735
		T8	0235407	3050548	0235488	3050399
		T9	0235466	3050645	0235599	3050373
		T10	0235576	3050685	0235675	3050380
		T11	0235677	3050733	0235762	3050335
		T12	0235761	3050403	0235711	3050219
		T13	0235860	3050398	0235733	3050203
		T14	0235944	3050407	0235992	3050185
2	Grassland	T1	0235320	3050557	0235282	3050262
		T2	0235423	3050410	0235341	3050208
		T3	0235621	3050333	0235592	3050201
		T4	0235480	3050171	0235566	3049699
		T5	0235734	3050210	0235712	3049813
		T6	0235815	3050157	0235847	3049881
		T7	0234996	3050598	0235065	3050139
		T8	0235088	3050539	0235123	3050111
		T9	0235179	3050467	0235200	3050099
3	Simal	T1	0235065	3050139	0234973	3049921
		T2	0235123	3050097	0235033	3049864
		T3	0235212	3050078	0235106	3049810
		T4	0234368	3050748	0234449	3050131
		T5	0234523	3050560	0234640	3050004
		T6	0234524	3050559	0234684	3050186
		T7	0234653	3050480	0234775	3050199
		T8	0234764	3050511	0234804	3050343
		T9	0234736	3049946	0234684	3050186
		T10	0234755	3050199	0234835	3049877
		T11	0234822	3050327	0234894	3049944

Appendix 3: Plants in Transect

Tree Species

S.N	Local Name	Scientific Name	RD	RF	RBA	IVI
1	Bakaina	<i>Melia azedarach</i>	0.141343	0.348432	0.115848	0.257191
2	Ban bhogate	<i>Citrus maxima</i>	0.212014	1.045296	0.114643	0.326657
3	Bar	<i>Ficus benghalensis</i>	0.070671	0.348432	0.014854	0.085525
4	Bhellar	<i>Trewia nudiflora</i>	41.06007	33.79792	34.76026	75.82033
5	Chhatiwan	<i>Alstonia scholaris</i>	0.282685	0.696864	0.160003	0.442689
6	Kalikath	<i>Aporosa octondra</i>	0.989399	1.742161	0.171129	1.160528
7	Karam	<i>Adina cordifolia</i>	0.070671	0.348432	0.068207	0.138878
8	Kutmero	<i>Litsea monopetala</i>	10.53003	16.37631	5.004038	15.53407
9	Pipal	<i>Ficus religiosa</i>	0.070671	0.348432	0.015715	0.086386
10	Simal	<i>Bombax ceiba</i>	25.22968	18.81534	33.68338	58.91306
11	Sissoo	<i>Dalbergia sissoo</i>	21.34275	26.13241	25.89192	47.23468

Source: (Identified in National Herbarium and Botanical Laboratory, Lalitpur, Nepal)

Shrub Species

S.No	Scientific Name	Common Name	Density	R.D	Frequency	R.F
1	<i>Achyranthes aspera</i>	Dattiun	1.121019	2.400436	8.8050314	3.357314
2	<i>Artemisia dubia</i>	Patti	2.496815	5.346426	6.918239	2.63789
3	<i>Artemisia sp</i>	Gandhe	0.050955	0.109111	1.2578616	0.479616
4	<i>Callicarpa macrophylla</i>	Daichamre	4.917197	10.52919	42.138365	16.06715
5	<i>Calotropis gigantea</i>	Aakh	0.407643	0.872886	4.4025157	1.678657
6	<i>Clerodendrom viscosum</i>	Raybeli	0.178344	0.381888	4.4025157	1.678657
7	<i>Colebrookea oppositifolia</i>	Dhursilo	2.267516	4.855428	39.622642	15.10791
8	<i>Eupatorium capilifolia</i>	-	0.050955	0.109111	1.2578616	0.479616
9	<i>Eupatorium odoratum</i>	Banmara	5.197452	11.1293	25.157233	9.592326
10	<i>Hyptis suaveolens</i>	Jungali simal	0.152866	0.327332	1.8867925	0.719424
11	<i>Ipomoea carnea</i>	-	0.050955	0.109111	0.6289308	0.239808
12	<i>Marthynia annua</i>	-	0.178344	0.381888	4.4025157	1.678657
13	<i>Phragmites karka</i>	Narkat	0.305732	0.654664	3.1446541	1.199041
14	<i>Pogostemon benghalensis</i>	Rudhilo	6.394904	13.6934	44.025157	16.78657
15	<i>Ricinus communis</i>	Areth	0.076433	0.163666	0.6289308	0.239808
16	<i>Solanum aculeatissimum</i>	Kataiya	0.356688	0.763775	5.0314465	1.918465
17	<i>Solanum xanthocarpum</i>	-	0.076433	0.163666	0.6289308	0.239808
18	<i>Thysanolaena maxima</i>	Amriso	0.127389	0.272777	0.6289308	0.239808
19	<i>Urtica dioica</i>	Sisnoo	17.17197	36.77032	42.767296	16.30695
20	<i>Zizyphus mauritiana</i>	Bayar	1.375796	2.94599	10.691824	4.076739
21	-	Barful	0.509554	1.091107	3.7735849	1.438849
22	-	Bhati	2.878981	6.164757	9.4339623	3.597122
23	-	Kumkum	0.356688	0.763775	0.6289308	0.239808
	Total		46.70064	99.99999	262.26415	100

