

# CHAPTER I

## INTRODUCTION

### Background

Primate is an order of mammals, which includes the monkeys, apes, humans and other similar forms typically having dextrous hands and feet, binocular vision and a well-developed brain. They are commonly called monkeys, excluding only the tree shrews; the lemur-like forms, the apes and humans and therefore embodies a tremendous evolutionary and adaptive arrangements of animals (Tattersall, 1993).

Primates today are found throughout the tropical zones of South America, Africa and Asia. Within those continental areas where they do occur, primates occupy all types of habitat, from climax rain forest and moorland, on high mountain ranges to open savannah and desert habitat (Dunbar, 1998). In broader sense Primates, now a days are confined 40<sup>0</sup>N to 40<sup>0</sup>S of equator in the moderate habitat (Chalise, 1999).

Monkeys are included under the sub-order Simiiae of order primates. Further monkeys according to the geographical distribution are categorized into two types: New world monkeys and Old world monkeys.

The new world monkeys lack cheeks pouches and nostril open to side rather than down. Area between the nostrils is wide and flat. Most have long prehensile tail and non-have callous pads on the buttocks, E.g. Spider monkeys, Capuchins etc. The old world monkeys have protruded muzzle and well developed cheek pouches, nostrils set close together facing forward and downward. The tail is never prehensile and some species are tailless. Both the hands and feet are adopted for grasping. Callous pads on the buttocks often bright and incase of females swollen during estrus period (Walker, 1968).

In Nepal, only three species of monkeys (Hanuman Langur, Rhesus and Assamese Monkeys) are recorded until to date (Chalise *et al.*, 2005). The Rhesus monkeys (*Macaca mulatta* Zimmermann, 1780) are found freely ranging in wild as well as in urban religious places. The Langur monkeys (*Semnopithecus entellus* Dufresne, 1797) are found freely ranging in

wild forest and marginal areas of Nepal (Southwick *et al.*, 1982). The other species Assamese monkey (*Macaca assamensis* Mc Clelland, 1840) reported from mid-hills and high Montana forest of Nepal, whose ecological and behavioral details are still largely unknown (Chalise, 1999)

### **1.1.1 Rhesus Monkey** (*Macaca mulatta* Zimmermann, 1780)

**Rhesus Monkeys** are found throughout India and Nepal, eastern Afghanistan, and northeastern China and Indochina, and considered pest species by their nuisance behavior. *M. mulatta* is likely the most adaptable to a wide variety of habitats and elevations, from high heat to snow fields to cities. It is partly migratory, sometimes ascending the Himalayas to an altitude of about 2500 m (about 8200 ft) in summer. An adult rhesus has a stoutly built body that may be up to 63 cm (25 in) long, with a tail half that length. The skin hangs in loose folds about the neck, breast, and abdomen. The silky hair is yellowish brown, the naked skin is brown to yellowish-brown, and the large posterior callosities are bright red (<http://encarta.msn.com/en-cyclopedia>, 2006)

Most social groups range from 8-180 individuals of both sexes, but there are generally 2-4 times as many females as males. Dominance hierarchy is more evident among small groups of males than those with more females who tend to live together more peacefully than the males. Breeding tends to occur between high-ranking individuals. The job of the males is to defend the group, while the females form a small internal subgroup to raise the young macaques whose social status within the troop is inherited from the mother. *M. mulatta* is highly vocal sounding a shrill bark for alarm, barking or screeching as an aggression response, a scream when under attack, an aggressive growl, and a squawk of surprise (<http://brainmuseum.org>, 2006)

The young are readily tamed and have been used in menageries and circuses and as “organ-grinders’ monkeys,” but their dispositions worsen with age (<http://encarta.msn.com/encyclopedia>, 2006)

The gestation period for *M. mulatta* is 135-194 days and usually one baby is born. Infrequently a set of twins is produced. Babies are nursed for about one year, first clinging to

their mother's bellies and later riding on her back. Sexual maturity in females is reached between the ages of 2.5 and 4 years while males 2-3 years after that. Females reach menopause at age 25.

Foraging occurs mainly on the ground, but *M. mulatta* is arboreal and an excellent swimmer. As are all macaques, *M. mulatta* is primarily diurnal. Preferred foods include wild and cultivated fruits, berries, grains, leaves, buds, seeds, flowers, and bark (<http://brainmuseum.org>, 2006)

### **1.1.2 Hanuman Langur (*Semnopithecus entellus*)**

Langurs are popularly named after the Hindu monkey-god Hanuman, and considered the sacred animal. Head and body length of female is 40-68cm and that of male is 51-78cm. Approximate tail length is 69-101cm. Weight of adult female and male 11.2kg and 18.3kg respectively. The color of their fur ranges from gray, dark brown to golden with varying amounts of black, depending on the subspecies. They also vary in size - subspecies from the southern part of their range are smaller than those from the north. Hanuman langurs have the largest geographical distribution of the 250 or so non-human primates, and dwell from the Himalayan Mountains to the cultivated plains of Tarai. They are found across India, Pakistan, Bangladesh, Sri Lanka and Burma. Hanuman langurs inhabit tropical, dry thorn scrub, pine and alpine forest, and urban areas. They feed on leaves, fruits, buds and flowers. They live in groups of 11-64, typically 1 male: multi-female, but occasionally multimale: multifemale. They have a home range of 200-1200ha. Hanuman langurs spend up to 80 per cent of their time on the ground, although they will also spend time in the trees. They are diurnal and move quadrupedally. When a new male takes over a troop, he systematically kills all the infants sired by the previous alpha male. After a gestation period of 168-200 days, females give birth to one infant. The infant is weaned after 13-20 months (<http://www.bbc.co.uk/nature/animals>, 2006).

Of all the primates, monkeys, next to human have adapted best to widely diverse environmental conditions. They are found in tropical forests, dry savannas, mountains, villages, temples and even in large cities (van Hooff, 1990).

Human beings and wild monkeys share the common resources to meet daily needs in most part of the country. Human do not accept them and exploit their habitat. It results in the beginning of the monkey and local people conflicts. People often blame that monkeys' population is increasing and wild lifers claimed that habitat has been continuously decreasing. Moreover, rapid increase in human population demand more space and resources resulting in the encroachment of ancestral habitat of wild fauna for cultivation due to shrinking of natural habitat or expansion of agricultural length and organization create a serious environmental problems. The scarcity of prefer food and habitat compels monkeys to cause damage, stolen of food, clothes etc. So, local people and monkeys both are responsible to create these problems.

### **1.1.3 Assamese Monkey** (*Macaca assamensis* and *M. pelpos*)

The local vernacular names of this monkey are Pahare Bandar, Pupa, Timnyau and Kala Ganda. This monkey has darker fur in exposed area while whitish blonde-haired to ashy white in abdominal and inner parts. It has purple snout particularly around the nose while crimsoned red to pinkish red around the eyes and chick. General Assamese monkey consists of nearly 2 ft in head and body length while tail is one-third of it. It is heavier and larger than rhesus weighing more than 12 kg weight (Chalise, 2005).

Assamese monkeys inhabits in the mountains and hills along the Himalayas. It is recorded from Nepal, India (Mussoorie, Assam), upper Burma, south china and north Thailand ranging from 610m to 1830 m asl. Assamese monkeys of Nepal are diurnal animal found along the hills, valleys and upland river basin along the east-west mountainous range with diversified ecological zones. They are found in riverside hill-Sal forest area to mixed deciduous and evergreen forest of *Schima-Castonopsis*, *Elaeocarpus-Macaranga* forests in mid-hills and Quercus-Pine-Rhododendron forest of high mountains. These monkeys are shy, timid and less aggressive to human beings in comparison to rhesus monkey. They are arboreal, terrestrial and omnivorous animals with multi-male and multi-female social troops.

They predominantly leaf eater but will feed on petiole, gum, shoot, flower, fruits, seeds, bark and caterpillar while they do long foraging activities to find young sprouts of grass, aquatic

herbs and their pith, aquatic insects and larva, climb hanging greenish rocks to lick and eat a special type of ground soil. (Chalise, 2005)

### **Statement of the Problem**

Monkey and human being are related in the sense that a particular species of monkey is popularly considered the remote ancestor of present day human. However, with the rapid increment in human population in and around the monkey's habitat, the relationship between these primates has turned into enmity. It is frequently argued that human beings are sole blame of destructing habitat of monkey. It is because monkeys are very often causes of nuisance to local people leading to the seeds of accord between these two creatures. There is a local belief that the population of monkey is becoming increased day-to-day whilst those dealing with wild lives have claimed that the habitat of monkey has been always in the threat by human beings. It can emphatically be pinpointed that large areas have been cleared for farming with the expansion in human population. It has definitely disturbed the natural balance. Vijayapur area is no far an exception to this fate. Their population may be degraded due to exploitation of their habitat and may create so many socio-economic problems in future.

### **Objectives of the Study**

The major objective of research is to analyze the people and monkeys conflict in Vijayapur Area (Dharan) of Eastern Nepal.

The specific objectives of the study were as follows:

- ) To explore the status and general distribution of monkeys in Vijayapur area.
- ) To find out the causes of human-monkey conflicts.
- ) Identify the existing situation of the conflicts between monkey and people.
- ) Assess the effectiveness of deterrence methods used to minimize monkey problems.
- ) Recommend suitable preventive measures to mitigate human-monkey conflict in Vijapur Area.

## **Conceptual Framework of the Study**

Need For

### **Resolving Conflict**

#### **Rationale of the Study**

Each and every species of earth are the member of natural ecosystem and they all have equal right to live on. However, there are some species, the importance of which cannot be overlooked, which cause the nuisance in farming activities. As farming is the mainstay of Nepalese populace, farmers are obviously not in the position to sacrifice their crops for at the

cost of conservation of these species. This has invited the problem of conflict between local people and the species inflicting damages. In many areas of the country, farmers are encountering the problems of wild animals to their arable crops and household properties. Wild monkeys are not far an exception. So there is the need to resolve this conflict vis-à-vis nurturing the natural species. This calls the use of sustainable measure of conflict resolution and resource use. Vijayapur area of Dharan is one of the tourism areas; different animals are the natural beauties and source of recreation for the visitors. Conservation of their natural habitat, besides reducing the level of damage they cause to the local people, could contribute lot in the natural diversity. Besides this, these monkeys are extensively used in the scientific research for the medical use and behavioral studies. This study once carried out would be of particular significance to the people involving in this area and findings could be replicated to similar setting in different parts of the country. This study is, therefore, necessary to note their population, adaptability, conflicts, and socio-economic problems so that they can be managed in proper way without affecting human welfare and monkeys' habitat. Resolving conflict between wild monkeys and local people could lead to the increment in farm productivity thus enhancing their income.

