CHAPTER-1

1. INTRODUCTION

1.1 General Background

Wild life conservation has been quite successful form the view point of habitats of several threatened species (Mishra 1991). Active conservation of habitat has increased the population of wildlife within the protected areas, which results the depredation of livestock and crops outside the park. The relation between park and people becomes crooked when the park animals damage the outer peripheral area and disturb the adjacent settlements. Damage of agricultural crop, human harassment, injuries and death and livestock depredations are the common unbalanced relationship (Jnawali 1998, Studsord and Wegge 1995, Shrestha 1994 and Kasu 1996).

The local people, who once were enjoying free access to areas henceforth covered by protected areas and were able to meet their needs from inside resources, now no longer, have legal access. Local people have seen the protected areas as an attempt by the government to curtailtheir access to their traditional rights of resources use. How ever, the protected areas and buffer zones have become a very good resource for villagers to fulfill their resources needs through venturing into illegal activities like poaching, logging and hunting, all of which are directly conflicting with the park's objectives (Mishra 1982, Milton and Binney 1980).

It is very difficult for villagers to understand why wildlife is allowed to damage their crops, whereas they cannot kill any wildlife, which they have been utilizing for many years.

Depredation of crops by wild boars occurs to varying extend throughout their distributed range of Nepal, wherever cultivation encroaches the Wild boar habitat. By different factors the Wild boars harm the cultivated areas. However in ultimate terms crop raiding can be thought of as an extension of their natural optimum foraging strategy (Sukumar 1989).

It is not unusual to see why animals of the protected areas are attracted to areas with grain or other crops. Cultivated crops are rich in protein and carbohydrates as well as some mineral nutrients than most of the wild plants and animals available in adjacent in isolated stands or scattered throughout the forest, agricultural crops and cultivated animals occur in relatively large, concentrated stands. Thus, the animals of the protected areas to have such items do not have to expend as much energy searching for food.

Many other animals like bear, deer, porcupine etc. also play the main role for crop depredation in the agricultural farm near to the park. For searching food and for other purpose they damage the crops.

1.2 Objectives

Wildlife have affected the local people of Sundarijal VDC either by crop depredation or killing the livestock. The main objective of this study was to collect detailed information on the impact of wildlife at Sundarijal VDC. Following specific objectives have been set to estimate the actual crop loss caused by wild animals.

1. To identify the causes of Park People Conflict in ShNNP
2. To identify the actual crop loss and

3.   To identify livestock and avian stock depredation in Sundarijal VDC.

1.3   Limitation of the study

Park people conflict has its origin in multidimensional factors that render it more complexes than it looks at first and all such causes of conflicts can not be studied at the same time. Thus, this study concentrated itself on only of them. It is the conflict between people and Wild life. For a trend analysis of this type of problem, it takes long time study or information is needed. This study however will be based on the data available from the village in different seasons of a year.

This study was entirely based on data collected from interviews applying schedule surveys for crop depredation and human harassment by Wild life and others. There are 9 wards in Sundarijal VDC and the whole VDC was the study area, which was seriously affected by wildlife. During the study period, the actual crop damaged fields were visited with the local farmers during crop growing season. Different semi-structured questions were asked to local people. Victims who had encountered Wild life attacks were formally interviewed in order to identify actual crop damage.

The study was continued starting from the southern part of VDC that was visited twice during the crops raiding period. Financial constrain, lack of sufficient equipments and security problem also limited the study.

1.4   Rationale of the study

This study has provided data on crop depredation in Sundarijal VDC for 2010/2011. It has also given information on human harassment and impact on local people due to wild animals. The human wildlife conflicts have created tussle between the government and local people and which in turn has become problematic in management of wildlife. This scenario is felt all over the country and especially in adjacent VDCs of Shivapuri Nagarjun National Park. The present study aims at analyzing the complex issues of park-people's interference by focusing day to day problems faced by local people in the boundary of Shivapuri Nagarjun National Park.

2. STUDY AREA

2.1 Description of the study Area

Shivapuri Nagarjun National Park is located on the northern fringes of Kathmandu Valley. It is surrounded by 23 VDCs of three districts, Kathmandu,Nuwakot, Dhading and Sindhupalchowk (DNPWC 2010). It lays between $27^0$45'N - $27^0$52'N latitude and $85^0$15'E - $85^0$30'E Longitude (SWWR 1999). It covers 153 km^2 stretching approximately 9 km from north to south and 20 km from east to west (DNPWC 2010).

Sundarijal VDC is one of the adjacent VDCs of Shivapuri Nagarjun National Park which was the study area and it is located between $27^0$18'N - $27^0$27'N longitude and $85^0$22'E - $85^0$28'E latitude (SWWR 1999).

2.2 Climate

Shivapuri lies in the transition zone between subtropical and temperate climates. The data obtained from the Kalanki station showed that the maximum temperature was on May and minimum temperature was on January for the year 2007/08. Likewise maximum rainfall was on August and minimum was on November for the year 2007/08 (GovN 2008)

2.3 Geology and Soil

Geologically, Shivapuri area occupies the inner Himalaya region. The dominant rocks are gneiss and magmatite with mica schistand pegmatic granite. The soils of the area range from loamy and sand on the northern side to sandy loam on the southern slope. Entire area is characterized by its steep topography. More than 50% of the area has greater than 30% slopes. In several spots soil erosion is a serious problem. Erosion hazard is very high in the northern slope. Landslides, gullies the stream bank erosion, both natural and man induced are found all over the area. (SWWR 1999)

2.4 Flora and Fauna

The vegetation in ShNNP consists of variety of natural forest types, depending on altitude and aspect, including pine, oak, rhododendron, and so on, In general, forests in Shivapuri Nagarjun National Park can be categorized by four types. They are (a) lower mixed hardwood forests of *Schima Castonpsis* (b) Chirpine forests dominated by *Pinus roxberghii* (c) Upper mixed hardwood forests to *Rhododendron, Aesculus* and *Betula* etc.

The establishment of protected area has led to an important increase in forest cover and standing stock. This and the greatly reduced levels of disturbance have resulted in a considerable improvement in wildlife habitats and an increase in forest dependent species. Recorded species in the Shivapuri area include: eight threatened mammal species, such as leopard (*Panthera pardus*), leopard cat (*Prionaliurus bengalensis*) and clouded leopard (*Pardofelis nebulosa*), 177 species of birds, including at least 9 threatened species, such as the orange-billed leaf bird (*Chloropsis hardwickii*), 102 species of butterflies, including a number of rare and endangered species, such as the Kaiser-I-Hind (*Teinoplpus imperalis*) and 129 species of mushroom. It is also one of the view sites where the rare relict Himalayan dragonfly (*Epiophlebia laidlaw*) is found (SWWAR 1999).

2.5   Land Use in Sundarijal VDC
The total area of Sundarijal VDC is 10180 ropani. The composition of land of Sundarijal VDC is being covered in the following patterns. Where 5430 ropani is agricultural land (Khet and Bari), 640 ropani is bushy land, 3510 ropani is forest land, 340 ropani is grassy land and 240 ropani is sandy land. (Topo Sheet/government of Nepal 2008)

2.6   Social Economic Status
Sundarijal VDC constitutes of people of different castes. The Brahmin, Chhetri, Gurung, Lama, Pariyar, Sunar, Bishwokarma and Magar constitute the population of the VDC. The Brahmin constitutes the largest population of the VDC. Agriculture is the main source of income in the VDC. A good number of populations are engaged in army, police, teacher and employ of profession.

2.7   Animal Husbandry
Animal husbandry forms an integral part of the economy. People mostly keep cow (*Bos indicus*), Buffalo (*Bubalus sps.*), Goat (*Capra hircus*) and Pig (*Sus sps.*). Male buffaloes and oxen are used for hauling and transportation. Goat husbandry is the major source of income.

2.8   Farming System
Paddy and Maize are the major crops in the study area which are grown in the rain-fed lowlands, millet and wheat are also grown. Farming system is primitive. The work is mainly done manually by draft animals. Compost manure is used as bio-fertilizer. Some farmers use chemical fertilizer and pesticides to increase the yield of crops. Most farmers practice kitchen garden and plant vegetables, fruits, potato, tomato, cauliflower, sweet potato etc. Vegetable farming is one of the major cash crops in the study area. They sell their surplus food grains in the nearby market.

CHAPTER-III

LITERATURE REVIEW

Protected areas are the forefront of efforts to conserve biological diversity in developing countries like Nepal along with rest of the world. But many protected areas in Nepal are in crisis due to the increasing human activities and sometime, wild animals' interference in the crop fields. The management of the protected areas requires people's participation for its sustainability.

Milton and Binney (1980) carried out a survey on resolving resource conflicts between wildlife conservation and agricultural land use in Padmpur VDC, Chitwan district. They showed that crop loss inflicted by wildlife was the main problem of the inhabitants of the area adjoining to park. The study in Chitwan identified three zones of crop damage by wildlife. The zone of highest damage suffered from 50% to 100% losses. A large number of people from such zones either wished to resettle or were deeply concerned that government took other effective actions such as fencing or loss compensation.

Jnawali (1989) reported on human harassment and crop damage by greater one horned rhinoceros (*Rhinoceros unicornis*) in Sauraha adjacent to CNP. The loss was found Rs. 172000 of which 68.6% occurred within a distance of 500m. The highest economic loss 27.6% occurred to paddy.

Sharma (1991) found that the main cause of conflict was due to crop and livestock depredation in CNP. In 1991, he calculated crop damage by two methods, interview and Net Area Damage (NAD). He reported that real crop damage was five times less by NAD method than interviewed. He also reported that paddy was severely damaged following by wheat, maize, oil seeds, lentils, and vegetables and miscellaneous.

Kattel (1993) reported that 87% people had perceived about increasing number of wild boar (*Sus scrofa*) and it was one of the raiding animals in the neighboring villages of Shivapuri. He found that wild boar was present from 1000-2700m. in altitude of Shivapuri Nagarjun National Park.

Kharel (1993) identified Wild boar (*Sus Crofa*), Himalayan black bear (*Selenarctos thibetanus*), monkey (*Macca milatta*) and deer (*Muntiacus muntjak*) species were major crop raiders in Langtang National Park.

Khatri (1993) found that crop damage by Nilgai (*Boselphus tragocamelus*) averaged 8.3% of the total crop loss caused by wild animal in BNP.

Nepal and Weber (1993), reported that rhinoceros (*Rhinoceros unicornis*), chital (*Axis axis*) and Wild boar (*Sus scrofa*) were the principal crop pests in CNP. They calculated rhino, Wild boar and chital destroyed 60%, 27% and 12.9% of the total crop damage respectively.

Acharya (1999) surveyed on Wild boar-man interaction in BNP. He found an economic loss of Rs. 20,95,346 of which 52.73% occurred in Thakurdwara and 47.27% in Shivpura. He found the highest economic loss (15.40%) occurred a paddy

crop, followed by potato (15.40%), maize (15.21%), wheat (13.80%), mussuro (12.42%) and yam (7.57%).

Gautam (1999) gave a report on the crop damage by wild animals in proposed buffer zone of SWR. He found highest economic loss 74.28% to paddy crop followed by wheat (17.08%) and maize (8.62%). He found that among the wild animals, highest economic loss 43.29% by wild elephant, followed by Wild boar (28.67%), chital (24.09%) and blubull (3.92%). He reported that loss of crop to wild animals ranged from 61.62kg to 162.33 kg per household.

Gurung (2002) reported on Wild boar distribution and park-people conflict in Shivapuri Nagarjun National Park. He found the sources of conflict. He also studied about the crop damage near the village of Shivapuri Nagarjun National Park.

