ECOLOGICAL STUDY OF RHESUS AND ASSAMESE MACAQUES AND THEIR CONFLICT WITH HUMANS IN NAGARJUN FOREST, KATHMANDU, NEPAL

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Submitted to
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DECLARATION

I hereby declare that the work presented in this thesis entitled "**ECOLOGICAL STUDY OF RHESUS AND ASSAMESE MACAQUES AND THEIR CONFLICT WITH HUMANS IN NAGARJUN FOREST, KATHMANDU, NEPAL"** has been done by myself, and has not been submitted elsewhere for the award of any degree. All the sources of the information have been specifically acknowledged by reference to the author(s) or institution(s).

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RECOMMENDATION

This is to recommend that the thesis entitled "**ECOLOGICAL STUDY OF RHESUS AND ASSAMESE MACAQUES AND THEIR CONFLICT WITH HUMANS IN NAGARJUN FOREST, KATHMANDU, NEPAL"** has been carried out by Mr. **BishwanathRijal** for the partial fulfillment of **Master's Degree of Science in Zoology** with special paper 'Ecology and Environment'. This is his original work and has been carried out under my supervision. To the best of my knowledge, this thesis work has not been submitted for any other degree in any institutions.

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LETTEROFAPPROVAL

On the recommendation of the supervisor Dr. Mukesh Kumar Chalise, Associate Professor, this thesis submitted by Mr. BishwanathRijal entitled "**ECOLOGICAL STUDY OF RHESUS AND ASSAMESE MACAQUES AND THEIR CONFLICT WITH HUMANS IN NAGARJUN FOREST, KATHMANDU, NEPAL"**, is approved for the examination and submitted to the Tribhuvan University in partial fulfillment of the requirements for **Master's Degree of Science in Zoology** (Ecology and Environment).

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CERTIFICATE OF ACCEPTANCE

This thesis work submitted by Mr. BishwanathRijal entitled "**ECOLOGICAL STUDY OF RHESUS AND ASSAMESE MACAQUES AND THEIR CONFLICT WITH HUMANS IN NAGARJUN FOREST, KATHMANDU, NEPAL"** has been approved as a partial fulfillment for the requirements of **Master Degree of Science in Zoology** specializing in Ecology and Environment.

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LIST OF ABBREVIATIONS

Abbreviated form	Details of abbreviations
%	Percentage
AD	Anno Domini
asl	altitude
CBS	Central Bureau of Statistics
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
d.f.	Degree of Freedom
DHM	Department of Hydrology and Meteorology
GoN	Government of Nepal
GPS	Global Positioning System
IPS	International Primatological Society
IUCN	International Union for the Conservation of Nature and Natural resources
LNP	LangtangNqational Park
m	Meter
Max. /Min.	Maximum/ Minimum
mm	Millimeter
NGIIP	National Geographic information infrastructure Programme, Kathmandu
ShNP	Shivapuri National Park
SNNP	ShivapuriNagarjun National Park
Sq. Km.	Square Kilometer
T. U.	Tribhuvan University
VDCs	Village Development Committees
WWF	World Wildlife Fund for nature conservation

ABSTRACT

Ecological study of Rhesus and Assamese macaques and their conflict with humans in Nagarjun forest Kathmandu, Nepal were studied from February 2012 to March 2013. Monkey population was determined by direct counting of the individuals in each group. Quadrate method was used to analyze vegetation pattern of natural forest or monkey habitat.

The distribution of the monkeys wasfound 270 and 166 numbers of rhesus macaques and assamese macaques in 7 different blocks respectively. The total area of 16 km^2 was surveyed by total count method, questionnaire survey and behavioral data were collected by scan sampling method. Two species of monkeys, Rhesus monkey (Macacamulatta) and Assamese monkey (Macacaassamensis) were found in study area. Habitat shown their preference maximum in tree shrub area (45%), which is followed by rocky area (23%), smooth ground (14%), stream side (10%) and crop land (9%) by Rhesus macaques while Assamese macaque shows their preference maximum in tree shrub area (65%) which is followed by rocky area (17%), smooth ground (17%), and crop land (1%). Crop raiding was the main cause of conflict to human beings; Maize (57%) and wheat (28%) were reported to be the worst affected crops, whereas pulses (1%) were the least.Shouting and following (31%) as well as using stone and catapult (25%) were the common methods of deterrent against the macaques. Additionally, there were considerable reports of human attacks and harassment (31%). Translocated M. mulatta individuals were more problematic to the local humans than naturally occurring ones. Our findings further showed that the macaque problem has increased from <50% in 2011 to 92% currently. Financial compensation was suggested to be an effective measure to reduce human-macaque conflict in these areas (47%).For the resolution, outreach education program launched from October 2013 to January 2014 in four different schools which includes 400 students and teachers, the 75% were reported awareness is important. From study some mitigation point is recommended for the Government and villagers.