### **Scope and Limitation of the Study**

This study covers about the causes of monkey and human conflict in Vijayapur Area Dhahran. Based on the outcome of this region, generalization cannot be made in overall context. Due to the limitation of time, the study was not sufficient to cover the every facet of monkey human conflict. The relevance of the study basically lies on the response of the respondents assuming they have truth. Regarding the extent of losses caused by the crops, it was difficult to estimate the losses in quantitative value, because respondents were found never to keep such data and hence questionnaire regarding the crop loss in terms of percent, monetary value were omitted.

The outcomes from the study will be valuable information to the person, researcher, organization and other line agencies working in the field of wildlife –human conflict especially focusing in monkey species. The research work will help the Dharan Municipality for the proper management of monkey-people conflict.

## *Chapter II* **LITERATURE REVIEW**

### **2.1 Population Status and Distribution of Monkey in Nepal**

Conservation Assessment and Management Plan (CAMP) workshop 2002 has classified available primates for Nepal. Assamese monkey's of Nepal designated as "Nepal population" from the existing two subspecies (*M. a. assamensis* and *M. a. pelops*) based on the information on their fur coloration, head body tail length and its ratio, size, variation and weight etc. (Sanjaya *et al.*, 2003). It is categorized as endangered species. Three species of Hanuman Langur has been classified as: *Semnopithecus entellus hector* (Lesser Hill Langur) as critically endangered, *Semnopithecus entellus ajax* (Western Himalayan Grey Langur) as Endangered and *Semnopithecus entellus schistaceus* (Central Himalayan Langur) as near threatened. The assessment to the Rhesus monkey (*Macaca mulatta*) was categorized as least concern as its abundance population and larger area distribution.

The latest primate census data recorded these three groups of monkeys in different ecological zones of Nepal from Tarai plain to lap of Himalaya. The population of Assamese monkey recorded in Nepal from different sites shows altogether 282 mature individuals while total population with different age and sex comprises up to 525 (Chalise, 2004). The total counts of Hanuman Langur population around different localities are 719 until to date; however more than 200 mature individuals were recorded. The total population of Rhesus recorded is 1696 individuals, with 1065 inside the Kathmandu valley and 631 out of valley (Chalise, 2004)

In Nepal, Rhesus monkeys are found in tropical rain forest of Tarai to the valleys across of higher elevation of Makalu-Barun, Langtang and coniferous, alpine forest of Rara area too (Southwick *et al.*, 1982). They are in larger number in religious jungles and temples like Pashupati, Swayambhu, Sankhu, Bajrajogini etc. of Kathmandu Valley (Chalise, 1998). Hanuman Langurs, *S. e. ajax* is reported from East Langtang, Melamchi area, *S. e. hector* from Central to West Nepal in outer Tarai, and *S. e. schistaceus* is reported from south to north in Central Nepal (Chalise, 2004)

### **2.2 Human-Primate Conflict**

While human-wildlife conflict is a global wildlife management issue, human-primate conflict specifically is particularly problematic in Asia, Africa and the Caribbean. Baboons were found to be major crop raiders in Uganda (Naughton-treves, 1998; Catherine Hill, 2000) and Kenya (Strum, 1986). Vervet monkeys raid crops in Barbados (Boulton *et al.*, 1996). In



addition to the Tarai region, rhesus monkeys are also a major crop pest in the hills and mountains of Nepal (Giri and Shah, 1992; Chalise, 1997, 2001, 2003; Ghimire, 2000)

In a study made by Naughton-Treves (1998) around the Kibale National Park, compared the farmers' assessment of crop losses with systematic measurements of crop damage by wildlife and found that their perception did not correspond closely to the monitored records. The main factors influencing local risk perception were labour investment, potential for total loss, gender identity and an animal's ability to destroy large crop areas. Farmers ranked maize and sweet potato as the two most vulnerable crops out of ten different cultivated plants, despite monitored records demonstrating that banana suffered the highest percentage of damage. Their perception was influenced by the fact that maize and sweet potato crop could have been destroyed in a single depredation event, while banana fields were never entirely devastated. Moreover, women were principally responsible for cultivating food crops and complained more often about damage to cassava, while men dedicate themselves to cash crops and identified banana as one of the most vulnerable crops. Likewise, the most damaging animals identified were olive baboons (*Papio cynocephalus*), bushpig (*Potamochoerus sp.*) and elephants (*Loxodonta africana*), in reality the redtail monkey (*Cercopithecus ascanius*) was the species most frequently visiting agricultural fields.

People from urban areas are more likely to be bitten than those living in rural areas, largely due to fact that they are ignorant of primate behavior, and states like Delhi, Uttar Pradesh, Haryana and Himachal Pradesh are the worst affected, reporting the maximum number of cases. The reasons for this are many, namely: (1) Extensive urbanization (2) Increased encroachment of forests (3) Haphazard trapping of forest monkeys for biomedical research leading to chaotic fissioning and the related dispersal of monkeys to nearby human habitations (4) Decrease in the number of forest trees, that provide natural food to monkeys (5) Decreased availability of water in the monkey's natural habitat (I have observed monkeys moving between areas in search of water especially during the summer months) (6) Decreased human tolerance to other life forms in the same environment (7) Increase in the population of Rhesus monkeys. (Malik, 2001).

Assamese monkeys are found in the foothills of high hills of Annapurna Conservation Area destroy cultivated crops occasionally and people occasionally kill these animals simply while chasing away them from the crops (Gurung, 2002).

Monkey conflict in Zanzibar [Red colobus (*Procolopus kirkii*), endangered]: On this island, farmers consider most medium and large-size mammals as a threat to their crops and name the red colobus as the third most serious vertebrate pest. This case deserves particular attention because the red colobus is one of the most endangered primates in Africa and in Zanzibar its presence is limited to only 1,500-2,000 individuals, which reside on the island of Unjuga (Siex *et al* 1999).

It has been estimated during 1980, that there were ca. 2 lakh Rhesus macaques in the country, with 30% being found in human habitations. But the present (1999) estimate of over 5 lakh Rhesus macaques of which ca. 55% being found in human habitations is an alarming trend. Consequently, there is also an increase in man–monkey conflicts and in the absence of a management plan of both forests and commensal monkeys, this problem of man–monkey conflict is only going to increase in future (Malik, 2001)

While numerous studies have been conducted on crop raiding in rural areas, human-primate conflict is no less prevalent and damaging in other settings. Southwick *et al.* (1965) briefly mentioned that rhesus were a general nuisance to residents in Uttar Pradesh, India by climbing on balconies and removing clothing from wash lines. Vervet monkey entered kitchens and vehicles to obtain food, destroyed property, attacked and sometimes bite people at tourist lodge in Kenya (Lee *et al.*, 1984). Zhao and Deng (1920) described various interactions, sometimes with fatal outcomes, between religious pilgrims and Tibetan macaques at a tourism and Buddhism center in China. In his thorough literature review on human-macaque conflict in Japan, John Knight (1999) mentions that monkeys have damaged houses, entered kitchens and attacked people.

Crop raiding by Rhesus monkeys is one of the serious problems in Bandipokhara VDC, palpa as in other parts of Nepal (Chalise, 1997).

The adaptability, intelligence and manual dexterity of primates make them a difficult animal to contain and control. Conflict reduction measures are usually costly and often ineffective in the long term, even if the problem is temporarily solved (Strum, 1986).

Conflict between wildlife and people is an important factor affecting the relationship between protected areas and the people who live near them (Studsrod and Wegge, 1995).

A study was undertaken because villagers in agricultural areas adjacent to the southern border of the Jozani Forest Reserve claimed the red colobus' consumption of coconuts (*Cocos nucifera*) to be the cause of serious crop yield losses. The authors found out that, contrary to villagers' perceptions and predictions, the monkeys are not a limiting factor, but instead contributed to a slight increase in the final coconut yield for a 2.8% potential harvest through pruning small and immature coconuts. In addition, the primates are a source of income through tourism. It has been concluded that farmers may have incorrectly blamed the red colobus monkeys for crop damage caused by another less visible species, the Sykes monkey (*Cercopithecus mitis albogularis*); or have intentionally exaggerated their losses in order to receive a greater percentage of the Jozani Forest Reserve's tourism revenue (Siex *et al.*, 1999)

### **2.3 Commensalisms**

Primatologists describe the rhesus as one of the most commensal of all primate species (Southwick and Lindburg, 1986). In other words, it often prefers to live along forest edges, close to human habitation. So, in addition to its varied natural habitats discussed above, this species inhabits villages, towns, cities, road sites, temples and rail stations where it is highly adapted to the presence of humans. In fact, Southwick *et al.* (1965) estimated that only 12% of 802,000 rhesus in North India resided in forests, while the other 78% resided in human habitations. The authors concluded that it is difficult to state what natural habitat for rhesus actually is. While the forest groups tend to be shy and rely almost exclusively on natural foods, the urban groups have become increasingly bold. Rhesus have become one of the most successful old world primate pest species. Characteristics that contribute to its pest behavior

are its adaptability to different habitats and changing environmental conditions, its omnivorous diet and its terrestrial as well as arboreal nature (Strum, 1986).

Saj *et al.* (2001) reported that agricultural area adjacent to a forest zone are worst affected by the vervet monkey. Farms located within 300m of a forested boundary incur the greatest risk of crop raiding. Surveyed gardens 200m from the forest edge received significantly less crop raiding than farms located 100m or 50 (P = .040;  $\alpha = 0.05$ ). They suggested that the development of non-agricultural activities on land adjacent to forested areas may reduce vervet crop-raiding by deterring from traveling greater distances from the forest edge due to increased obstacles or risks.