Source: (Identified in National Herbarium and Botanical Laboratory, Lalitpur, Nepal)

Herb Species

S.N	Scientific Name	Local Name	Frquency	R.F	Density	R.D
1	<i>Ageratum houstonianum</i>	Nilo gandhe	28.93082	8.084359	132.0755	4.996431
2	<i>Alternanthera paronychioides</i>	Bhiringi jhar	1.257862	0.351494	3.144654	0.118963
3	<i>Alternanthera sessilis</i>	-	0.628931	0.175747	1.257862	0.047585
4	<i>Amaranthera spinosus</i>	Kande lunde	2.515723	0.702988	7.54717	0.28551
5	<i>Athyrium sp</i>	-	3.773585	1.054482	8.805031	0.333095
6	<i>Bidens polisa</i>	Kalo kuro	1.257862	0.351494	5.031447	0.19034
7	<i>Boehmeria rotundifolia</i>	-	4.402516	1.230228	19.49686	0.737568
8	<i>Bothriospermum tenellum</i>	-	0.628931	0.175747	0.628931	0.023793
9	<i>Chamaesyce hitra</i>	-	5.660377	1.581722	14.46541	0.547228
10	<i>Chrysopogon zizanioides</i>	-	2.515723	0.702988	50.31447	1.903402
11	<i>Colocasia antiquorum</i>	Karkalo	0.628931	0.175747	0.628931	0.023793
12	<i>Commelina benghalensis</i>	Bankane	5.660377	1.581722	15.09434	0.571021
13	<i>Conyza japonica</i>	Salaha jhar	0.628931	0.175747	1.886792	0.071378
14	<i>Curcuma aromatica</i>	Ban haledo	0.628931	0.175747	3.144654	0.118963
15	<i>Cynodon doctylon</i>	Dubo	22.64151	6.326889	193.0818	7.304306
16	<i>Cyperus rotundus</i>	Mothe	19.49686	5.448155	134.5912	5.091601
17	<i>Digitaria ciliaris</i>	Chitre banso	2.515723	0.702988	4.402516	0.166548
18	<i>Digitaria sanguinalis</i>	Banso	7.54717	2.108963	30.81761	1.165834
19	<i>Dioscorea bulbifera</i>	Bantarul	5.031447	1.405975	10.06289	0.38068
20	<i>Diplocyclos palmatum</i>	Sava	1.886792	0.527241	5.031447	0.19034
21	<i>Drymaria diandra</i>	Janai laharo	1.886792	0.527241	11.32075	0.428266
22	<i>Dryopteris cochleata</i>	Neuro	7.54717	2.108963	18.86792	0.713776
23	<i>Equisetum arvanse</i>	Ankhle	2.515723	0.702988	4.402516	0.166548
24	<i>Euphorbia hirta</i>	Dudhe jhar	5.660377	1.581722	14.46541	0.547228
25	<i>Fimbristylis dichotoma</i>	Pani mothe	0.628931	0.175747	1.257862	0.047585
26	<i>Flemingia chappar</i>	Bhatmas har	0.628931	0.175747	3.144654	0.118963
27	<i>Gonostegia pentandra</i>	Chiple jhar	10.06289	2.811951	25.15723	0.951701
28	<i>Hemarthria compressa</i>	Ghode dubo	18.23899	5.096661	119.4969	4.520581
29	<i>Hydrocotyle sibthorpioides</i>	Gholtapre	1.886792	0.527241	6.289308	0.237925
30	<i>Imperata cylindrica</i>	Siru	33.33333	9.314587	894.3396	33.83298
31	<i>Justica sp</i>	Bisaune jhar	0.628931	0.175747	13.20755	0.499643
32	<i>Lablab purpureus</i>	-	1.257862	0.351494	5.031447	0.19034
33	<i>Lantana camera</i>	Vanpanda kanda	1.257862	0.351494	2.515723	0.09517
34	<i>Martynia annua</i>	Gridhamkki	1.257862	0.351494	2.515723	0.09517