Gaire (2007) found that Wild boar was the main crop pest in Bardia National Park. Dalits, who lived near the park, were more affected than any other ethnic group. As they had a few lands for cultivation and it is also damaged by wild animals.

Khatiwada (2008) found that wild boars were also found in the high altitude forests of Kangchanjunga Conversation area.

Kurkait and Chalise (2010) also reported that there was a great loss in the surrounding villages of Shivapuri Nagarjun National Park. There was a total loss of Rs. 587618.74 of a small village.

Thapa (2010) found that Wild boars were the main crop pests in Bardia National Park. The animal was found in the rooted food field mostly and said that its main food in the farm was rooted food.

Regmi (2010) found that Wild boars were also found in Bardia National Park. It was also a main crop pest to the surrounding villages of the park.

4. MATERIALS AND METHODS

4.1 Reconnaissance Survey

The reconnaissance survey of the proposed study areas was carried out in first week of September 2010. During that time conflicted areas and land use pattern were identified. The survey also included field observation and interaction with local people. Sites for most crop raiding areas inside Shivapuri Nagarjun National Park were selected. Then whole wards were selected in VDC, where different wild animals were frequented.

4.2 Data Collection

This study was totally based on primary and secondary data. Primary data were collected from the field observation and questionnaire survey.

4.2.1 Questionnaire Survey

A total of 121 households (with the head of the family and in some cases the person above 21 yrs) were interviewed using the semi-structured questionnaires. The interview focused on family composition, economic condition of the respondents, ethinicity, land, occupation and conflict issues such as crop damage and human harassment. Altogether twenty two questions were asked to the respondents from a set of a questionnaire named as household questionnaire and another set of questionnaire containing six questions were asked to VDC authorities and leaders. There was one more set of questionnaire for park staffs. The questionnaire set is given in Appendix. 1.

4.2.2 Secondary Data Collection

Secondary data were collected from records and reports from different sources of VDC. Other secondary sources were from journals, books and unpublished dissertation works. The secondary data was also collected from the office of Shivapuri Nagarjun National Park.

4.3 Sampling

Sundarijal VDC was selected for the study. The latest household number and the human population were available from the VDC office. On the basis of number of households in each ward, the sample size for the study was determined. For the study, simple random sampling was adopted. Information was taken from key informants such as village head, local leaders, park authorities and army.

There are altogether 504 households in the study area but only 121 households are taken as sample for the present study due to time constraint. The sampled households constitute 24.70% of total households.

4.4 Field Observation and Net Area Damage Measurement

This field observation was done for one year round. The seasonal crops were recorded during growing to harvesting period. Therefore, field survey was conducted several times within a year (from Sept. 2010 to Sept. 2011). A single visit included at least seven days.

The damaged area was measured with the help of measuring tape. For the measurement of damaged area, topographical map (Sheet no 278502C, Scale

1:25000) was also used for the verification of the damaged area. The actual affected area was assessed with photographs taken on the spot.

Extend of damage in crop fields was measured as follows:

1. Damage plots were outlined and marked with ropes and ribbon flags.
2. The damaged plots were then subdivided by parallel transects with the help of ropes and straight bamboo sticks.
3. The following formula was used to measure the size of damaged area.

   A= L×d

   Where, A= Area of damaged irregular plot.
           L= Length of transects
           D= distance between transects

At harvesting time, 3-5 control plots, each measuring 2×2m were laid out randomly around the damaged plots in a distance of 2-5m. The crop was harvested at maturity. Yields from the damaged plots and control plots were sun dried and weighed to determine the percentage lost due to damage. The percentage lost by damage was measured from early green stage to mature stage. Local techniques were used to harvest, winnowing and drying. The yield was measured in local units. Grains and crops were given back to the farmers after the work was finished.

4.4.1 Evaluation by Net Area Damage Method

In the study area, there was considerable damage by wildlife. The Net Area Damaged (NAD) by wildlife is considered the real damage. Most of the farmers exaggerated the damage, which may be attributed to the compensation. Net Area Damage was calculated adopting Sharma's (1991) and Jyawali's (1989) methods. The NAD is a fraction of Gross Area damaged, where the wildlife actually ate or otherwise damaged crops. Extend of damage is somewhat dependent in the growth stages of crops. The damage estimation is adjusted by multiplying the area by a factor of 0.25 for the beginning stage of any crop (prior to the flowering stage). The rationale for he adjustement is that farmers can replant the damaged parts because of their early stages, and regenerated new shot to flower recovering most of the damage. But another factor is taken as 1 for the crop damaged or eaten during milky stage to harvestable period. This multiplication is adopted because of the fact that the farmers can not replant the crop during the harvestable period and the damaged parts of the crops after the flowering period would not re-grow or regenerate the new shoots and could not cover the damage portion of the corps. Thus, it is multiplied here by the stage factor 1 for the crop damaged in the harvestable period.

The NAD is summation of area-damaged × factor for the percentage loss of crop × factor for the stage of crop. The factor for the percentage loss is estimated in the field for each individual case and damaged was recorded.

NAD= [Area Damaged × %Loss of crop × Stage of crop]

4.5 Data Analysis

To find per household / ropani, total loss of each crop was estimated in NC / ropani and it was divided by the total sampled households

Mathematically,

$$\text{Per house hold loss/Ropani} = \frac{\text{Total loss NC/Ropani}}{\text{Total Sampled/households}}$$

The total loss in rupees was estimated by multiplying with the market price of the crops during that period and the estimated loss / ropani was taken in Kg.

The following formula is used to calculate the loss per unit area.

$$xLy = \frac{xE - xA}{xLc}$$

Where, x = Specific crop: if Paddy, then (P) is used, if Maize (M) is used similarly

xLy= the loss in yield of the crop x per unit area of land

xE = expected production of crop x.

xA = actual production of crop x.

xLc = total land coverage under crop x.

Where, x = Specific crop

L = Total loss

E = Expected production of crop x.

A = Actual production of crop x.

The crop loss was the difference between expected and actual production of different crops.

CHAPTER-V

5. RESULTS

5.1 Crop depredation
5.1.1 Frequency of wildlife's visit to different crops

The frequency of wildlife visits in the crop land that was not the same through out the year(fig.1). There were 1012 reported cases of Wild boar in sample areas, which is followed by monkeys, porcupine, birds, deer, rats and bear. The total visit of wildlife was 3341.
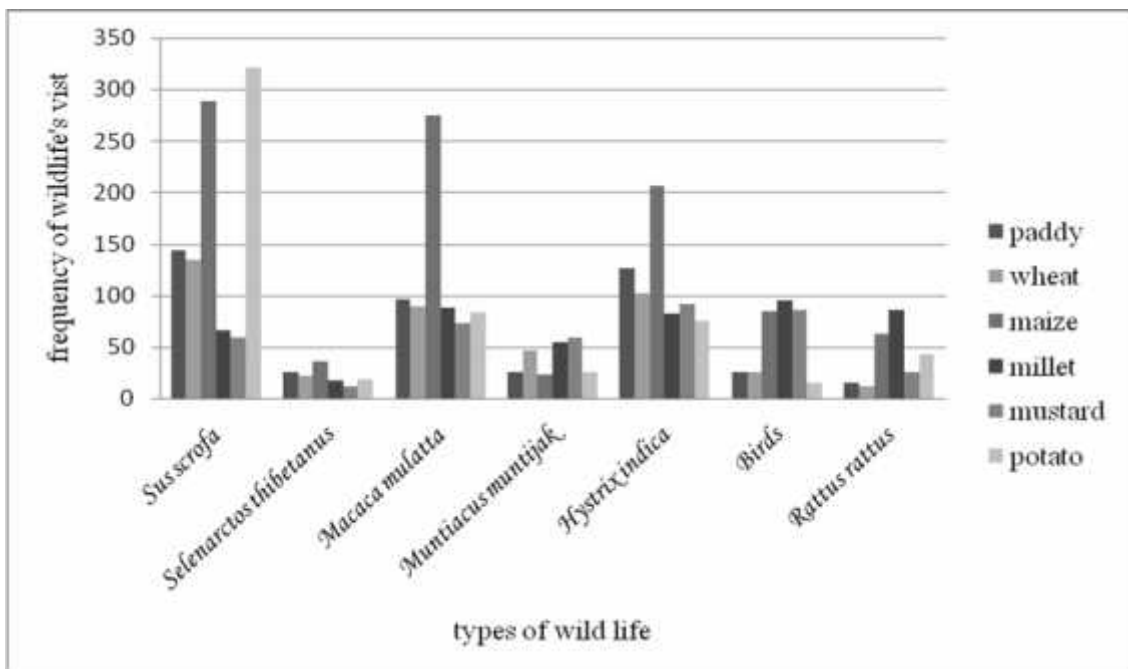

Figure 1: Frequency of wildlife's visit to different crops in the sampled area.

5.1.2 Population size of wildlife

Birds were in the largest number of group size of 50 with maximum number and 5 with minimum number, which was followed by monkey, rat, Wild boar, porcupine, deer, bear, jackal, common mongoose, leopard and wild cat(fig.2).
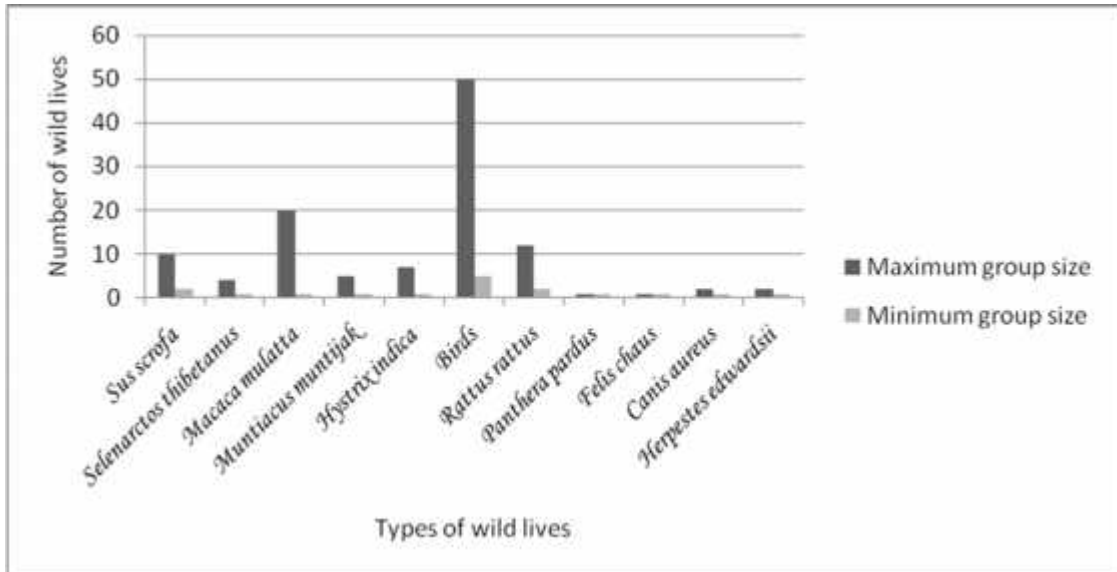
Figure 2: Number of wildlife raiding the crops and preying upon livestock and avian stock.