Monkeys loot shops for food in disputed temple town. Hungry monkeys have gone on the rampage in an Indian temple town. They have been plundering shops selling fruit and vegetables in Ayodhya. Pilgrims usually make offerings of fruits, nuts and food to the monkeys. But visitor numbers have plummeted because of fears of violence between Hindus and Muslims. The site of a razed mosque in the town is at the centre of a nine-year dispute between Hindus and Muslims, who both consider it to be holy. The tension was partly to blame for religious violence that engulfed the western state of Gujarat earlier this year. More than 700 people were killed. Newspaper Aaj Kal reports a policeman who tried to drive away the marauding monkeys had one of his ears bitten off. Animal lovers have bought food for the famished monkeys but say the efforts are barely enough to feed a few hundred and there are over 20,000 in the town. Authorities say they do not have resources to feed them. Shopkeeper Pawankumar Sharma said: "It is unfair to expect them to put on their best behavior when they are cut off from the food they normally get." Millions of Hindu visitors to Ayodhya make offerings to the monkeys who are believed to represent the monkey god Hanuman. S R Prajapati, assistant conservator of forests, said: "We can only hope that things will soon get back to normal. It's sad to see the animals trapped in a human conflict." (<http://lists.ibiblio.org/pipermail/monkeywir>, 2006)

Economic considerations can influence people's perceptions of animals. People in need of food and other necessities may hunt sacred animals for survival. Sacred animals are less

likely to be protected when they threaten human livelihood. Pirta *et al.*, (1997) reported that 83% of the 214 people interviewed in Northern India claimed rhesus macaques often damaged their crops. On the island of Ngeaur, Republic of Palau, local openly despise long tailed macaques, which reportedly destroy their crops. The people of Ngeaur use rifles, dogs and traps or chase or kill monkeys (Whetley *et al.*, 2002).

#### **2.4 Threats to macaques**

While not endangered, the rhesus is under constant threat of natural habitat destruction due to increasing human population. When forests are not totally cleared, they are still often impacted through illegal timber extraction, livestock grazing and lopping. As a result, primate populations are being reduced or eliminated in many parts of the world (Wolfheim, 1983, cited by Richard *et al.*, 1989)

A secondary threat arises when the highly adaptable, commensal rhesus moves into human habitats to acquire its daily needs, often taking up permanent residence alongside humans. Conflict between rhesus and humans is bound to occur. At first it is humans who appear to be the victims of such conflict, however, if left unabated, the roles are reversed and it is the monkeys who become the victims through changing attitudes from that of tolerance and reverence to frustration and anger. The result has been retaliatory killings of rhesus (Southwick *et al.*, 1965; Richard *et al.*, 1989). The erosion of conservation ethics was predicted to result in dire consequences (Pirta, 1986) and sure enough, did result in the extirpation of local populations of rhesus in India and China (Zhang *et al.*, 1989, cited by Southwick and Siddiqi, 1994; Malik and Jhoson, 1994, cited from Knight, 1999). Nepal is not immune to this activity. Ale and Gurung (1995) reported hunting of rhesus in the lower Manang region by farmers seeking relief from crop raiding.

To counter these threats, forest conservation is an obvious priority. In addition, the attitudes of people toward monkeys need to be routinely assessed as Pirta (1986) did with Indian villagers toward crop-raiding rhesus macaques and King *et al.* (1984) did with suburban residents of Malawi toward crop-raiding vervet monkeys. In conclusion, the long-term status of rhesus is dependent on both habitat conservation and addressing the immediate problems experienced by humans.

The main threat of primate conservation in Nepal is habitat loss for agriculture expansion, logging and shifting cultivation followed by the revenge feeling of farmers due to their crop damage (Chalise, 2003).

## **2.5 Monkey Problem Management**

Rhesus monkeys *Macaca mulatta* and people have coexisted for many years in Vrindaban in Mathura District, Uttar Pradesh, India. The monkeys are highly valued both by locals and pilgrims to the area, in part because of their quasi sacred status, but during the last two decades the increasing human and monkey populations of the township have led to severe human-monkey conflict and a decrease in people's respect for the monkeys. To ease this situation one of the world's largest ever translocations of monkeys was undertaken. In 1995, 30 groups of rhesus monkeys, comprising an estimated 1,338 individuals, were recorded in Vrindaban. Of these, 12 groups, a total of 600 individuals, were translocated in January 1997 to eight sites in seminatural-forested areas within the same District. A post-translocation study indicated that the translocated monkeys were settled and appeared to be exhibiting normal behavior. This study indicates that translocation of commensal monkeys to forested areas can be a successful technique for their rehabilitation. (Imam *et al.*, 2002)

To protect crop fields and orchards from wildlife and langurs farmers of Kumbhalgarh Wildlife Sanctuary (KWS), India use many methods. These methods include patrolling the fields, throwing stone with "gophan", keeping dogs, fencing with thorny twigs, potash bomb etc. The most commonly used crop protection strategy in guarding their fields by constant vigilance during crop seasons. (Chhangani *et al.*, 2004)

An interesting case study in from Northern India, where about 260,000 rhesus monkey (*Macaca mulatta*) live in areas of human settlement and translocation has been reported to be the best nondestructive control measure. In the state of Uttar Pradesh, Vrindaban, where the density of rhesus monkeys was extremely high (304 individuals per square kilometre), their presence caused a serious nuisance to inhabitants. They reported suffering from monkeys biting, stealing, damaging and destroying property, such as cars, gardens, house furnishings,

television antennae and electric poles. In 1997, 600 rhesus monkeys were moved from an urban area of Vrindaban to eight different semi-natural forest patches. The density was reduced by 45% of the total original population and this reduced the conflict. The programme was successful as the monkeys that had been moved, did not show any sign of stress and the villagers and their spiritual leaders in the site that received the monkeys accepted and tolerated their presence. Moreover, after four years the translocation took place, the monkey population in Vrindaban remained low and the conflicts were resolved (Imam *et al.*, 2002).

Provisioning has conditioned the animals to be dependent upon food from visitors. This practice has optimized/changed their foraging strategy of macaques by beg-robbing the feeder, especially submissive persons with bags. Provisioning by locals, a staff member, a tourist, or a researcher has influence on altering the macaques' home range, time spent foraging and population growth in relation to food availability (Southwick *et al.*, 1976). Locals and tourists carry food when they visit monkey-populated areas and temples. Most visitors feed monkeys for pleasure. Locals often feed them as an offering. Increasingly, however, food is being used to "pacify" aggressive monkeys (Itani, 1975). A more distressing consequence of provisioning is the increase in biting behavior towards humans (Fa, 1991). Itani (1975) found that the biting behavior was almost non-existent for 4-5 years after the start of provisioning at Mt. Takasaki, but quickly went up to almost 26% of visitors receiving bites. This was most commonly a result from handing groundnuts too abruptly and 11% were due to those who got too close to macaque babies.

Berman & Hua (2002) in a study of "Impact of Translocation and Range Restriction of a group of *Macaca thibetana*" found that infant losses markedly increased following translocation and management. They also found higher intragenic competition for provisioned food in managed groups compared to never managed groups, which may have put infants at increased risk.

In a study of effects of trapping on the vervet (*Cercopithecus aethiops sabaues*) for seven years, the population abundance has remained relatively constant despite of annual catch. The number trapped annually has increased from less than 200 in 1980 to almost 1,000 in 1986. However the proportion of juveniles to adults has increased markedly, largely because of an increase in the proportion of juvenile females. The study showed adults are more vulnerable to trapping than juveniles and the possibility that Juvenile survivorship has increased since trapping began may explain these trends. The change in age structure of the population toward juveniles is one explanation for the claimed increase in crop damage in Barbados at constant population size (Horrocks and Baulu, 2004).

## **2.6 Monkey-Disease Carrier**

The screening of over 2,000 Rhesus captured in the Himalayan foothills of India and imported to the United States of America during the late 1970s revealed that over 40% of the macaques, tested positive for at least one potentially harmful pathogen eg. *Shigella*, *Salmonella* and Herpes B (<http://www.wii.gov.in/envis/primates/downloads/monkeymenace>, 2006)

Health concerns are an important impetus behind conservation efforts. Due to morphological similarities between human and non-human primates numerous diseases can be spread between species, sometimes affecting only one species depending on the primate and the disease (Fiennes, 1978).

## **2.8 Economic loss**

Hanuman Langur raids causes both direct and indirect loss. A study made by Chhangani *et al.*, (2004) at Kumbhalgarh Wildlife Sanctuary (KWS), India, found that Hanuman Langur damage most agricultural crops to a considerable extent. Extent of crop damage depends on the number of troop members and crop protection strategies employed farmers. In the home range of the troop all the farms orchards are raided and damage affected. They found that langurs spoil more crops than they actually eat, juveniles and infants in particular bring about damage during play on the ground as well as on the fruit trees. The damage is up to 27 % of total yield and rarely up to 5 %. The estimate of damage was assessed on the basis of the



information gathered from farmers and through visual observations from 12 farms. The calculated crop damage from two bisexual troops B-1 and B-2 (including one focal troop (B-2)) and two all male bands AMB-1 and AMB-2 comes to about US \$ 900 per annum from a total of 102 animals living in the periphery of crop fields and orchards. If we include the costs of crop protection per household it ranges between US \$ 150-200 per farm per year, which comes to US \$ 1800- 2400 for 12 farms. Besides this direct loss, they also cause indirect loss by feeding upon the flowering and fruiting trees, that reduces the fruit production considerably, which farmers cannot workout. Juveniles and infants break branches blooming with flowers and fruits during play.

## **2.9 Monkeys and Religion**

Hinduism and Buddhism are distinct religions, yet worshipers often use temples interchangeably (Singh, 1999). Both religions share a reverence for nature that stems from their beliefs of reincarnation and karma. Beliefs based on religious values and folklore often serves to protect monkeys at or near temples (Koller and Koller, 1998).

Respects for animals extend beyond the cow to other living creatures, including monkeys in Hindu religion (Chapple, 1993). Monkeys are often considered sacred in Hinduism because they are symbolic incarnations of Lord Hanuman, the Monkey god. Monkeys in India such as the Rhesus macaque and the Hanuman langur represent living incarnations of Lord Hanuman and Hindus would be remiss if they did any harm or failed to help them (Carter & Carter, 1999; Wolfe, 2000). Those associated with Hindu temples, especially Hanuman temples, are protected within temples grounds.