35	<i>Mazus pumilus</i>	Malati jhar	0.628931	0.175747	1.257862	0.047585
36	<i>Medicago denticulate</i>	Chari amilo	2.515723	0.702988	6.918239	0.261718
37	<i>Microstegium nudum</i>	-	0.628931	0.175747	1.886792	0.071378
38	<i>Mikania micrantha</i>	Lahare banmara	47.16981	13.18102	267.9245	10.13562
39	<i>Mimosa pudica</i>	Lajawati	0.628931	0.175747	3.144654	0.118963
40	<i>Oplismenus composites</i>	-	1.886792	0.527241	13.20755	0.499643
41	<i>Oxalis corniculata</i>	Chari amilo	8.805031	2.460457	35.84906	1.356174
42	<i>Panicum antidotale</i>	-	4.402516	1.230228	10.69182	0.404473
43	<i>Passiflora foetida</i>	-	1.886792	0.527241	6.289308	0.237925
44	<i>Phaseolus mungo</i>	Ban masang	3.144654	0.878735	6.918239	0.261718
45	<i>Piper longum</i>	Pipla	13.20755	3.690685	50.9434	1.927195
46	<i>Plectranthus mollis</i>	-	2.515723	0.702988	8.805031	0.333095
47	<i>Polygonum plebeium</i>	Sukul jhar	1.886792	0.527241	6.918239	0.261718
48	<i>Pteris sp</i>	-	8.176101	2.28471	29.55975	1.118249
49	<i>Saccharum spontaneum</i>	Kash	22.01258	6.151142	238.3648	9.017369
50	<i>Strobilanthes sp</i>	Kibbu	2.515723	0.702988	25.15723	0.951701
51	<i>Taraxacum sp</i>	Tuki Ful	1.257862	0.351494	6.289308	0.237925
52	<i>Thelypteris auriculata</i>	Bishkoche	3.144654	0.878735	8.176101	0.309303
53	<i>Thelypteris sp</i>	-	20.75472	5.799649	132.0755	4.996431
54	<i>Urena lobata</i>	Chyarchyare	5.660377	1.581722	19.49686	0.737568
	Total		357.8616	100	2643.396	100

Source: (Identified in National Herbarium and Botanical Laboratory, Lalitpur, Nepal)

Appendix 4: Household Questionnaire Survey on Common Peafowl in GBZCF.

Date:.....

Family Head Name.....

1. Name of respondent.....Age..... Sex.....
2. Family member.....Male.....Female.....Children.....Adult.....
3. House Owner.....Village.....ward no.....
4. Are you permanent resident of Jagatpur VDC or migrated here?
If migrated when..... From where.....
5. How much land do you have?
Bigha..... Kathha..... Dhur.
6. Do you recognize pheasant? a) Yes b) No
7. How many peafowl have you seen?.....a) .how many time?.....b) when?.....
8. Do peafowl come to agricultural field? a) Yes b) No
9. Do they visit in-group or alone? a) Group.....each group number..... b) alone.....
10. At what time they visited your crop field.
a) Morning b) Afternoon c) Evening d) Night
11. Which crop do you grow in your field? How much did you harvest and lost last year?

Name of Crop	Harvesting in KG or Muri	Loss due to Peafowl in KG or Muri	Name of Crop	Harvesting in KG or Muri	Loss Due to Peafowl in KG or Muri
Maize					
Paddy					
Wheat					
Mustard					

12. What method do you adopt to prevent the crop damage by peafowl?
a) Chasing b) Shouting c) Guarding field at night d) Fencing Manneqium
e) Making Scarecrow in the field f) Beating Drum g) Manneqium h) Other

13. Do human activities affect the peafowl habitat or survival? a) Yes b) No

If yes how.....

14. Are peafowl chased or killed by people? a) Yes b) No

15. For what purpose peafowl are mostly killed.

a) For Feathers b) For damaging c) For meat

d) Export to other Country

16. Are the people who poach the peafowl punished?

a) Yes b) No; if No why?

17. Do you have any religious views about peafowl a) Yes b) No

18. Are peafowl equally important as other birds? a) Yes b) No

19. Do peafowl share their home range with other birds? a) Yes b) No

If yes, with what species of birds.....

20. What are the major threats of peafowl?

21. What are your views about peafowl conservation?

a. Should be protected, how and why.....

b. Should not be protected, why.....

22. What are the problems in Conservation of peafowl?

23. What are the measures to solve the conservation problem?

Any recommendation.....

24. Does this forest hold enough area preferred by peafowl?

a) Yes b) No If No, why?

25. What do you use to cook food?

a) Fire wood b) Fuel wood c) Bio Gas d) Gas Stove

e) Other.

26. Do you have any Livestock?

Name	Number
Cow/Bull	
Buffalo	
Goat	
Sheep	
Other	

27. Why should you conserve the forest?

28. Do you think rate of damage?

a) Increasing b) Decreasing c) Not Known

If increasing what is the cause.....

If decreasing what is the cause.....

29. What kind of Habitat do they prefer?

a) Open Grassland b) Grassland with adjoining forest c) Forest
d. Riverbed Forest with flowing water e) Riverbed forest without water.

30. What is your opinion about number of peafowl?

a) Number increase b. Number decrease c) Not quite known

Thank you for your support on behalf of my supervisor and myself.

Appendix 5: Local Market price of Crops of GBZCF.

S.N.	Crops	Monetary Value in NRs. Per quintal (in average)
1.	Rice	2,150
2.	Maize	2,200
3.	Wheat	2,250
4.	Mustard	8,000

Appendix 6: Photos during research



1. Study area encroached by Mikania



2. Study area with Sisnoo (*Urtica dioica*)



3. A Peacock male alert



4. Male and Female peafowl on foraging



5. Eggs of Peafowl in the nest



6. Questionnaire with Local People