5.1.3 The Gross Area and Net Area damaged of crops by wildlife

The highest total Gross Area and Net Area Damage by wildlife were indicated for paddy, the total Gross Area was 2155.6 ropani and the total Gross Area affected by wildlife was 455.50 ropani, which was 21.13 percentage of total Gross Area(fig.3). The Net Area Damaged by wildlife was 107.70 ropani and its NAD percentage was 4.99. The lowest Gross Area and Net Area Damage were found for mustard, the total Gross Area was 421.50 ropani. The total Gross Area affected by wildlife was 81.60 ropani, which was 19.35 percentage of total Gross Area. The Net Area Damaged by wildlife was 32.42 ropani. NAD percentage in terms of Gross Area was 7.69.
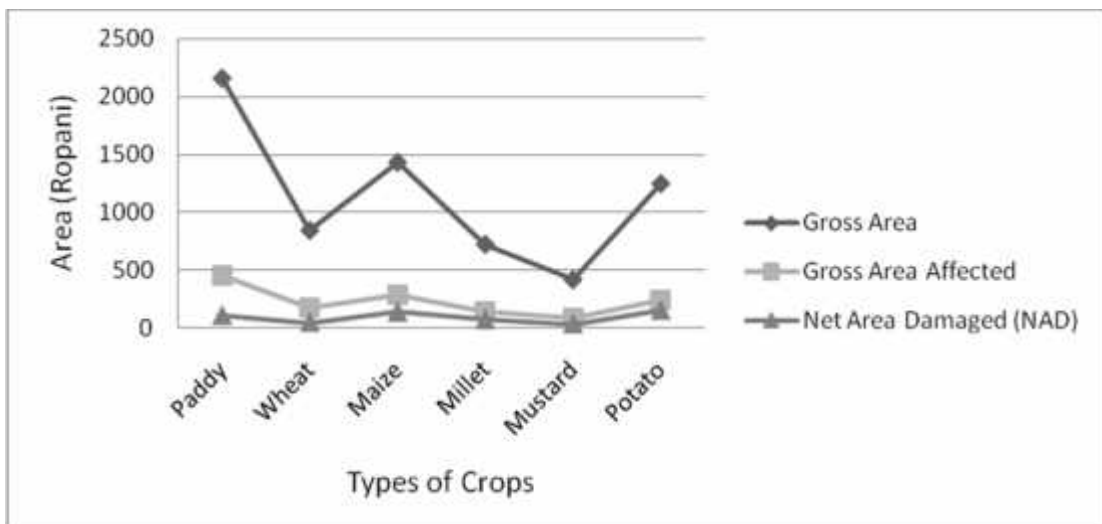

Figure 3: Total Gross Area and Net Area Damage of crops by wildlife in the sampled area (in ropani).

5.1.4 Net Area Damage (NAD) of crops by wildlife

The highest total Net Area Damage of crops done by Wild boar was 175.90 ropani, which is followed by porcupine, deer, monkey, rats, bear and birds by 95.09, 87.40, 72.83, 60.68, 27.10 and 26.90 ropani respectively. Similarly it is shown at Total Net Area Damage in paddy, wheat, maize, millet, mustard and potato were 107.77, 46.99, 136.42, 70.73, 32.42 and 151.57 ropani respectively(fig.4). Total Net Area Damaged was 545.90 ropani.
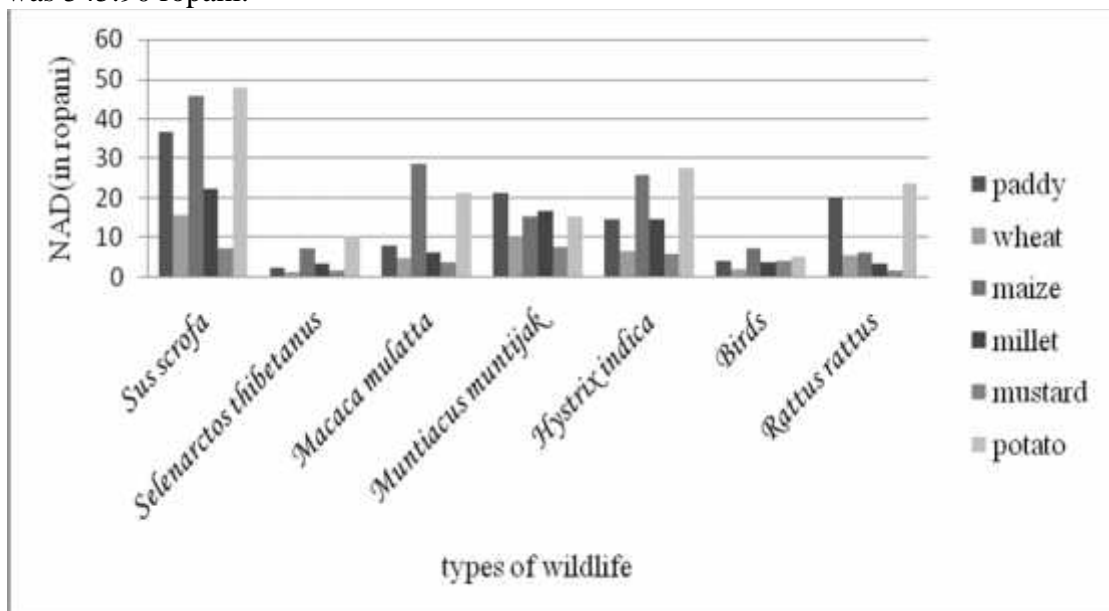
Figure 4: Net Area Damage (NAD) of different crops by different wildlife.

5.1.5 Percentage of Net Area Damage (NAD) of crops by wild lives

The highest percentage 32.05 of Net Area Damage of crops by Wild boar followed by deer, porcupines, monkeys, rats, birds and bears 18.34, 17.11, 12.18, 10.11, 5.79 and 4.42 percentages respectively(fig.5).
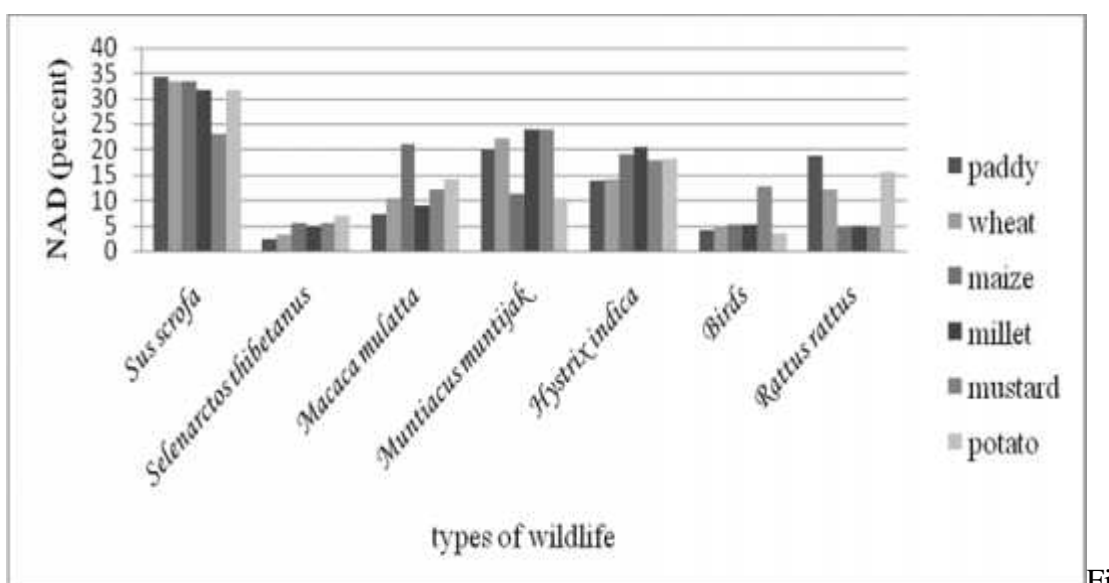
Figure 5: Percentage of Net Area Damage of different crops done by different wildlife.

5.1.6 Total Expected Yield of different crops

The highest total expected yield 551969.60 kg of potato from the sampled area 1248.80 ropani, which is followed by 284539.20 kg of paddy from 2155.60 ropani, 110302.50 kg of maize from 1432.50 ropani, 74786.40 kg of wheat from 846.00 ropani, 38462.10 kg of millet from 725.70 ropani and 19810.50 kg of mustard from 421.50 ropani(fig.6).
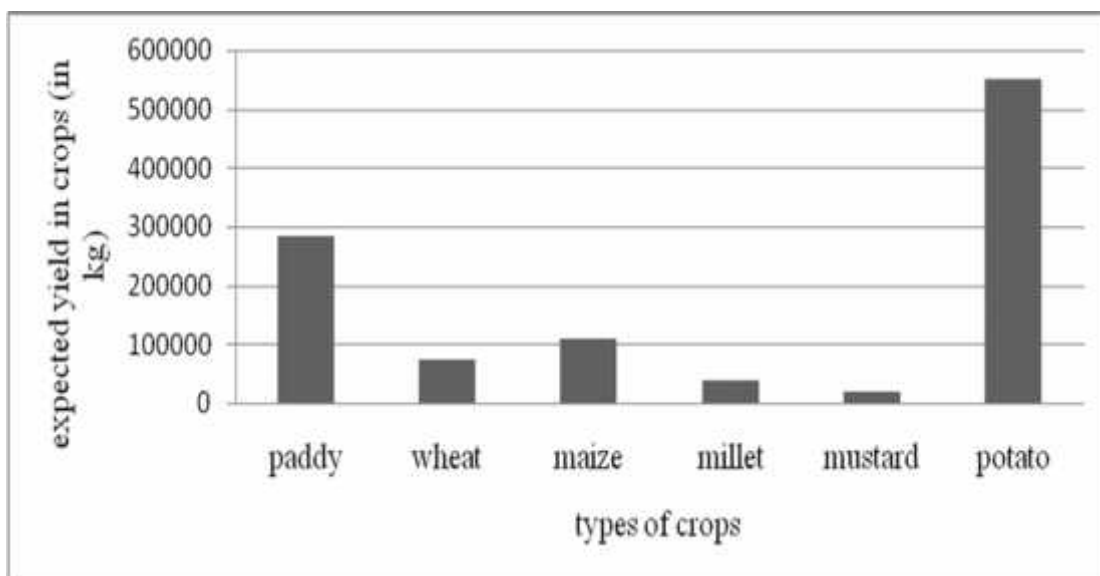
Figure 6: Total Expected Yield of different crops in the sampled area.

5.1.7 Loss of crops by wildlife

The highest total loss of potato is 66994.47 kg that is 12.13 percentage of expected production, which is followed by paddy, maize, wheat, millet and mustard were 14226.32 kg (4.99%), 10504.85 kg (9.52%), 4154.63 kg (5.55%), 3748.86 kg (9.74%) and 1523.81 kg (7.69%) respectively(fig.7).
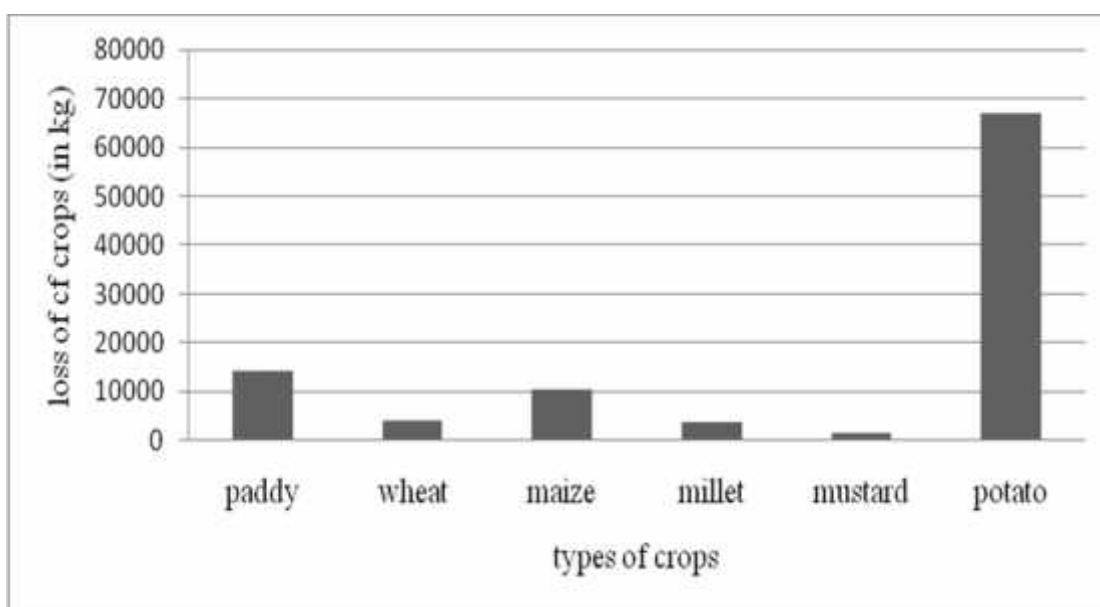
Figure 7: Loss of crops by NAD method in the sampled areas.