Like Hinduism, Buddhism also teaches a profound respect for nature, especially as it is believed that all animals have been reincarnations of our mothers and fathers in some past life (Burton, 2002). Buddhists are expected to actively conserve animals and avoid actions that they could harm them. As told in the popular tale *The Journey to the West*, the Monkey King, has earned monkeys traditional respect due to his connection to the Buddha and subsequent status in Eastern culture (Burton, 2002). The release of captive monkeys to the forest and the provisioning of gifts such as fruits and vegetables, are common Buddhist

practice (Burton, 2002). Monkeys are highly valued because of Buddha's camaraderie with a monkey during one of his incarnations (Majumuria, 1977)

"Au! Au!" A man pants heavily as he drags a big bag uphill. But, his calls express devotion not pain. Au means 'come' in Hindi, and come they do. Dozens of greyhound-sized monkeys in silvery coats emerge from crevices in the sandstone cliffs, from behind spiky euphorbia bushes, out of the canopy of acacia trees and down from the temple roof. "Le! Le! - Take! Take!" The man opens his bag and places potatoes and carrots in the open palms that surround him. This is Jodhpur, northern India, but you'll find devoted Hindus serving one of their favorite deities - Hanuman - throughout the subcontinent. Biologists call them variously grey langurs, Hanuman langurs or Indian langurs. Hindus call them the incarnations of the monkey god Hanuman, a key player in The Ramayana, an epic story central to Indian culture (<http://www.bbc.co.uk/nature/animals>, 2006).

Religion plays an important role in human-animal relationships in Asia and is a major factor in the survival of many Asian primates (Southwick and Siddiqi, 1994). Buddhists display a wide tolerance to animals and traditionally do not slaughter animals for food. Zhao attributes the survival of Tibetan macaques in China to Buddhism (1994 cited by Knight, 1999). Wildlife has also had a long influence in Hinduism going back 22 centuries. Wild animals have been protected due to their presence in Hindu mythology (Bahuguna, 1986). One epic involves a monkey named Hanuman that helped God Rama fight the demon king Ravana. As a result, monkeys have long been worshipped and fed by Hindus in East Asia (Southwick *et al.*, 1965), resulting in a centuries-long association with Hindu temples and a more recent association with other city areas. Singh (1969) observed that monkey populations were higher in cities of practicing Hindus than elsewhere. The role of religion is theoretically one contributing factor to the commensal nature of rhesus monkeys (Southwick *et al.*, 1965).

In India, traditions and cultural/religious attitudes towards wild animals make local people more tolerant towards wildlife, despite its damage to crops and livestock. Orthodox Hindus for instance consider monkeys to be sacred animals, to be revered and protected. This

religious belief and traditional attachment to monkeys greatly influences people's perception of the conflict, resulting in its partial acceptance (Imam, 2002)

### **2.10 Monkeys and their Biomedical Research Use**

Because they are physiologically similar to humans, Rhesus monkeys have been used as research animals to an extent that has greatly reduced their population; India now bars their exportation. The monkeys have been used extensively in research on human blood chemistry, and the Rh factor in blood derives its name from them. Psychological studies carried out on the animals have aided in the understanding of infant-mother relationships in humans, and rhesus monkeys were launched in high-altitude tests of rockets following World War II (<http://encarta.msn.com/encyclopedia>)

Rhesus monkeys are used extremely as an experimental animal in many primate centers, biomedical institutes and psychological research because of similarity of Rh factor in human blood and in Rhesus monkeys. Similar diseases have been found in Rhesus and human such as small pox, measles, tonsillitis, harps 'B' causes by viruses, tuberculosis, bronchitis, tetanus, cold and cough by bacteria. The medicine against AIDS has been experimentation on Rhesus monkeys, which are most successful events in the medical sciences that increase the life span of human by the use of medicines. The other dangerous disease such as hepatitis B, swelling of liver, cancer has been experimented on them and the successful result has overcome to save human life (Chalise, 2004 b).

## *Chapter III* **STUDY AREA**

### 3.1 General Description

The study area lies in the Dharan Municipality of Sunsari District of Eastern Development Region of Nepal. Dharan is situated between  $26^{\circ} 46' 30''$  N to  $87^{\circ} 14' 14''$  and  $26^{\circ} 52' 30''$  to  $87^{\circ} 18' 27''$  E. It's altitude range from 305m to 700m. It's boundaries in east is Seutikhola (Panchkanya VDC), Sardu Khola (Bishnupaduka VDC) in west, Vedetar and Panchkanya VDC in North and Charkoshe Jhadi in North. The total population of Dharan is 95,332 comprising male 47,121 and female 48,211. The population density is 922.15 per sq/km and growth rate is 3.56%.The total land is 2,112 hectare. Of the total area, residential area occupies 614 ha, forest cover 155 ha, river 155 ha, river area 157ha (Shrestha, 2057)

### 3.2 Glimpse of Study site

The study site Vijayapur is 550 Km far from Kathmandu. The history of Vijayapur area is 225 years old. It lies in the top part of Dharan Municipality in the latitude of  $26^{\circ} 49' 14.5''$  N and  $87^{\circ} 17' 26.8''$  E longitude. It is in the height of 430m to 570m. The study site cover the total area of ward no. 14 and some part of ward no.13,1 ,2 , 3 and 15. The land cover is about 350 ha and includes about 1000 households. The study area is the historically important and religious place. The are numbers of famous temple in Dhahran in this site viz. Panchkanya mandir, Pathivara mandir, Bindabasini mandir in Block A of the study site, Shivamandir, Hanuman mandir in the Block B, Singhadevi and Krishna mandir in block C and Budda Subbha and Pindeshowri mandir in Block D.

#### 3.2.1 Topography

Geologically Vijayapur area is located in the Siwalik foothills, situated between Mahabharat range in North and tarai range in south. The geological formation of the study area is tertiary Siwaliks and composed of Tertiary sandstone, siltstone, shale and conglomerate (Joshi, 1986). The structure of the Siwaliks is fragile because of which their origin is thought to be quite young. Soil is loamy in the Siwaliks while it is more alluvial in the Tarai (MPFS, 1988).

**Figure 1.** Map of Sunsari District Showing Dharan Municipality



**Figure 2. Map of Dharan Municipality Showing Study Site**

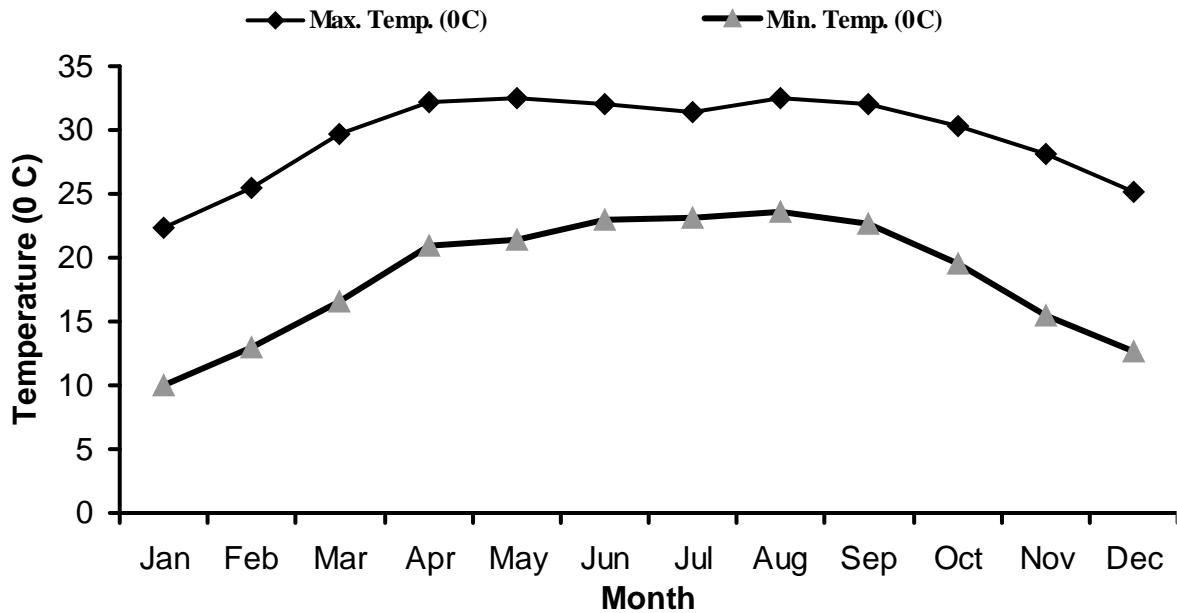
### **Figure 3. Map of the Vijayapur Area**

#### **3.2.2 Climate**

The climate of the study area is under sub tropical monsoon. Although, it is situated above about 500m from sea level, four distinct seasons were identified in this area. It is little bit



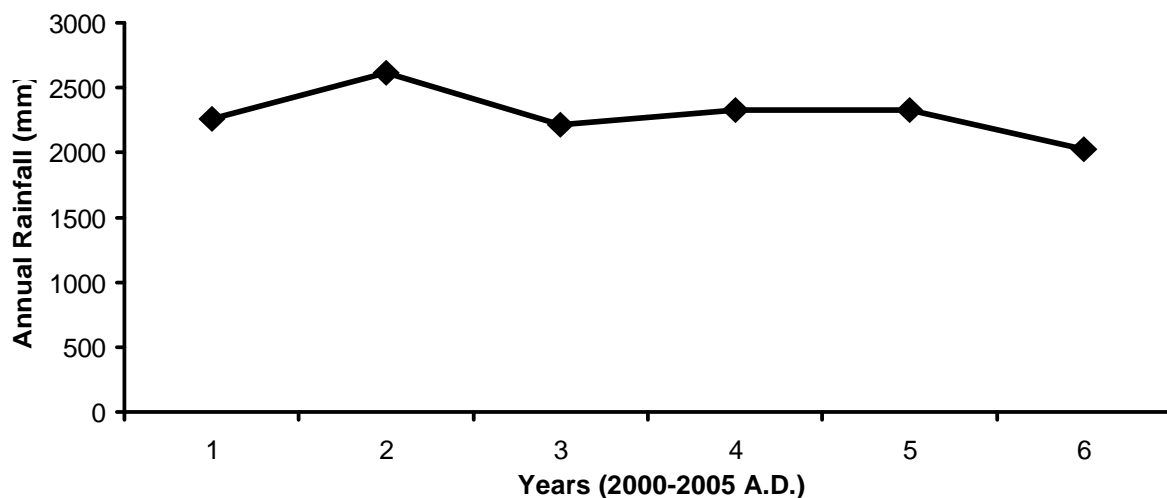
cold in winter with longer warm period in summer. The maximum average temperature reaches up to 30°C in the summer and minimum average temperature in winter is 14°C (Figure 4).