5.1.8 Loss of crops by different wild lives

The highest total loss of crops by Wild boar was 32432.1 kg; which is followed by porcupine, rats, monkeys, deer, bears and birds were 17763.21 kg, 14314.15 kg, 13568.5 kg, 13046.41 kg, 5935.92 kg and 4092.46 kg respectively. Total loss was 101152.75 kg(fig.8).
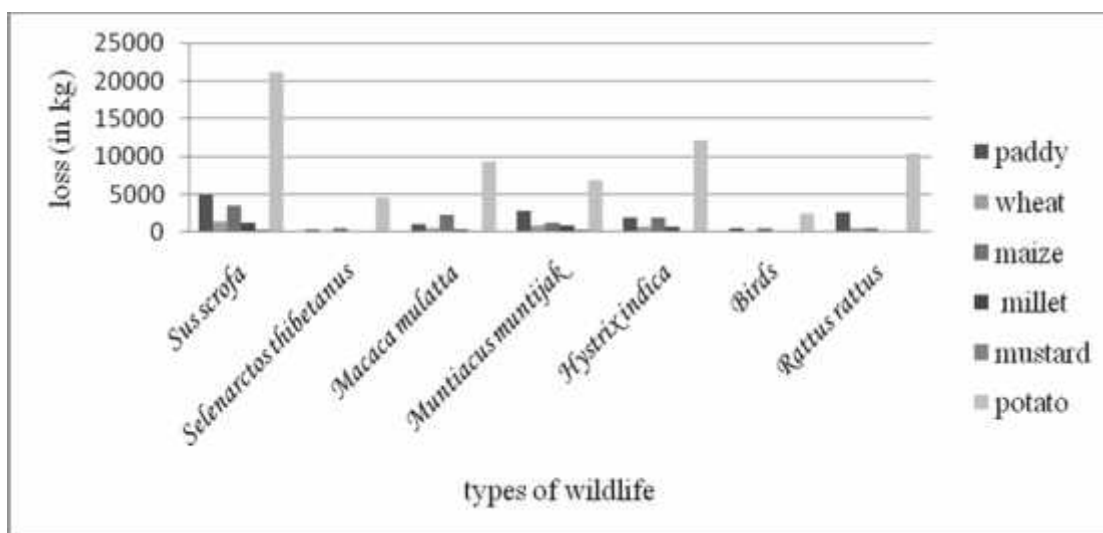
Figure 8: Loss of different crops by different wildlife in the sampled area (in kg).

5.1.9 Economic loss of different crops

The total loss of crops in monetary value, which was Rs. 1803982.68. The loss in different crops like paddy, wheat, maize, millet, mustard and potato were Rs. 199168.48, 62315.4, 367669.75, 93721.5, 76190.5 and 1004917.05 respectively(fig9). The rate of crops was calculated based on the villagers' information during field study in 2011 A.D.
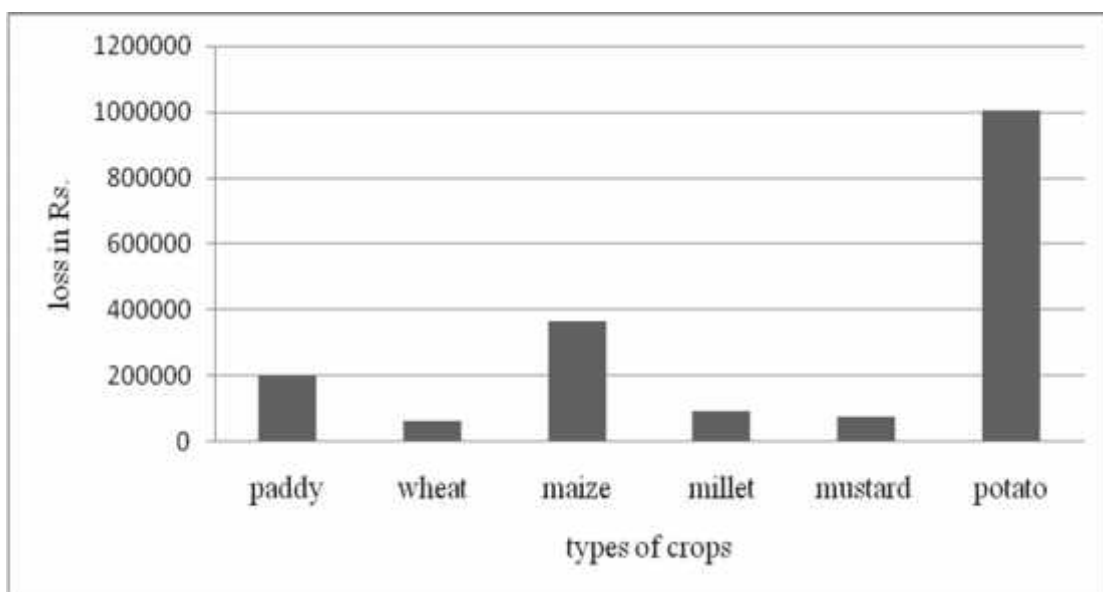
Figure 9: Total economic loss of different crops (NPR)

5.1.10 Total Economic loss of different crops by different wildlife (in NC)

The highest loss of crops by Wild boar (Rs. 576212.4), which is followed by porcupine (Rs. 321454.55), monkey (Rs. 256289.06), deer (Rs. 238365.85), rats (Rs. 226262.81), bear (Rs. 104770.25) and birds (Rs. 80619.85)(fig.10).
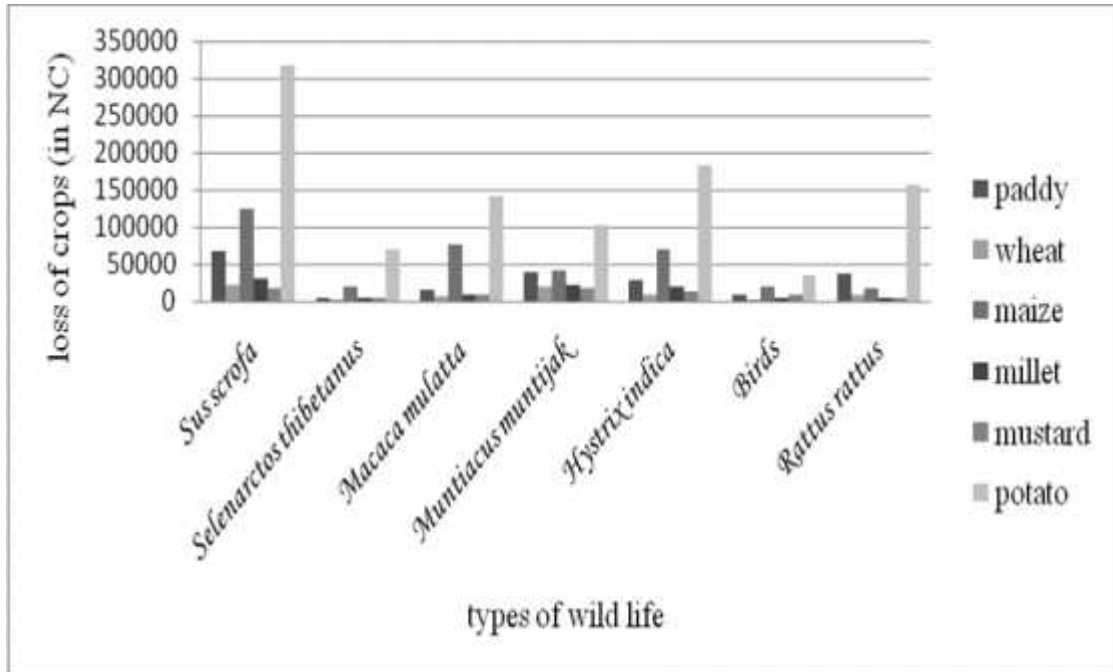
Figure 10: Economic loss of different types crops by different wild animals (NPR)

5.1.11 Ranking of wildlife in crop damage

The loss of crop from Wild boar which was the highest amount of 32432.1 kg. It was in the first position of ranking of crop damage. Similarly, Porcupine in second position which destroyed 17763.21 kg of crop, rats in third position with 14314.15 kg crop damage. On the descending order of crop damage were monkey (13568.5 kg), deer (13046.41 kg), bear (5935.92 kg) and birds (4092.46 kg)(fig.11).
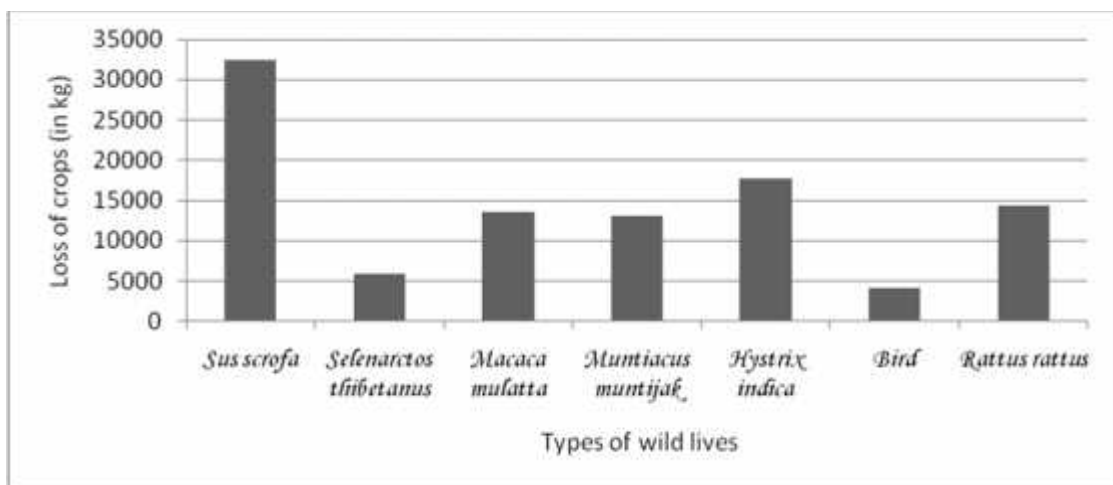
Fig. 11: Ranking of wildlife in crop damage.