**Figure 4.** Average Maximum and Minimum Temperature of Dharan (2000-2005 A.D.)

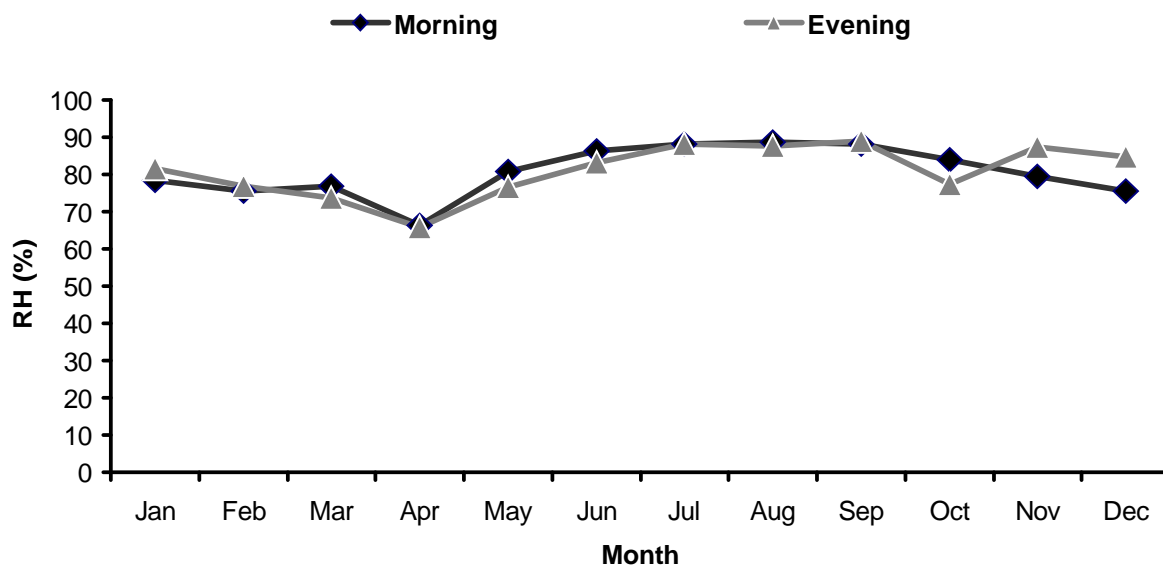
The study area is regarded as second highest rainfall receiving place. Almost 90% of the rainfall occurs at June to September during rainy season (Figure 5) where as average annual rainfall is 2185 mm per annum (Figure 6). The rain bearing wind blow from bay of Bengal towards the west of Nepal in the rainy season.

**Figure 5.** Average Monthly Rainfall (2000-2005 A.D.)



**Figure 6.** Average Annual Rainfall of Dharan

The relative humidity (RH) infact is higher in eastern region than western region indicates that air has absorbed water vapors in the highest percentage. Because of the higher amount presence of water molecules in the monsoon wind, the temperature of the air decreases and its capacity to hold moisture decreases in the summer. The RH is higher in the summer (90%) and lower (65%) in the winter. The RH is maximum in morning than in evening (Figure 7). Although night of most area of Dharan receives dew, the Vijayapur area does not receive any dew.



**Figure 7.** Average Monthly Humidity at Morning and Evening Time (2000-2005 A.D.)

### 3.3 Flora and Fauna of then Study Site

#### 3.3.1 Flora

Some of the common flora of this study area are as follows: Sal (*Shorea robusta*), Chilaune (*Schima wallichii*), Siris (*Albizia procera*), Bhakkiamilo (*Rhus javanica*), Amala (*Phyllanthus emblica*), Bhalayo (*Semecarpus anacardium*), Harro (*Terminalia chebula*), Barro (*Terminlia bellirica*), Bel (*Aegle marmelos*), Fandir/Jamun (*Syzygium cumini*), Pipal (*Ficus religiosa*), Angeri (*Berchemia edgeworthi*), Asare (*Osbeckia stellata*), Dabadabe (*Symplocos ramosissima*), Karam (*Adina cordifolia*), Bar (*Ficus bengalensis*), Kaju (*Sterulia foetida*), Masala (*Eucalyptus citriodora*), Khanyu (*Fisus semicordata*), Khirro (*Sapium insigne*), Khasreto (*Fiscus hispida*), Rajbrikshya (*Cassia fistula*), Simal (*Bombax ceiba*), Simali (*Marraya paniculata*), Kimbu (*Morus nigra*), Kera (*Musa paradisiacal*), Supari (*Areca catechu*), Mango (*Mangifera indica*), Katahar (*Artabotrys uncinatus*) etc.

#### 3.3.2 Fauna

The fauna inhabiting the Vijayapur area are as follows. The mammalian fauna includes Jackal (*Canis aurens*), Squirrel (*Callosciorus* sps), Jungle cat (*Felis chans*), Procupine (*Hystrix indica*), Common Mongoose (*Herpestes edwardsii*), Pangolin (*Manis* sps.), Leopard cat (*Priouilurus bengalensis*), Forest rat (*Bandicota* sps), Fox (*Vulpes vulpes*).

Since the study area is near to Koshi Tappu, many species of birds seen around. Some commonly found bird species recorded are: Common maina (*Acridotherus tristis*), Cuckoo (*Cuculus* sps), Common Koel (*Eudynamus scolopacea*), Black kite (*Milvus migrans*), Eagle (*Spilorus cheela*), House crow (*Corvus splendens*), House sparrow (*Passer domesticus*). The reptilian species includes Garden Lizard (*Calotes versicolor*), Cobra (*Naja naja*), King cobra (*Ophiophagus* sps.), Dhaman (*Ptyas masosus*), Hareu (*Amphiesma stolata*) etc.

## *chapter IV*

### Materials and Methods

#### **4.1 Equipment**

Following equipments were used during the field study

- a. Binoculars   b. Measuring tape   c. Digital camera   d. Topo map   e. GPS

#### **4.2 Methodology**

##### **4.2.1 Reconnaissance Survey**

A preliminary survey of the study area was done on September 2005 to find out the monkey distribution, habitat and monkey affected areas in Vijayapur before starting of regular fieldwork. The survey process included field observation, interaction and pretesting of questionnaire with local people.

##### **4.2.2 Field Survey**

Fieldwork was carried out in the second and third visit in the month of June and September 2006. During the field survey related information were collected by using various methods.

##### **4.2.3 Sampling Method and Sample Size**

Stratified random sampling method was used to select respondents for the study. The study site was first divided into four strata: Block A, Block B, Block C, Block D. From each block 25 respondents were selected randomly. Hence no. of respondents from each block was 25 and as a whole the sample size was 100.

##### **4.2.4 Data Collection Methods and Procedures**

*Both the primary and secondary data were collected for the study.*

#### ***4.2. 4.1 Primary Data Collection***

##### ***4.2.4.1.1 Households questionnaires***

A pre-tested semi-structured questionnaire was used to interview the respondents. A questionnaire containing information like the monkey visitation, monkey related problem, preventing methods used by the locals, possible remedial measures of conflict etc. was used to collect the information from respondents (see appendix I). Most questions were fixed alternative for easy scoring and analysis.

*Secondary data related to the study was reviewed from different books, annual reports, news article, research report, dissertation, journal, website, visiting different concern offices, library.*

#### **4.2.4.1.2 Monkeys population and distribution study**

The head count of monkey population was done with the help of binoculars. First of all, the regular observation was done both early morning and evening time to locate their distribution in different study sites. A regular watching was conducted without disturbing natural setting. Repeated observation was made in focal troop to identify individually and to recognize their home range.

#### **4.2.4.1.3 Troop composition and age/sex composition**

Troop composition was separated by direct counting the individuals in each group and age sex ratio were distinguished by their body color, body proportion, height and body size (Roonwal and Mohnot, 1977).

The closest animals in a troop with distinct territory are taken as the individuals of one troop. The composition of the troop was differentiated into Adult males, Adult females, Sub adult males, young adult females, Juveniles and infants according to their body size, coloration and behaviors.

**Adults** were those attained the maximum height and body maturity. Adult males were distinguished by large sexual organs. Females were distinguished with small head and protruded nipple.

**Young and sub adults** were those who attained the height however not matured in body fitness and sexual activities. They were grown up one and independent.

**Juveniles** are the individuals that are left nipple contact (weaned) and depend on natural other foods and mostly following mother.

**Infants** are those who still suck the nipple as their main food.

#### **4.2.4.1.4 Ad-libitum sampling**

This is a sampling technique in which additional information on rare events and on general occurrence (behaviors) in the troop is noted down systematically (Chalise, 1995). This

method was adopted to take information was adopted to take information about the events of conflict and other behaviors that are not in fix time period.

Following events of conflict were categorized and considered for his study.

### **1. Aggressive Interaction by Monkey**

**Threat:** One or more of the events with direct eye contact with the recipient such as head bob facial grimace, charge threat etc.

**Biting and nail scratch:** Monkey inserting its nail or teeth into skin or any part of human.

**Food snatching:** Grabbing the food carried by human or stored in the house

### **2. Aggressive interaction by Human beings**

**Stone throw/catapult:** Throwing stone, rock or wooden log towards monkey by hand or via catapult.

**Chase out:** running towards monkey with or without carrying stone. Stick or any weapons may be used.

**Charge threat:** Monkeys head bob stimulation, small steps towards monkey and giving throw the motion of throwing object towards monkey.

**Shout:** Yelling high sound in the direction of monkey.

**Encroachment of Habitat:** Cut trees or clear the natural vegetation or collection of firewood, fodder or natural foods including cattle grazing.

#### **4.2.4.1.5 Quadrat method**

To study the vegetation pattern of natural forest of Panchkanya. It is divided into three transect of more or less equal difference. And to study the true of each side, a Quadrat of 10m x 10m was laid down randomly. The plant local name was identified by the experience person working as a forest guard. The different characters of vegetation were determined in terms of dominance, diversity and relative density.

Simpson's index of Dominance  $fCAX \frac{ni^2}{N}$

Shannon Index of general diversity  $\bar{H} XZ \frac{ni}{N} \log \frac{ni}{N}$

Where,

ni = importance value

N = Total no. of importance value (Odum, 1996; Krebs 1994)

Relative Density  $fR.D.AX \frac{\text{No. of individual Species 'X'}}{\text{Total no. of all Species}} X 100\%$

#### **4.2.5 Data Analysis and Presentation**

*Households questionnaires responses were carefully processed, arranged to make sense to researcher for report writing. The collected data was edited, coded and tabulated. The editing was done thoroughly for analysis and interpretation. Both descriptive statistics (percentages, frequencies) and Inferential statistics (probability value) were used to analyze the data. Statistical softwares Epiinfo 2002 and Epi cal were used to analyze the data statically. Prevalence proportion at 95% confidence interval was calculated by Epi cal. Chi square test was used to look the associations among and between different study factors. Charts, table, graphs, bar diagrams were used to present the data in most simplified and understandable form.*

## CHAPTER V

### RESULTS

#### 5.1 Monkey of the Study Site

All the respondents (N = 100) in the study site reported the presence of two species of monkey: Rhesus Monkey and Hanuman Langur.

**Plate 1.** Hanuman Langur (*Semnopithecus entellus*)



## 5.2 Distribution of Rhesus Monkey and their Population

A total 203 individuals of four troops of Rhesus monkeys were observed in four different study blocks of Vijayapur Area. One troop with 26 individuals in study block A, One troop with 61 individuals in study block B, 2 troops with 116 individuals in study block C and no troop in D block (Table 1). The maximum number of monkeys were reported from block B and C, whereas no monkey troop was reported from Block D during the study period. The higher population of monkey in B and C block may due to their suitable habitat for resting, grooming, self protection etc. as these areas are full of with trees, open ground, water sources. Similarly it is near to human settlements and temples, where they can easily get food.

**Table. 1** Rhesus Monkey Troops in Different Study Blocks of Vijayapur Area

Block	No. of Rhesus monkey troop	Total population	Location
A	1	26	Panchkanya
B	1	61	Hattisar
C	2	44	Dantakali,
		72	Singhadevi
D	No	-	-
Total	4	203	

The variance to mean ratio was used to determine the distribution pattern of rhesus monkey in different troops. The calculated value of variance to mean ratio  $S^2/\bar{x}$  was found to be 5.98. Since the value of  $S^2/\bar{x} > 1$ , the results showed that uneven or clumped type of distribution pattern, which is the commonest pattern of the distribution of the mammals.

Here chi-square value at 3 degrees of freedom (0.05) level of significance is 19.60 compared to tabulated value 7.815 and p value is 0.000. That means, there is significance difference in population distribution of rhesus monkeys in different place of vijayapur area.

### 5.3 Distribution of Hanuman Langur Monkey and their Population

*One troop of Hanuman Langur with total of 19 individuals was observed in study block B and C/D (Table 2.). This group is one male multi-female type. The distribution of common Hanuman Langur was reported from lower western forest of Hattisar and Dadagaun (from Ekaldhare, Duidhare and Tindhare). These are the areas with quite abundance of palatable plant species and is undisturbed areas suitable for Langur. Natural forest of this area is also linked with fruit crops. So due to availability food Hanuman Langur are found in these part of Vijayapur.*

**Table 2.** Distribution of Hanuman Langur and its Population

Block B and C	Total population	Location
Adult male	1	Ekal Dhare (Hattisar), Dui Dhare (Dhantakali), Tin Dhare (Dada gaun)
Adult female	2	
Sub-adult male	2	
Sub adult female	5	
Infants	4	
Juveniles	5	
Total	19	

### 5.4 Group of Monkey Damaging More

Majority of respondents i.e. 92% (N = 100) agree with the Rhesus monkey as the damaging one than other group of monkey. They are more commensal and visits to human residential area and causes nuisance to human welfare by raiding crops, garden fruits, grabbing and taking food materials, clothes, frightening children and women, moving over the roof of the

house and disturbing night sleep etc. This is due to the distribution of Hanuman Langur in small part of Vijayapur. However, a few respondents were found of different view in the regard (Figure 8), Langur are less commensal compared to Rhesus. So they mostly stay in natural forest area. However, in condition of food scarcity, they often visit to near by crop fields for crop raiding.

**Figure 8.** Percentage of Damage by Monkey Species

### **5.5 Extent of Monkey Problem**

*Regarding the degree of monkey problem, most respondents (46%, N = 100), monkeys are creating high problem in their welfare (Figure 9). Monkeys are becoming increasing problem to human life in different ways. These shows the almost all respondents of the study site were found suffering from the monkey problems, though degree of damage level varies according the nature of monkeys, place of human settlements, distance from natural habitat etc. People from densely populated areas were mostly suffered from home raiding by monkey and causing nuisance in their daily life where as people quite away to city area were found the problems crop raiding.*

**Figure 9.** Extent of Monkey Problem

High level of monkey problem is reported by the respondents of study block B followed by A and C (Figure 10). **Figure 10.** Extent of Monkey Problems in Different Study Blocks (N = 100)

Block B and C are densely populated area compared to other one's. Provisioning and being near to monkey habitat, the problem is further exacerbated.

### **5.6 Problems Caused by Monkey**

Respondents of study site reported monkeys are affecting their welfare in different ways (Figure 11). It was found that although monkeys of these areas harass all residents, crop

growers, office-goers, students and visitors, the degree of harassment varies between these groups. Residents are the worse affected as the monkeys raid their crops, homes and gardens, which leads to a vicious circle of aggression between the two resulting in the maximum number of cases of biting. The second category comprises office-goers who are also equally harassed, but are less likely to be bitten as most are adult males get bitten in their localities and not at schools. This is true, as in schools that are monkey infested, children move around in groups (security in numbers), along with guards who have a *lathi* (long bamboo stick) in their hands. This deters the monkeys from attacking. It is my personal observation that women and children are harassed and bitten more than men, as monkeys are more aggressive towards those humans whom they think that they can easily dominate, and these are likely to be women and children

**Figure 11. Monkey Related Problems (N = 100)**

The chi-square value with degree of freedom 4 is 38.57 compared to tabulated value 9.488 at 0.05 level of significance and probability value (P) 0.000 shows that there is significance different in nature of damage caused by monkeys.

Among different study blocks of Vijayapur Area, crop raiding was the major problem of study block A and D (as reported by 92% and 88% of respondents respectively; N = 25/Block). Similarly, house raiding by the monkey was the major problem in study block B and C as reported by the 72 and 64% of the respondents (Figure 13).

**CD** = Crop Damage; **GT** = Grabbing/Taking; **DC** = Damaging cables; **BS**= Biting/Scratching; **Os** = Others

**Figure 12. Monkey Related Problems in Different Blocks of Study Site (N = 25/Block)**

### 5.6.1 Crop Damage

Of the total respondents, majority i.e 76 respondents who are directly involved in agriculture reported crop raiding as the major problem. Monkey damage crop by different ways, sometimes eating the harvestable part, sometimes premature dropping of fruits and flower buds and sometimes uprooting the whole plants.

*The people of block A, were found to mainly suffer from crop damage problem. It is the nearest area from monkeys' natural forest of Panchkanya. Continuous grazing of animals, collection of fodder from the forest, depletion of natural regeneration due to improper management of forest had diminished the monkey palatable plant species in the forest, resulting in the movement of monkey towards nearby agri-crop field to furnish their hunger.*

Crop mostly eaten includes maize (49%), Vegetables (11%) pulses, potato, tomato, carrot, radish cauliflower, pumpkin, eggplant, cabbage, fruits (23%) like banana, mango, litchi, nuts etc (Plate 3, 4). Maize (as reported by 49% respondents) and fruits such as banana, mango, litchi, nuts, guava etc. (as reported by 23% respondents) are reported to be worst affected (Figure 13). Besides, vegetables (as reported by 11% respondents) such as potato, beans, cabbage, cauliflower etc., millets, mustards were found to be damaged by the monkey in the study site

**Figure13.** Percentages of Crop Damage by Monkey in Vijayapur Area.

However crops like lady's finger, peas, soyabeans, coriander, ginger, turmeric and chilli were less preferred by the monkey (Plate 5).

**Plate 3. Mango Fruits Damaged by Monkey**



**Plate 5. Farmers Growing Turmeric as Being Less Damaged by  
Monkey**

**5.6.2 Harassment**

*Besides crop damage monkeys were frequently found to cause harassment by different ways. women and children alone in the pathway were most suffered from monkey. Monkey bite, scratch, teasing, fell down while running is commonest problem (Figure 14). Movement along the roof of the houses there by disturbing night sleep (Plate 6), shaking of the water pipelines, knocking over and breaking the clay flower plots (Plate 9), dragging clothes off the line from (Plate 8), entering into the house through the window, door (Plate 7) etc. were the frequent nuisances caused by the monkey.*

*Because of urbanization, there is lack of natural food for the monkeys. They frequently visit in these human settlements causing aforementioned happenings.*



*Further religious faith of the people showing care and sympathy towards monkey had aggrandized the problem. Provisioning is high in these areas. Some people (especially Madwari) are the blind supporter of monkeys regarding them as a symbol of god Hanuman. Entry of monkeys in their house is regarded as the entry of the god. They do not take and harmful activities towards the monkeys. People of Madwarai group feed monkey in temple during Puja. Monkey wants to stay mostly in the human settlements area. There are three different Hanuman temples in these areas. Mukesh Agrawal, a local resident of ward no. 1, said that people were used to make daily offerings of food to monkeys in these temples in earlier days.*

*Realizing the increasing problems of monkey, now they had discontinued the trend of regular artificial provisioning in the Hanuman Mandir. However, such food offerings are still being made in different locations outside the Mandir. This tradition of provisioning and sympathy had caused changed in monkey behavior. They are increasingly becoming dependent for food offerings by human.*

**Figure 14.** Monkey Harassment by Biting, Scratching and Chasing (N =100)

*The people of Block D (Budha Subba, Nayatole and Pindeshowri) were not so suffered from monkey problems from last five years. Before, five years also, there were severe monkey problems. Following this, people cut all bamboos and often trees during five years due to monkey problem and this process is still continued. Urbanization has increased. Though this site is popular for the production of agricultural crops, the people of this area are comparatively least suffered from monkey due to the lack of forest for the habitation of monkey. It can be inferred from the study that degree of crop damage is also directly related to the distance from of natural habitat of the monkey i.e. lower the distance higher will be level of damage and vice versa. This shows that lack of*

*suitable habitat for the protection reduces the damage to the crops though there is ample availability of crops in the field.*