5.2 Total number of livestock reared by the sampled households

Chicken was the highest number by 910, which was followed by goat (335), buffalo (277), bull (100), cow (86), pig (13), pigeon (100) and duck (10)(fig.12).
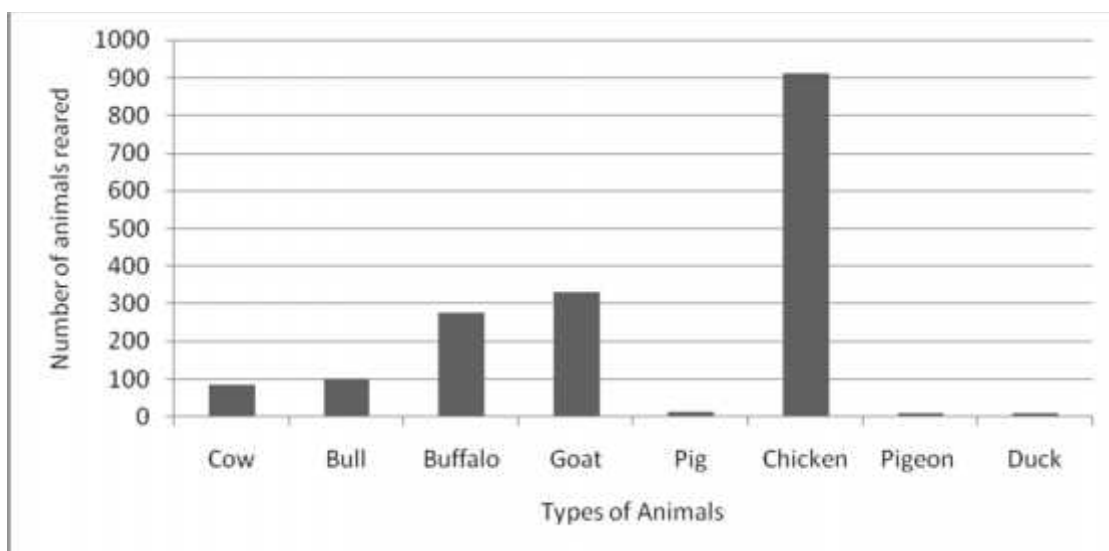
Figure 12: Total number of animals reared in the study area

5.2.1 Livestock depredation by wildlife

The park animals had been the cause of loss of livestock and avian stock in Sundarijal VDC. The livestock like goats, cows, bulls, buffaloes, pigs etc and avian stocks like chicken, duck etc were killed by the park animals. The most important predators were Leopard (*Panthera pardus*), Wild cat (*Felis chaus*), Jackal (*Canis aureus*), Common Mongoose (*Herpestes edwardsii*). Jackal was found in the highest number (55) throughout the year.

Figure 16 showed that chicken were lost in the highest number by wildlife by 86, which was followed by goats (34), bulls (12), cows (11), pigs (5), buffaloes (2) and pigeons (2)(fig.13).
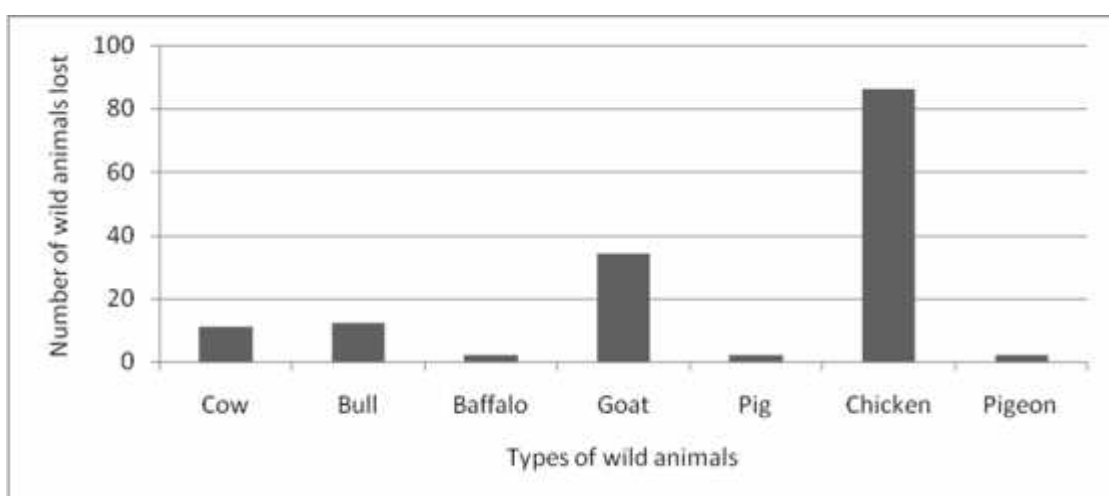
Figure 13: Number of animals lost by wildlife.

5.2.2 Estimated economic loss by livestock depredation in the study area

The highest loss in monetary value was for goat by Rs. 85000, which was followed by cow (Rs. 66000), bull (Rs. 60000), buffalo (Rs. 44000), chicken (Rs. 30100), pig (Rs. 8000) and pigeon (Rs. 300)(fig.14). The total loss was Rs. 293400. The rate of livestock and avian stock were calculated based on the villagers' information during field study in 2011 A.D.
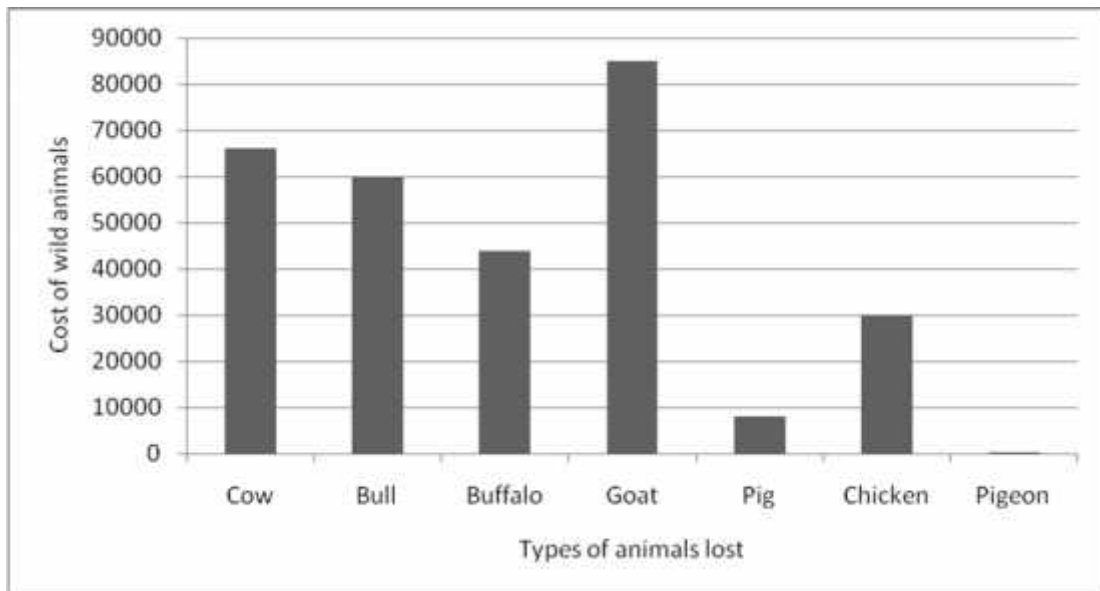
Figure 14: Estimated monetary value of livestock and avian stock in the study area

CHAPTER-VI

DISCUSSION

The present study conducted in Sundarijal VDC of Kathmandu District which has been facing the serious problems of Wild animals especially wild boars and many other wild animals from ShNNP for many years. Park-people conflict in ShNNP was due to problem created from Park and also from local people of the adjacent areas. 72% people during the survey said that presence of Park resulted in loss of their crop and livestock from wildlife. Similarly, park had been a source of irritation for local people who did not follow rule and regulation for livestock grazing (6), fodder (13), timber and firewood collection (3) and poaching of wildlife (2) among 24 respondents from park staffs. Park and local people realized that conflict between these two groups arose due to four major sources and these were fuel wood and fodder, crop damage, livestock grazing and human harassment. This is due to the presence of park near by the VDC, the illegal use of park by local people for their requirement and the visiting of wild life for the food.

Similar types of conflicts exist as also pointed out from Upreti (1985), were crop damage, encounter between man and wildlife, loss of livestock by predators, fishing and hunting, antipathy towards parks and reserves and tourism. Sharma (1991) found causes of conflict in Royal Chitwan National Park where crop and livestock damage, loss of human life by wild animals nearest to the park due to habitat encroachments from local people.

This study also showed that the total Net Area Damaged (NAD) was 545.90 ropani. Out of which the highest was by Wild boar 32.22%, which was followed by porcupines 17.42%, deer 16.02%, monkeys 13.34%, rats 11.12%, bears 4.96% and birds 4.92%. Similarly, the highest Net Area Damaged was found in potato field 27.76%, which was followed by maize 24.98%, paddy 19.74%, millet 12.95%, wheat 8.62% and mustard 5.93%. The Wild boar was the main crop raider so it ploughed the field, ate tuber of potato at that time it damaged most of the areas and it had made the highest damage in potato field. Wild boars mostly visited in the season when the potato was planted or in the ripen stage. Wild boar and other animals raided the crops just before the harvesting time. Some animals like monkey, porcupine raided on the milky stage of cereals but deer raided on small grown plants and they grazed on them.

Similar type of result was pointed by Gurung (2002), who found total NAD was 466.93 in Sunkhani VDC in Kathmandu district. The highest NAD was by Wild boar in 38.53%, which was followed by porcupine 20.83%, monkey 20.09%, deer 8.72%, bear 9.12% and birds 2.68%.

In this study, Wild boar (*Sus scrofa*) was found as main crop raider in Sundarijal VDC, adjacent to Shivapuri Nagarjun National Park. Other crop raiders were porcupine (*Hystrix indica*), monkey (*Macaca mulatta*), bear (*Selenarctos thibetanus*), deer (*Muntiacus muntijak*), rats (*Rattus rattus*) and different birds. Due to the lack of food inside the park at the time of seasonal changes, intra and inter

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specific competitions, temperature changes in winter and summer seasons and population of the wildlife, the wildlife came out of the park and they entered to the cultivated area and raided. In the study, Wild boar was found most visited wild animals in the cultivated land by 845 times. Wild boar was found mostly raiding in tuber like potato, sweet potato etc. Other wildlife like bear, porcupine, rat, monkey and deer were also found raiding in all types of plants. They raided the crops according to the taste and season of plants.

Similarly Kharel (1993) identified Wild boar (*Sus scrofa*), Himalayan black bear (*Selenaectos thibetanus*), monkey (*Macaca mulatta*) and deer (*Muntiacus muntjak*) species as major crop raiders in Langtang National Park. Nepal and Weber (1993) reported rhinoceros (*Rhinoceros unicornis*), chital (*Axis axis*) and Wild boar (*Sus scrofa*) as principal crop raiders in CNP. Sharma (1995) found wild buffalo (*Babulus babulis arnee*) and Wild boar (Sus scrofa) as main crop raider in KTWR. Previous study of Soti (1995), Poudel (1995), Gurung (2002) and Purkait and Chalise (2010) found Wild boar (*Sus scrofa*) as a principal crop raider in ShNNP. Gautam (1999) identified wild elephant (*Elephas maximus*), Wild boar (*Sus scrofa*) and chital (*Axis axis*) as main crop raider in Suklaphanta Wildlife reserve. Gaire (2007), Thapa (1008) and Regmi (2010) identified Wild boar (*Sus scrofa*) as a main crop raider in Bardia National Park. Khatiwada (2008) found Wild boar (*Sus scrofa*) as a main crop pest in Kangchenjanga Conservation area. In all these studies, Wild boar (*Sus scrofa*) seemed to be one of the main crop raiders in most of the parks and reserves of Nepal.

In this study, crop damage of 101152.94 kg was found due to wildlife depredation. Out of total damage, highest loss was found in potato (66.25%), this was followed by paddy (14.08%), maize (10.38%), wheat (4.10%), millet (3.70%) and mustard (1.50%). As Wild boar is the main pest and most visited wild life in the cultivated land and this may be due to the taste of tuber like plants results the highest loss in potato. Crop damage depends on various factors like nature of crop and preventive measures used by farmers, the number of wildlife and distance from jungle boundary. The main reasons for this damage may be the lack of sufficient food in the jungle followed by liking of taste of crop.