**Plate 8.** Clothes Carried Away by the Monkey

**Plate 10.** Monkey Moving Over the Electric Cables

5.7 Monkey Deterrent Strategies

*People are found to use different methods to keep monkeys from entering their home, garden or personal space. They have the difficult task of simultaneously*

*guarding vegetables laid out to dry, the garden, clothes on the line. Shopkeepers kept catapults and sticks within reach to protect their food stock. Women were seen rushing out of their houses waving sticks waving sticks as monkeys approached their gardens. Women guarded their drying foods by shouting and throwing stones towards approaching monkeys. Boys were often observed chasing after monkeys with catapults. In fact, most boys and men throughout the entire study site were observed to have a catapult in their hands or back pocket.*

**Figure 15.** Various Deterrent Methods against Monkeys (N =100)

**Plate 13.** Screening the House to Ward off From the Monkey

*Stone throw-catapult was reported and observed to be most effective method to ward off monkeys as reported by the 92%, 68% and 84% respondents respectively of block A, B, and C (Figure 16). This is because it can charge from long distances, cheaper, easily available in local markets and monkey also affected strongly. However, this can be only temporary means to ward off the monkey.*

**Figure 16.** Different Deterrent Methods Against the Monkeys (N = 25/Block)

With the personal communication with Mr. Nanada L. Giri, 60 yrs old local inhabitant reported that once upon a time (around 2043-2044 B.S.), people of Vijayapur chased away monkey far from the city. However, before returning back to the city, they saw monkeys, which were chased by them. They thought this is due to the will power of god. So then they never tried to chase the monkeys. However, cases of killing the monkey in extreme cases by the locals was also found in the study. In the course of interaction, the guard of the Hattisar campus reported that he had killed 3 monkeys during 2046 B. S. by use of Bhala (A long

stick with pointed metal end) as he was irritated with the nuisance of monkey which were frequently entering the kitchen.

He also revealed the history of mass translocation of monkey from Vijayapur area, Dhahran. Monkeys were trapped by dating (injecting analgesic into monkey body with the use gun), kept in net and loaded in truck to another place with the involvement of foreigner people. This clearly shows that the problem of conflict between monkey-human was existed long time back in Vijayapur area.

### 5.8 Causes of Monkey Destruction

*People of the study site reported that monkey problems are increasing to greater extent particularly from last 4 to 5 years back. Different people gave different arguments on the increasing problem. Food scarcity, increasing population of monkey, habitat destruction due to urbanization, internal migration etc. was reported as the cause beyond this (Figure 17). Majority of the respondent agree on the food scarcity as the major cause. Due to food scarcity, they are forced to move towards people residential area where they can obtain their food materials. They raid the crop, garden, enter the home through opening and carry everything what they find. Further increasing human population is destructing their natural habitat. Forest encroachment for land to support increasing population, timber and fodder to livestock is disturbing the natural habitat of the monkey. This is further aggravating the problem. Community near to forest area is facing more problems from the monkey. They stay in the forest and frequently visit to community from there. When they find problem in community, they immediately enter into the forest for safeguard. Artificial feeding especially by Madwari had lured the monkey*

*towards residential area. They show sympathy to monkey because of religious faith. They symbolize monkey as Hanuman. Because of this activity, monkeys are becoming increasingly not afraid of human. They frighten children and women and grab the food from their, as they feels they can easily dominate them.*

**FS** = Food Scarcity; **IPM** = Increasing population of monkey; **MHL** = Monkey habitat loss; **IM** = Internal migration; **AP** =Artificial provisioning; **RF** = Religious faith

**Figure 17.** Categories of Causes of Monkey Being Destructive

The chi-square value with degree of freedom 5 is 18.02 compared to tabulated value 11.070 at 0.05 level of significance and probability value (P) 0.002 shows that there is significance difference of causes of monkey problems.

Food scarcity as reported by 64%, 84%, 92% and 76% respondents of study block A, B, C, and D respectively was the major cause for increasing problem of the monkey (Figure 16 & 17). The different causes reported by the respondents for increasing problem of monkey is related to each other.

**FS** = Food Scarcity; **IPM** = Increasing population of monkey; **MHL** = Monkey habitat loss; **IM** = Internal migration; **AP** =Artificial provisioning; **RF** = Religious faith

**Figure 18.** Causes of Increasing Monkey Problems in Different Study Block.

### 5.9 Frequency of Monkeys Entering Compounds

Monkeys have entered the compound of 100% respondents. The reported frequencies of intrusions are shown in the figure 19. Monkeys were also reported to have entered in the



houses. Most respondent alleged that monkeys easily open unlatched screen doors and push open wooden doors.

Most respondents i.e. 43% (N = 100) said that their compound is invaded by monkey daily, followed by monthly, 2-3 days and weekly.

**Figure 19.** Frequency of Monkey Entering the House Compound (N = 100)

The chi square value at 3 degree of freedom (0.05 level of significance) is 14.27 compared to tabulated value 7.815 and p value is 0.002. Hence there is significance difference infrequency of entering the compounds by the monkey.

Regarding the problem of frequency of visit in different study block within Vijayapur area, block B and block C are worst affected. 64 % respondents (N= 25/Block) of Block B followed by 60% respondents of Block C reported their resident compound is invaded by monkey daily (Figure 20).

**Figure 20.** Frequency of Monkey Entering the House Compound in Different Study Blocks (N = 25/Block)

Time	Between Different Blocks		
	Chi square value; n =3	p value	Remarks
Daily	7.81	0.050	Significance difference
2-3 days	1.67	0.642	Insignificant difference
Weekly	1.26	0.739	Insignificant difference
Monthly	6.06	0.108	Insignificant difference

This shows that there is significance difference of daily visits in different study blocks. Daily visit of monkey is more in human residents area of block B followed by C.

### 5.10 Provisioning

*Regarding the questionnaire, have you ever given any food items to monkey, only 18% (N = 100) of the total respondents said they have given food for*

*monkey. They had offered food items sometimes when there is wastage of leftover food, sometime as time passing, sometimes as symbol of hanuman because of religious faith. However regarding the questionnaire have you ever seen artificial provisioning by other, 72% (61.99- 80.30 at 95% CI) reported they had seen the artificial provisioning by other people. Tourists, pilgrims, local visitors were reported as the category of people practicing artificial provisioning.*

**Figure 21.** Percentage of Respondents Knowing Provisioning by Other People.

*Among 72 respondents who have ever seen artificial provisioning, 47 % respondents reported people give food to monkey because of religious faith, 36% respondents reported as a source of entertainment/enjoyment of feeding monkeys; 31% of respondents as a reason of love to these creature and sympathy for insufficient food in forest, 23% as utilization of wastage food materials and 18 % respondents were not having the clear of reason of artificial feeding (Figure 22).*

**Figure 22.** Percentages of Reasons of Provisioning

### **5.11 Monkey Problematic Time**

Respondents were asked at what time of day monkeys are most active and visit their compounds. About 34 % respondents (N=100) indicated morning time i.e 4am-10am followed by 26% at evening time i.e.5pm-8pm (Figure 23).

**Figure 23.** Monkey Problematic Time

Here chi square value at 2-degree value of freedom (at 0.05% level of significance) is 2.49 compared to tabulated value 5.991 and p value is 0.288. This shows that there is a significance difference in monkey activity in different daytime.

### **5.12 Vegetation of Natural Forest of Panchakanya**

Vegetation of the natural habitat was analyzed by laying down fifteen quadrat of 10mx10m. Five quadrat was laid in each three transects. A total twenty of species of trees were found and the value of diversity index was found to be 0.846, which is near to 1. This concludes there is high degree of diversity of plant. Similarly the value of dominance index of sal (*Shorea robusta*) and chaliaune (*Schima walichii*) was found to be 0.07077 and 0.05755 respectively. These plant species can be used as food by monkey. Among the rest plants, most of them can be use as food by monkey. The relative density for *Shorea robusta*, *Schima walichii*, *Albizia sp.* was found to be 26.60%, 23.99% and 19.23 respectively (Annex VII).

## *Chapter VI* **DISCUSSION**

Among the three different species of monkeys reported from Nepal, only two species of Monkey Rhesus monkey (*Macaca mulata*) and common Hanuman Langur (*Semnopithecus entellus*) were found in the study area Vijayapur, Dharan. Vijayapur area may be suitable habitat for both of these monkeys. Assamese monkey (*Macaca assamensis*) was not found in the study Area, Vijayapur. However this monkey was reported from upper Northern Sunsari District and its boundaries.

Rhesus monkey was found in highest number with total head count of 203. It may be due to its most commensal characters to human. Langur population was found to be 19. The lesser no. of Hanuman Langur may be due to the availability of small natural habitat and being less commensal to human.

*The Rhesus monkey was found distributed in the study site A, B, and C. of Vijayapur, Dharan. They were reported from Northern Panchkanya forest, lower part of Vijayapur, Hattisar and Pritivipath and some southern part of Dantakali and Singhadevi chowk. The troop with highest no. of population was found near to human settlements (study block B & C) which was nearest from natural habitat than deep forest of Panchkanya. As Rhesus monkeys are defensive in nature and opportunistic in crop raiding, to avoid the predator and to get food with less effort, they are likely to find in periphery of human habitation (Van hoof, 1990). Bashyal (2005) also supports the situation of rhesus behaviors of this kind. He has recorded the Rhesus monkey in different sites of Shivapuri National Park (ShNP), mainly near the edge of cropland and human settlements areas.*

*Nepal, H.K. (2005), found the utilization of microhabitat by Rhesus monkey different. They spent most of time in higher vegetation (tree-shrub) with alternative use of rocky, smooth ground, streamside and cropland as well. They show seasonal variation in utilization of microhabitat with more use of streamside and trees areas in spring and smooth ground. Chalise (2001) from Langtang reported that in month of April they were mostly found around the crop field in summer season when there is less food in the forest areas.*

*Crop raiding, grabbing and taking of food materials, clothes, damaging cables, biting/scratching etc. were the common problems reported by the respondents. Among them; crop raidings reported by 76% respondents (N = 100) was highlighted as the commonest problem. Patty Mc. Court (2005) 92% respondents of Hetauda were found to suffered from crop damage from monkeys. 87% of respondents complained the harassment by monkey by taking food spilling or eating from the kitchen, porch or roof.*