Similarly, Shrestha (1994) found Bodreni as a most affected area with annual loss of 38.5% in its total production in CNP. The loss was 50.88% of maize, 25.50% of paddy and 6.60% of mustard respectively. The highly affected area was Padampur where 22.56% of total production was estimated as crop loss. The loss was 25% of maize, 24% of paddy and 5.33% of mustard. Poudel (1995) calculated that loss of paddy was 2.06% of total production in Sundarijal VDC adjacent to Shivapuri Nagarjun National Park. Similarly, total loss of wheat, maize and millet were 30.41%, 35.21% and 47.36% of expected production respectively. He calculated that Wild boar (*Sus scrofa*) destroyed maize, wheat and millet by 85%, 70% and 90% of total

loss respectively Soti (1995) in Kakani VDC adjacent to Shivapuri Nagarjun National Park calculated the loss of maize as 999.88 quintal. Likewise, the total loss of millet, wheat and paddy were 55.57, 23.65 and 23.06 quintal respectively. He found the Wild boar as the main crop raider. He found Wild boar destroyed maize, wheat, millet and paddy by 80%, 45%, 90% and 40% respectively. Sharma (1995) found that Wild boar destroyed potato, paddy and wheat by 67.76%, 21.17% and 11.07% of total loss respectively in P. Kusaha VDC adjacent to KTWR. Similarly in Shripur VDC, potato wheat and paddy were 49.27%, 33.83% and 16.89% of total damage respectively. Kasu (1996) in Parsa Wildlife Reserve, found the loss of 23857 kg of paddy which was 77.52% of the total paddy damage. Likewise, total loss of wheat and maize were 4896 kg or 15.91% and 2022 kg or 6.57% respectively. He found that deer, boar and elephant destroyed 52.2%, 32.61% and 15.19% respectively of the total crop damage. Limbu (1998) found that a total 117517 kg crop loss consisting 65240 kg of paddy, 37967 kg of wheat and 14310 kg of potato were damaged in P. Kusaha VDC, adjacent to KTWR. Gurung (2002) found crop damage of 46872.40 kg in Sunkhani VDC adjacent to ShNNP. He found highest loss in paddy of 12085.83 kg followed by maize of 11531.46 kg, potato of 11281.50 kg, wheat of 6421.85 kg, millet of 5119.01 kg and mustard of 432.75 kg.

The study estimated economic loss of crop was Rs. 1803982.68 of which 11.05% to paddy, 3.45% to wheat, 20.38% to maize, 5.20% to millet, 4.22% to mustard and 55.70% to potato. The reported economic loss was Rs. 14908.94 per household on an average. The highest loss was in potato. According to market price, the highest was mustard that cost Rs. 50 per kg and lowest was paddy Rs. 14 per kg. in economic loss.

Similarly, Limbu (1998) found the economic loss of Rs. 831966. Highest economic loss 54.89% was estimated to paddy followed by wheat (36.51%) and potato (8.60%) in P. Kusaha VDC, adjacent to KTWR. Baral (1999) found the loss of Rs. 2095346 of which 52.73% in Thakurdwara and 47.27% in Shivapur VDC. Highest loss (28.32%) occurred to paddy, followed by potato (15.40%), maize (15.21%), wheat (13.80%), mussuro (12.42%) and yam (7.57%). Gautam (1999) found the loss of Rs. 947470 in ward no. 19, 13, 18, 15 and 14 of Mahendranagar Municipality adjacent to Suklaphanta Wildlife Reserve. Higher economic loss of 74.28% was estimated to paddy crop followed by wheat (14.08%) and maize (8.62%). Among the wild animals, highest economic loss of 43.29% was estimated by wild elephant followed by Wild boar (28.67%), chital (24.09%) and bluebull (3.29%). Gurung (2002) estimated economic loss of Rs. 554989.31 of which 33.24% to maize, 10.14% to millet, 17.35% to wheat, 19.59% to paddy, 3.39% to mustard and 16.26% to potato.

Similarly, livestock depredation took in the park due to presence of carnivore. Highest loss of livestock in the ward no. 1 and 2 is due to the location at the adjacent to the forest which was easy to attack by carnivore. The total economic loss was less than from crop depredation by herbivore and omnivore but the possibility of higher loss in livestock was greater. The main predators for livestock and avian stock depredation

were leopard (*Panthera pardus*), wild cat (*Felis chaus*), Wild boar (*Sus scrofa*), jackal (*Canis aereus*) and common mongoose (*Herpestes erdwardsii*).

Similar result was reported by Gurung (2002), he found that 280 livestock were killed by wildlife in his study area, Sunkhani VDC, Kathmandu district. The total economic loss was Rs. 48355.

Besides the crop and livestock damage there was also harassment of people from wildlife. They were in dilemma for their cultivation planning in the future. The leopard (*Panthera pardus*) and Wild boar (*Sus scrofa*) were found to become main cause of human harassment in the study area. There were not any losses of human being.

Local people had adopted different kinds of preventive measures to protect their crop damage. For instance, spending night in watch towers and machan, use of noise making tools, beating tins and boxes, chasing with stones, guarding by dogs to deter the Wild boars and other wild animals etc. Shouting and chasing with fires, beating tins and boxes, spending whole night in watch towers and machan were more popular methods.

According to the villagers, spending whole nights in watch towers and machans had an adverse effect on the people's health as well as on the efficiency of villagers' work. They become irritated from park because they lose their valuable time for chasing the wildlife and guarding their crops and livestock. Extra loss of money for keeping dog,

Similarly, local people were unknown about all rule and regulations of park, and at the time of chasing wildlife and other illegal activities created unknowingly or from poachers, they get burden from park. Local people's act of collecting fodder, felling and looping trees, grazing inside the park, moving inside the park without permission especially in the hot spot and breeding season for particular species developed conflict towards park. The main reason of agricultural loss and harassment to the local people occurred due to lack of complete physical barriers between cultivated areas and forest. Lack of planning, lacking of alternative practices for agriculture, ignoring people's needs were responsible for today's problem in Sundarijal VDC. So, the problems are growing more serious than ever.

CHAPTER-VII

7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

The study of park-people conflict was conducted in Sundarijal VDC of Kathmandu district, located adjacent to the northwestern side of Shivapuri Nagarjun National Park. The main objectives of this study were to quantify the amount of crop and livestock depredation, source of conflict between park and local people and to find out possible solution to problems. The survey was done in 121 households by both questionnaire and NAD method to access the crop and livestock depredation. Park staffs and village leaders were also interviewed to know the causes of park-people conflict and its preventive measures. Present study indicates that the poor socio-economic condition creates conflicts between local people and park. The main causes of conflict are breaking the rules and regulations of the park; crop and livestock depredation and human harassment due to wildlife, livestock grazing, hunting and poaching and fodder, timber and firewood cutting by local people inside the park.

Crop damage amounting 101152.94 kg was found due to wildlife in the study area for the year 2009-2010. Out of this total damage, potato came to be first with 66994.47 kg followed by paddy (14226.32 kg), maize (10504.85 kg), wheat (4154.36 kg), millet (3748.86kg) and mustard (1523.81 kg). The study estimated loss of crops was Rs. 1803982.68 of which 11.05% to paddy, 3.45% to wheat, 20.38% to maize, 5.20% to millet, 4.22% to mustard and 55.70% to potato.

Among the wildlife, Wild boar is serious pest species of crop, 32.07% followed by porcupine (17.56%), rats (14.15%), monkey (13.42%), deer (12.89%), bear (5.87%) and birds (4.04%). The main causes of crop damage in Sundarijal VDC were (1) Lack of effective physical barrier (2) Lack of sufficient food inside the park (3) taste of agricultural crops (4) high density of wildlife.

During the study it was found the loss of 11 cows, 12 bulls, 2 buffaloes, 34 goats, 2 pigs, 86 chicken and 2 pigeons by wildlife recently in the study area. There is no loss in duck during the research.

The economic loss of livestock and avian stock was Rs. 293400 and average loss was Rs.2424.79 per household. The main predators were leopard (*Panthera pardus*), wild cat (*Felis chaus*), Wild boar (*Sus scrofa*), jackal (*Canis aereus*) and common mongoose (*Herpestes erdwardsii*). The leopard (*Panthera pardus*) and Wild boar (*Sus scrofa*) were found to become main cause of human harassment. There were not any losses of human being. Leopards were found to visit house to house. Villagers even feel insecure to work in the field and walk through the jungle alone.

Traditional preventive measures include machan, fence and various type of scaring devices, which are partially successful to control the damages.

7.2 Recommendations

Following measures are suggested to mitigate the problem.

1. The food habit of the wildlife should be thoroughly studied and local villagers should be encouraged to grow unpalatable, less preferable crops.

2. Most of people living around the park are illiterate and do not have knowledge about the issue of environmental degradation and its overall impact. They do not know the importance of protected wild animals and forest resources. They do not have better understanding of the role of the park. The education on the importance of park and conservation of natural resources was given to them time to time, they can realize the importance of such park for present and future generation and can enjoy the nature, feel the importance of the wildlife, feel it as their own and for their benefits.

3. Park authorities should make walls and fences around the park.

4. The park should provide preventive measures including the effective noise producing equipments and other scaring devices to chase out wild animals.. Park also has to provide wood for making machan (raised platforms) and should encourage farmers to unite watching the fields.

5. Instead of putting their traditional emphasis on agriculture, the farmers should be encouraged to adopt other occupations such as small cottage industries, poultry farming, tourism and other means of livelihood.

6. Those who live at the proximity of the core area should be shifted to other suitable places.

7. Local people should use modern preventive measures leaving traditional preventive measures.

8. Park office or government should provide compensation for damage.

PLATES

Plate 1: Main gate to enter the national park

Plate 2: Dense forest near the Shivapuri Peak

Plate 3: Catapult to chase animals.

Plate 4: A villager chasing wild animals using catapult.

Plate 5: Questionnarie survey with villagers.

Plate 6: Foot print of Wild boar

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APPENDIX 1

About the issues of Human Conflict in SNP
Household Questionnarie

Name:……………………………………..
Village/VDC:………………………………………..
Ward No.: …………………………………
Occupation:………………………………………..

1.   How many members are there in your family?
        ……………………………………………………………………………
        …………………………………………

2.   Do you have livestock/avainstock?
        Yes……………………………… No………………………………………..
        If yes how many do you have?
        Cattle……………………Buffalo
        …………………………Goat……………………Pig………………..
        Chicken…………………Duck……………………Pigeon…………………
        …….Parrot………………….
        Other…………………………

3.   How many livestock/avainstock were lost due to wild animal?

	Cattle	Buffalo	Goat	pig	Chicken	Duck	Pigeon	parrot	Other
By Leopard									
By Jackal									
By wild cat									
By Common mongoose									
By Bird									
By others									

4.   How much land do you have?
        ……………… Ropani

5.   How much khet and how much bari?
        Khet………………ropani, bari ………………… ropani

6.   In how many ropani of land do you grow following crops?
        Paddy…………… Wheat……………….. Maize……………….
        Millet…………………..
        Mustard………………. Potato…………………. Radish……………….
        Other…………………

7. Do you practise mixed cropping system?
   Yes………………….. No…………………….
   If yes, which crop do you plant together?
   ………………………………………………………………………………
   ………….
8. What is the average yield of crops?(Kg/ropani)
   Paddy………………. Wheat………………. Maize…………………
   Millet……………………..
   Mustard……………….. Potato………………. Radish…………………..
   Other………………..
9. What is the total production of these crops?(In Kg)
   ………………………………………………………………………………….
10. Do wild animals attack on your crops?
    Yes…………………………..
    No…………………………………………………………
    If yes, which are the main wild animals?
    Wild boar……………… Bear………………… Deer…………………….
    Porcupine…………………
    Monkey………………… Bird……………………. Other…………………
11. Which animals attack crops?

	Paddy	Maize	Millet	Wheat	Mustard	Potato	Other
Wild boar							
Bear							
Deer							
Porcupine							
Monkey							
Birds							
Other							

12. What is the frequency of their visit on crops?
    Wild boar………………. Bear……………………..
    Deer……………………………
    Porcupine……………………… Monkey……………………………..
13. What is the total loss of crops?(In Kg)
    Paddy……………. Maize………………. Wheat……………………….
    Millet………………….. Mustard……………… Patato…………………….
14. What is the total lost of crops by wild animals? (In Kg)

	Paddy	Maize	Millet	Wheat	Mustard	Potato	Other
Wild boar							
Bear							
Deer							
Porcupine							
Monkey							
Birds							
Other							

15. If there was no such wildlife damage problem,what would have been the total production? (in Kg)
Paddy…………… Wheat……………….. Maize……………….
Millet…………………..
Mustard………………. Potato…………………….. Radish……………….
Other…………………
16. Any crop you dodn't grow because ofd the fear of wild animals?
Paddy…………… Wheat……………….. Maize……………….
Millet…………………..
Mustard………………. Potato…………………….. Radish……………….
Other…………………
17. Do you apply any techniques to protect your crop from wild animals? If yes, mention
a) …………………… b) ……………………. c) …………………………….
d) ……………………….
18. Because of such wildlife damage problem. Are you thinking of leaving this place and going somewhere else?
Yes……………………………. No…………………………
19. Any other kind of injuries of harassment?
Yes……………………………. No…………………………
20. Have you received any compensation?
Yes……………………………. No…………………………
21. What are the sources of human conflict in ShNNP?
………………………………………………………………………………………
…………………………………..
22. What would be the best controlling measures? Any idea or recommendation do you have?
………………………………………………………………………………………
…………………………………..

Questionnnarie for park staffs
1. What are the main causes that conflict between the park authorities and local people?
a) Livestock grazing…………… b) Hunting and poaching………… c) Fodder cutting……….
d) Crop damage……….. e) Loss of live stock and avianstock……………. f) Human harassment…………….. g) Other…………..
2. In your opinion, why do animals come out of the park and do the damage?
a) Lack of foods insie the park………. b) Crop preference……………..
b) Lack of proper fence…………… d) Other…………..
3. Are the local people aware of the importance of National park and its rule and regulations?
………………………………………………………………………………………
…………………………………..

4. Have you adopted any measures to control the wild animals to come outside the park?

………………………….………………………………………………………
………………………………………………

5. What is the better and permanent solution to minimize the conflict between the park authorities and the local people?

………………………………………………………………………………………
…………………………

Questionnarie for Community Leader

1. What is your perception about the wild animals and national park?

………………………………………………………………………………………
…………………….

2. Would you like to tell your suggestion for the management of the park and maintaining of its balance?

………………………………………………………………………………………
……………………………….

3. Are there any complaints from public sector?

a) Yes…………………. b) ………………………………

4. Have you ever visited park officer about public complaints for solving the problems?

………………………………………………………………………………………
………………………………………

5. What are your suggestions for managing the p-ark using its resources for the local people?

………………………………………………………………………………………
……………………………………….

6. In your opinion, have you found any differences between past and current park management approach?

a) Yes……………….. b)…………………

If yes, what are the differences.

………………………………………………………………………………………
………………………………………..

गाउँले र निकुञ्ज बिच बिबाद सम्बन्धि प्रश्नावली
हरेक घरधुरिमा गरेको प्रश्नावली

नाम...................   गाउ ⁄ गा.बि.स.......................

वडा नं.................   पेशा............................

(१) तपाईको परिवारमा कति सदस्य छन् ?

....

(२) तपाईले बस्तुभाउ पाल्नुभएको छ ?
    यदि छ भने, तपाईसँग कतिवटा छन् ?
    (क) गाइगोरु........... (ख) भैसी.......... (ग) बाखा.......... (घ) सुङ्गुर........
    (ङ) कुखुरा.......... (च) हाँस.......... (छ) परेवा.......... (ज)
सुगा..........
    (झ) अन्य.............

(३) जंगली जनवारहरुले तपाईको कतिवटा बस्तुभाउ नोक्सान गरे ?

	गाईबस्तु	भैसी	बाखा	सुङ्गुर	कुखुरा	हाँस	परेवा	सुगा	अन्य
चितुवाले									
स्यालले									
जंगली बिरालोले									
न्यउरी मुसाले									
चराले									
अन्यले									

(४) तपाईको खेतीयोग्य जमीन कति छ ?
    ....रोपनी

(५) तपाईको खेत र बारी कति छ ?

(क) खेत........... रोपनी (ख) बारी............. रोपनी

(६) निम्न बालीहरु तपाईले कति जग्गामा लगाउनुहुन्छ ?
मकै ....रोपनी
धान............. रोपनी
कोदो ....रोपनी
गहूँ ....रोपनी
तोरी ....रोपनी
आलु ....रोपनी
अन्य ....रोपनी

(७) तपाईले मिश्रित बाली लगाउनुहुन्छ ?
(क) लगाउछु............ (ख) लगाउदिन.............

(८) कुन कुन बालीहरु सँगै लगाउनुहुन्छ ?
....

(९) निम्न बालीहरुको औसत उत्पादन कति छ ? (किलो ∕ रोपनी)
आलु..........
धान ....
कोदो ....
गहूँ..........
तोरी..........
मकै..........
अन्य ....

(१०) यी बालीहरुको पूरा उत्पादन कति छ ? (किलो ∕ रोपनी)
....

(११) के जंगली जनवारहरुले तपाईको बालीलाई नोक्सानी गर्छन् ?
(क) गर्छन्.................. (ख) गर्दैनन्........................

गर्छन् भने मुख्य जंगली जनवारहरु कुन कुन हुन् ?

(क) बदेल.......... (ख) भालु............. (ग) मृग..............
(घ) दुम्सी.......... (ङ) बाँदर............. (च) चरा.............
(छ) अन्य...........

(१२) कुन कुन जंगली जनवारहरुले तपाईको कुन कुन बालीलाई नोक्सान गर्छन् ?

	आलु	धान	कोदो	गहूँ	तोरी	मकै	अन्य
बदेल							
भाल							
मृग							
दुम्सी							
बाँदर							
चरा							
अन्य							

(१३) जंगली जनावरहरु कति पटक तपाईको बाली नोक्सान गर्न आउछन् ?
  (क) बदेल............ (ख) भालु............... (ग) मृग...........
  (घ) दुम्सी............ (ङ) बाँदर............... (च) चरा..........
  (छ) अन्य.............

(१४) जम्मा कति बाली नोक्सान भयो ? (किलोमा)
    आलु..........
    धान ....
    कोदो ....
    गहूँ..........
    तोरी..........
    मकै..........
    अन्य ....

(१५) जंगली जनावरहरुले जम्मा कति बाली नोक्सान गरे ? (किलोमा)

	आलु	धान	कोदो	गहूँ	तोरी	मकै	अन्य
बदेल							
भाल							
मृग							
दुम्सी							
बाँदर							
चरा							
अन्य							

(१६) यदि जंगली जनवारहरुले नोक्सान नगरे जम्मा कति बाली उत्पादन हुन्थ्यो ? (किलोमा)

आलु.........

धान ....

कोदो ....

गहूँ.........

तोरी.........

मकै.........

अन्य ....

(१७) जंगली जनवारहरुको नोक्सान रोक्न के के उपायहरु अपनाउनु भएको छ ?

(क)..................... (ख).....................

(ग)..................... (घ).....................

(१८) जंगली जनवारहरुको कारणले के तपाईले बस्ती सर्ने योजना बनाउनुभएको छ ?

(क) छ................ (ख) छैन...................

(१९) जंगली जनवारहरुले कुनै किसिमको हतोत्साही र चोटपटक पुर्‍याएको छ ?

(क) छ................ (ख) छैन...................

(२०) तपाईले कुनै क्षति पूर्ति पाउनुभएको छ ?

(क) छ................ (ख) छैन...................

(२१) निकुञ्जसँग विबाद हुनुको कारण के के हुन् ?

....

(२२) निकुञ्जसँगको विबाद समाधान गर्ने कुनै उपाय र सुझब दिनुहुन्छ कि ?

....

निकुञ्जको कर्मचारीको लागि प्रश्नावली

(१) निकुञ्ज र स्थानिय बासिन्दाबिच विबादका मुख्य कारणहरु के के हुन् ?

(क) निकुञ्जभित्र बस्तुभाउ चराउनु.................

(ख) जंगली जनावरको चोरी निकाशी र शिकार.................

(ग) निकुञ्जभित्र घाँस दाउरा गर्नु ....

(घ) जंगली जनावरबाट बाली नोक्सान हुनु.....................

(ङ) जंगली जनावरबाट हतोत्साही र चोटपटक लाग्नु..............

(च) अन्य कारण...........

(२) तपाईको बिचारमा जंगली जनावरहरु निकुञ्ज बाहिर आएर किन नोक्सान गर्छन् ?

    (क) निकुञ्जभित्र खानाको कमि...............

    (ख) अन्नबाली मन पराउने..................

    (ग) उपयुक्त छेकबारको कमि....................

    (घ) अन्य कारण......................

(३) के स्थानिय मानिसहरु निकुञ्जको आबस्यकता र यसको निति नियम सम्बन्धि सचेत छन् ?

    ....

(४) जंगली जनवारलाई निकुञ्ज बाहिर आउनबाट रोक्न कुनै उपायहरु अपनाउनुभएको छ ?

    ....

(५) निकुञ्ज र स्थानिय बासिन्दाहरु बिच उठेका विबादलाई समाधान गर्ने राम्रो र स्थायी उपायहरु के के हुन सक्छन् ?

    ....

सामूदायिक कार्यकर्ताका लागि प्रश्नावली

(१) निकुञ्ज र जंगली जनावरहरुप्रतिको तपाईको धारणा कस्तो छ ?

    ....

(२) निकुञ्जलाई व्यबस्थित गर्न र निकुञ्ज र स्थानिय बिच सम्बन्ध सामन्यीकरण गर्ने कुनै सुभाबहरु दिनुहुन्छ कि ?

    ....

(३) स्थानिय बासिन्दाहरुबाट कुनै गुनासाहरु छन् कि ?

    (क) छ............ (ख) छैन....................

(४) स्थानिय बासिन्दाहरुको गुनासाहरुलाई लिएर तपाईले कहिल्यै निकुञ्जका सम्बन्धित व्यक्तिहरुलाई भेट्नु भएको छ ?

    (क) छ............ (ख) छैन....................

(५) बिगत र अहिलेको निकुञ्जको ब्यबस्थापन सम्बन्धि तपाईले कुनै फरकपन पउनुभएको छ ?

    (क) छ............ (ख) छैन....................

    छ भने के फरक पाउनुभएको छ ?

    ....

Table 13: Productivity of different crops:

S.N.	Crops	Productivity (Metric ton/hectare)	Productivity (Kg/Ropani)
1	Paddy (Barse)	2.59	132
2	Paddy (Chaite)	2.59	132
3	Maize (Khet)	0.62	32
4	Maize (Bari)	0.88	45
5	Wheat (Khet)	0.72	37.1
6	Wheat (Bari)	1.00	51.3
7	Millet	1.04	53
8	Mustard	0.92	47
9	Radish	27.52	1400
10	Potato	8.68	442

Source : Kathmandu Agricultural Office

Equivalent
1 ropani = 0.0523076 hectare

Table 14: Local name, Common name and Scientific name of the crops grown in the study area.