*Mc Court (2005) in Hetauda found 85% household members were frightened by monkey usually as a result of charge threat, chase, facial grimace or vocalization. In her report 37% household reported that someone in their house had been either directly or indirectly harmed by monkey with different events of injuries such as fell down (23), scratch (12) and bite (6). Ojha (1976) found 90 victims who received 104 wounds and most of bites were during food snatching from house and mother monkeys protecting her infants. Thus all these report showed that, monkey aggression towards human is mainly concerned with the food and human interference of the habitat*

*Among the different crop, maize damage (reported by 43% respondents) is found to be highest followed by fruits (27% respondents). These are among the most palatable crops grown in the Vijayapur Area. This fact is also supported by Chalise (1997, 1999, 2001, 2003). Chalise et al (2001) and Chalise and Johnson (2005) reported that crop depredation proportion by monkeys is different in different crops. In MBCA they recorded highest loss of maize (32%) followed by potato (24%), rice (14%), fruits (12%), millets (11%), wheat (4%), buckwheat (2%) and pulses (1%).*

*Ghimire (2000) in Palpa found highest loss of maize (34.12%) followed by potato (23.05%), rice (12.01%), fruits (11.26%), wheat (5.97), millets (5.13), buckwheat (2.38%) and pulses (2.06). Thus, the loss of maize was found highest in most of mountainous areas. This could be as maize is more palatable, easy to raid and mostly grown by the people as major crop, so more available in every season.*

*Artificial provisioning causes change in diet of monkey, change in home range and habitat, change in behavior (Southwick et al, 1976, Lee et al., 1986) and increase in population (Fa, 1991).*

*From the study, some unpalatable crops for monkey were also reported, so to minimize the crop raiding problems. People should give priority for alternative farming like mushroom cultivation, planting of chili, lady's finger, ginger, garlic etc. Chalise (2001) reported that farmer's suffering from monkey crop damage in eastern Nepal were considering planting chili, garlic and tobacco.*

*Among the different deterrence methods, use of catapult to frighten the monkeys was found to be most effective means because it can charge from long*

*distances, cheaper, easily available in local markets and monkey also affected strongly. However, this can be only temporary means to ward off the monkey. Mc Court (2005) also reported the use of stone throw catapult (84 respondents), close door (44 respondents), stick wave (26 respondents), shout (22 respondents) other (9 respondents) in Hetauda as monkey deterrence methods.*

*Crop damage is also directly related to the distance from a natural habitat of the monkey i.e lower the distance higher is level of damage and vice versa. This shows that lack of suitable habitat for the protection reduces the damage to the crops though there is ample availability of crops in the field. Saj et al (2001) also reported the agricultural area adjacent to forest area worst affected by the vervet monkey. Farm located within 300m of forested boundary incur the greatest risk of crop raiding.*

*To put all in a nutshell, there exist conflict in varying between human and monkey in course of sharing nature resources. Extinction of each living creature though beneficial or harmful from nature causes imbalance of ecosystem inviting serious problem. Though monkeys are not listed as endangered mammal, it is time to give proper attention for the minimization of conflict associated with them. It is always admired by everyone that "Prevention is better than cure". Measures to minimize the conflict there by ensuring the survival of monkey and sustaining the human welfare will leads balanced nature.*

Food scarcity (as reported by 79% respondents; N = 100); increasing population of monkey (as reported by 58% respondents); monkey habitat loss (as reported by 55% respondents);

Internal migration (as reported by 42% respondents); Artificial provisioning (as reported by 30% respondents); Religious faith (as reported by 43% respondents) were reported as the causes of increasing monkey problems.

Mallik (2001) has reported the increasing problems of monkey is associated with the following reason viz. (1) Extensive urbanization (2) Increased encroachment of forests (3) Haphazard trapping of forest monkeys for biomedical research leading to chaotic fissioning and the related dispersal of monkeys to nearby human habitations (4) Decrease in the number of forest trees, that provide natural food to monkeys (5) Decreased availability of water in the monkey's natural habitat (6) Decreased human tolerance to other life forms in the same environment (7) Increase in the population of Rhesus monkeys.



*Chapter vii*  
**CONCLUSION AND RECOMMENDATION**

### Conclusion

Two sympatric species of monkey, Rhesus monkey (*Macaca mulata*) and Common Hanuman Langur (*Semnopithecus entellus*) of the total population 203 and 19 were found in the Vijayapur Area. The Rhesus distribution was mainly in northern, southern and western part of Vijayapur and Langur distribution was confined in the western forest area of Vijayapur. Among the two groups of monkey, the Rhesus monkey conflict with local people found to be more severe than the Hanuman Langur. It may be due to its higher population, aggressive nature and highly commensal.

Wild monkey-local people conflict in the study sites was found to be a serious social and environmental problem. Among the two groups monkey Rhesus problem is found in all areas of Vijayapur mainly in Narayanpur, ward no. 14, near Panchkanya forest and ward no. 1 and 2 to Hattisar Campus. Langur problem is less. It may be due to natural feeding in the forest areas.

The problem of monkey was high in Narayanpur and lower part of Hattisar. This may be due to nearest areas from the natural habitat, artificial provisioning in these areas, availability of palatable, safe site for protection, resting and grooming. Problem in Nayatole area (Easter part of Vijayapur) was found to less from five years back because of removal of larger trees and bamboo, which was the most ideal environment for the protection of monkeys themselves after crop raiding while people try to chase them.

Among the different problems due to monkey, crop raiding problem was found to be more in Narayanpur because there are crop grown areas, nearest from natural forest and these are linked with corridor of bamboo. Grabbing and taking food, clothes, harassment and cable network damage was found mostly in lower part of Vijapur (Hattisar). Since, these are the areas where residential people have the faith that they worship monkey as symbol of God Hanuman. Several Hanuman temples are located here, where people (especially madwari)

feed monkey. Due to artificial provisioning, the feeding behavior monkey was found changed. They are now lazy, so they stay mostly in these area and due to good nutrition which decreases the period of reproductive age and population goes increasing. So, monkey conflict is high in these areas.

The respondents of different groups suggested that local people are equally responsible for these problems due to their encroachment of forest, resources and artificial provisioning. Although people complained several times in Municipality for solution monkey problem, the municipality has not launched and program to address this issue due to the lack of implementation of management of plan and policies.

The monkeys enter communities at all the hours day and raid garden and agricultural fields, take/eat/destroy food items and other household materials, intimidate people and occasionally harm them. Catapult is the most effective means of deterrent monkeys for local people. This however provide no long-term or community wide reduction in conflict. Most respondents feel this as a problem of growing concern and want to solve this. Not all attitudes towards monkeys were unfavorable. Love and sympathy for the monkey, enjoyment towards watching monkey behavior in wild and worship of Hanuman God were also expressed. While these attitudes are favorable toward monkeys, they lead to activities that are partially responsible for the conflict. Religion and culture have played long roles in the relationship between man and monkey was also found to be time in this study as well.

On the basis of literature review and observation made, causes of conflict identified were as follows:

- ) monkey being most commensal non-human primate
- ) habitat destruction
- ) accessibility to human food in areas adjoining to forest
- ) religious faith about monkeys believing them as a sacred animal..

## Recommendations

As we know that fact, we cannot command the nature except obeying her. So, people should try to understand the natural fact. Every organism has equal rights for survival in the world. Nature gives suitable habitat for living species. But, due to increments of human population, pressure on monkey natural habitat, it has resulted in the conflict between man and monkeys. There is not single solution to minimize the conflict. The strategy should be aimed at reducing and mitigating conflict. Support to minimize the conflict and conservation of monkey, the following points should be remember in Vijayapur area and other urban areas too.

### Short-term Strategies

- ) Municipality should provide monkey proof garbage bins at temple sites and in highway in ward 1,2 and 3.
- ) Municipality should manage/move/remove local dumpsites.
- ) People should plant the monkey unpalatable crops such as spinach, lady's finger, winter beans, coriander, ginger, turmeric, chili etc especially in the area where there exists high crop raiding by the monkey.
- ) Not to tease or kill monkey, which will increase further conflict.
- ) Students (child) and women should walk in a group while moving through the monkey problematic areas.
- ) In the residential sites, people should place flower pot and other things in such a way not to fall while jumping or walking over the roof which may lead further accident.
- ) Further human settlement in and around the habitat of the monkeys should be discouraged.
- ) Artificial feeding doe by the people in ward 1 & 2, especially in Hanuman mandir which is in residential area should be avoided immediately.
- ) Telephones wires, cables and electricity wires should be supplied through underground method or through piped in severe monkey problematic areas.
- ) Municipality provide free medical service and timely anti rabies vaccination for the victims of monkey bite.

- ) Relocate or translocate them in suitable habitat from human settlements.

## Long-term Strategies

### 1. Habitat Improvement

The natural habitat of monkey should be improved in the community forest especially by planting the monkey palatable plants (Eg. Bar, Pipal, Amala) and also to provide provision of drinking water in their habitat.

### 2. Conservation of Natural Forest

Although Municipality keeps forest guard in Natural forest, it was found that people browse and collect fodder for their cattles, which provide the food for monkeys in natural habitat. So, this activity should be checked.

### 3. Conservation programmes

Government or Municipality should launch the conservation programme at local level in different ward at school, in college of Vijayapur and provide the education about its importance, scientific and religious value. And also provide the knowledge for the mitigation of conflict with monkeys while staying with them.

### 4. Awareness Program

People should be made aware about the do's and doesn't while staying with the monkey.

- ) About Artificial Provisioning and its consequences.
- ) About zoonotic disease transferable from monkey to human and vice versa.
- ) About behaving with monkey
- ) About likes and dislikes of monkey etc.

### 5. Monitoring of Population

Continuous study is necessary to know the population and conflict to make proper management from the University, Research Center and Line agencies.

### 6. Establishment of Monkey Research Center

Since, Rhesus monkey of Nepal was found to be most applicable for biomedical research, monkey from highly conflicted areas is to be used for biomedical experimentation and the compensation is provided from the money obtained from the research to conflicted site to increase the livelihood security of the people.

### **7. Development of Vijayapur as Eco-tourism center**

Since Vijayapur Area of Dharan is historically and religiously very important place in Nepal, annually many people visit this place from national and international level, So, the monkeys habitat are to be protected for monkeys watching which will be the source of recreation for the visitor. Human settlements should be made little bit farther from the city. The revenue from the visitors should be invested in the development of Vijayapur area and the development of human welfare..

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