Local name	Common name	Scientific name
Dhan	Paddy/rice	*Oryza sativa*
Makai	Maize	*Zea mays*
Ganhu	Wheat	*Triticum aestivum*
Kodo	Millet	*Eleusine coracana*
Tori	Mustard	*Brassica compestris*
Alu	Potato	*Solanum tubersum*

Table 15: Cropping Calendar

Crops	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Paddy (Barse)							←					→
Paddy (Chaite)			←				→					
Maize (Khet)					←				→			
Maize (Bari)			←				→					
Wheat					→						←	
Millet								←				→
Mustard										←		→
Radish		→								←		
Potato (Khet)				→						←		
Potato (Bari)			→							←		

Table 16: Name, area and establishment of Nepal's protected areas

Protected Areas	Area covered (sq. km)	Year of establishment
1. National Parks	**10838**	
Chitwan National Park	932	1973
Sagarmatha National Park	1148	1976
Langtang national Park	1710	1976
Rara National Park	106	1976
Shey-Phoksundo National Park	3555	1984
Khaptad National Park	225	1984
Bardia National Park	968	1988
Makalu-Barun National Park	1500	1991
Shivapuri Nagarjun National Park	144	2002
Banke National park	550	2010
2. Wildlife Reserves	**979**	
Shukla-Phanta Wildlife Reserve	305	1976
Koshi Tappu Wildlife Reserve	175	1976
Parsa Wildlife Reserve	499	1984
3. Hunting Reserve	**1325**	
Dhorpatan Hunting Reserve	1325	1987
4. Conservation Area	**12133**	
Makalu-Barun Conservation Area	7629	1991
Annapurna Conservation Area	830	1992
Kangchanjunga Conservation Area	2011	1997
Manaslu Conservation Area	1663	1998
Total Area	**25275**	
Percentage	**12%**	

APPENDIX 5

Table 17: Protected mammals, birds and reptiles in Nepal

Mammals

Scientific Name	Local Name	Common Name	Status	
			IUCN	CITES
Ailurus fulgens	Habre	Red Panda		I
Antilope cervicapra	Krishnasagar	Black Buck	V	III
Bos gaurus	Gauri Gai	Gaur	V	I
Bos mutus	JangaliYak	Wild Yak	E	I
Bubalus arnee	Arna	Wild Water Buffalo	E	III
Canis lupus	Bwanso	Tibetan Wolf	V	I
Caprolagus hispidus	Pudko Kharayo	Hispid Hare	E	I
Cervus duvauceli	Barasingha	Swamp Deer	E	I
Elephas maximus	Hatti	Asiatic Elephant	E	I
Felis lynx	Lynx	Lynx	E	II
Hyaena hyaena	Hundar	Striped Hyaena	E	
Macaca assamensis	Pahare	Assamese Monkey		II
Manis pentadactyla	Salak	Chinese pangolin		II
Moschus chrysogaster	Kasturi	Himalayan Musk Deer	E	I
Ovis ammon	nayan	Great Tibetan Sheep	I	I
Panthera tigris	Bagh	Bengal Tiger	E	I
Panthera uncia	Hiun Chituwa	Snow Leopaed	E	I
Pantholops hodgsoni	Chiru	Tibetan Antelope		I
Pardofelis nebulosa	Dhwanse Chituwa	Clouded Leopard	V	I
Platanista gangetica	Sauns	Gangetic Dolphin	V	I
Prionailurus bengalensis	Chari Bagh	Leopard Cat		II
Prionodon pardicolor	Silu	Spotted Lingsang		I
Rhinoceros unicornis	Gainda	One Horned Rhinoceros	E	I
Sus salvanius	Sano Bandel	Pigmy Hog	E	I
Tetracerus quadricornis	Chauka	Four Horned Antilope		II
Ursus arctos	Himali Rato Bhalu	Brown Bear		I

Birds

Buceros bicornis	Thulo Dhanesh	Great Horned Hornbill		I
Catreus wallichii	Cheer	Cheer Pheasant	E	I
Ciconia ciconia	Seto Stork	White Stork		II
Ciconia nigra	Kalo Stork	Black Stork		II
Grus grus	Saras	Common Crane		
Houbaropsis bengalensis	Khar Majur	Bengal Florican	E	I
Lophophorous impejanus	Danfe	Impeyan Pheasent		I
Sypheotides indica	Sano Khar Majur	Lesser Florican		II
Tragopansatyra	Monal	Crimson Horned Pheasant		III

Reptiles

Gavialis gangeticus	Ghadial Gohi	Gharial	E	I
Python molurus	Azingar	Asiatic Rock Python	V	I
Varanus flavescens	Sun Gohoro	Golden Monitor Lizard	I	I

Source: Yonzon, P. and Heinen, J. (1997)

Appendix 6

Table 18: Meteorological data on temperature, rainfall and humidity for the year 2007/08 at Kakani station.

| Month	Temperature ^{0}C		Rainfall (mm)	Humidity (%)
	Mean maximum	Mean Minimum		
January	15.36	5.5	21.7	71.28
February	16.6	6.71	30.92	68.99
March	20.71	10.56	46.2	66.6
April	24.62	13.22	68.86	61.99
May	25.12	16.2	260.2	74.8
June	24.95	18.09	441.07	84.7
July	24.67	18.77	578.49	90.44
August	24.7	18.58	692.31	88.17
September	24.04	17.64	352.96	85.12
October	23.02	14.41	55.51	78.53
November	19.72	10.45	17.7	60.64
December	16.15	7.94	21.47	69.1

Appendix 7
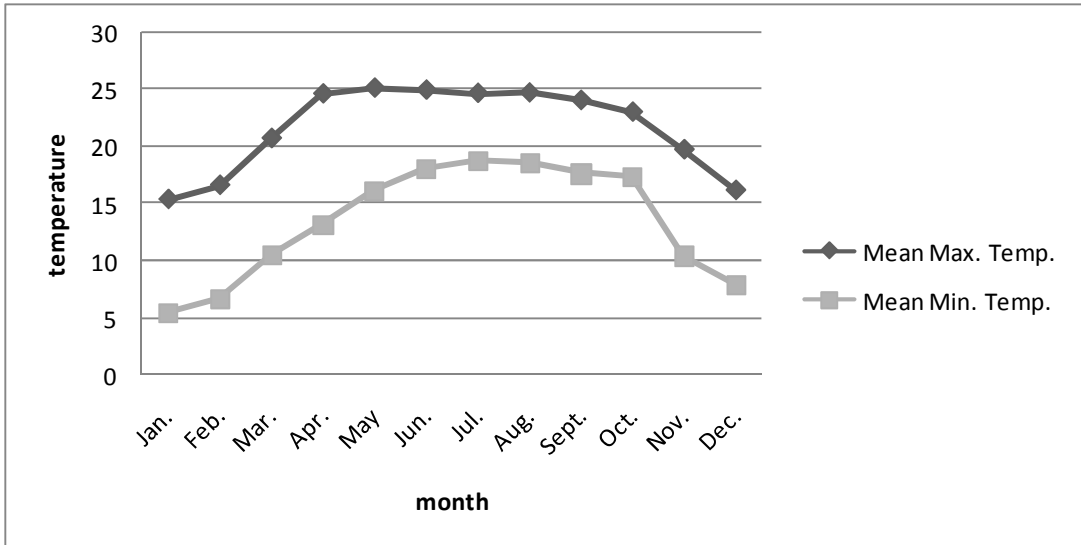
Figure 15: Monthly variation in mean maximum and mean minimum temperature for the year 2007/08 recorded at Kakani station.
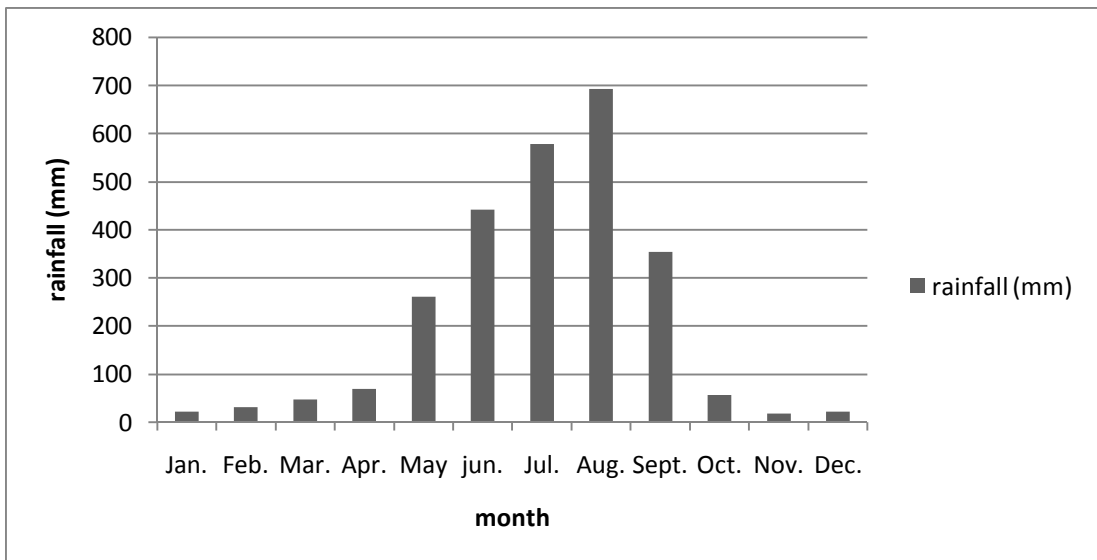
Appendix 8

Figure 16: Monthly variation in average monthly rainfall (mm) for the year 2007/08 recorded at Kakani station.
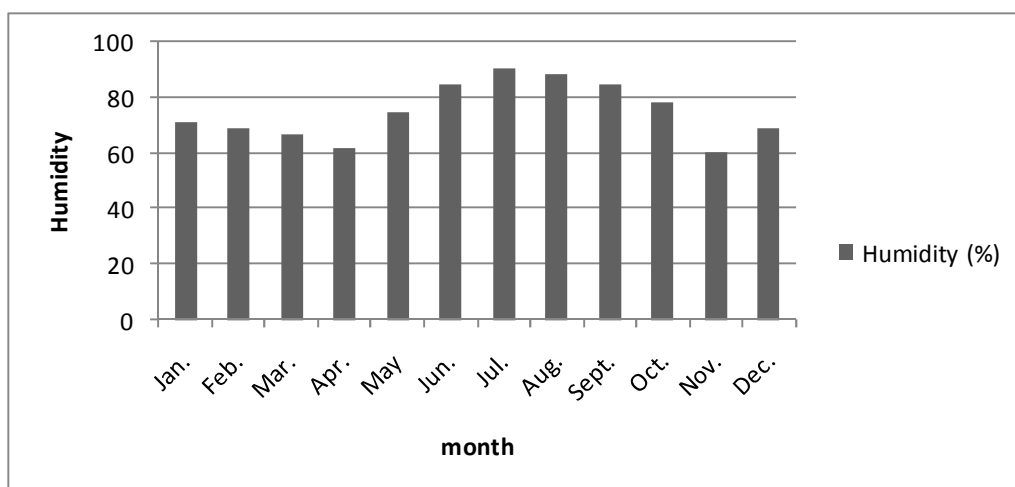
Appendix 9

Figure 17: Monthly variation in average monthly humidity (%) for the year 2007/08 at Kakani station

Appendix 10

Table 19: Effects on park by local people

S.N.	Main causes of effect	Number of respondents
1.	Livestock grazing	6
2.	Fodder cutting	13
3.	Timber and firewood collection	3
4.	Hunting and poaching of wildlife	2