Keywords: macaques, crop-raiding, human-macaques conflict, SNNP

1. INTRODUCTION

1.1General Background

Macaques (genus *Macaca*; Family: Cercopithecidae) are an ecologically extremely adaptive primates which are distributed more widely than any other non-human primate genus. After a split off from the baboons, mandrills, drills and mangabeys, they moved out of Africa and today only the Barbary macaque (*Macaca sylvanus*) is still found in Africa. All other extant Macaca species occur in Asia, ranging from Pakistan, India, Nepal and Tibet in the west to the Northeastern tip of Japan and just South of the Wallace line in the Southeast (Thierry et al. 2004). Macaques are found in tropical rain forests across Asia but may live at high altitudes in the Himalayas and other temperate regions with long snowy winters (Chalise 2013).

1.1.1Primates

Primate is an order of mammals, which includes the monkeys, apes, humans and other similar forms typically having dexterous hands and feet, binoculars vision and well developed brain. They are commonly called monkeys, excluding only the tree shrews; the lemur like form, the apes and humans and therefore embody tremendous evolutionary and adaptive arrangement of animals (Tattersall 1993). Of all the primates, monkeys, next to human have adapted best to widely diverse environmental conditions which are found in tropical forest, dry savannas, mountains, village, and temples and even in large cities (van Hoff 1990).

Monkeys are included under the sub-order Simiae 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 nostrils open two sides 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 check pouches, nostrils set close together facing forward and downward. The tail is never prehensile and some species are tail less. Both the hands and feet are adapted for grasping. Callous pads on the buttocks are often bright and in case of females swollen during estrus period (Walker 1968).

Human and monkeys share the same root of evolution. The living inquiring minds the structure of the hand, the social system and mother infant relationship and manipulative skills of the monkeys certainly make us ponder about what W.S. Gilbert had said about man: “man however well behaved at best is only a monkey shaved”. In anatomy and behavior monkeys are our closest relatives. They may hold the key to our origins and the roots of what we considered the human characteristics of friendship, love, aggression and tool use (Subba 1998).

Larger primates are widely hunted, many of the smaller ones are prized for commerce and the pet trade, and all suffer from habitat loss. Even where their forest remain, substance and commercial hunting in west and central Africa and south east Asia are resulting in vast areas of silent and empty forest. The 2000 IUCN Red List of Threatened species classifies primate's species and 224 species and sub species as threatened (Rylands 2001).

In Nepal, two species of macaques have been reported; Assamese macaque (*Macaca assamensis* McClelland 1840) and the Rhesus macaque (*Macaca mulatta* Zimmermann, 1780) among which the former one is less explored non-human primate of Nepal (Chalise et al 2013). *Macaca assamensis* is categorized as ‘Vulnerable’and is one of the protected mammals by the Wildlife Protection Act 1973 of Nepal (Chalise 2013a). Distribution of *Macaca assamensis* is restricted to the Himalayan foothills regions of Nepal. It occurs from central Nepal east through the Himalaya to Southern most China and North and Central South-east Asia (Fooden 1982). It has never had intensive field study anywhere in South-east Asia, or, barley, in South Asia (Mitra 2002,2003), so remains little known for such as a widespread monkey (Fooden 1982, Eudey 1991, Rowe 1996). It has conventionally been seen as a high land species (Lekagul and McNeely 1977), called it “an upland macaque, generally found in forested area above 500 m to as high as 3500 m”. A recent survey in Bhutan found Assamese macaques down to 600 m (Kawamoto et al. 2006).Choudhury (2008) referred to occurrences as low as 100 m, but detail information neither dealt nor discussed the finding.

This taxon is categorized as threatened due to its limited distribution of less than 22,000 km^2,an expected area of occurrence of about 914 sq. km. with ongoing decline in area, lessening population and narrowing quality of habitat. As stated of its restriction of occurrence, rising threats to the individual and its habitat, and decreasing number in fragmented patches, the Nepal Assamese population is categorized as Endangered. As

well as the National Parks and Wild life Conservation Act of 1973 lists the Assamese Macaque as a protected species of Nepal and included in appendix II of CITES (Chalise et al. 2005).

Because of their distribution pattern, Assamese macaque population would have been more influenced by forest habitat deterioration compared with rhesus macaque populations. The fragmented distribution of the Assamese macaque seems inadequate for maintaining a viable population in Nepal. There have been few studies to estimate the minimal viable population size necessary for the conservation of not only Assamese macaques, but also *Macaca* in general(Wada 2005). Species viability can be measured by evaluating population dynamics and environmental effects (Fa and Lind 1996).

Of equal concern is the fact that these animals are considered pests a frequent crop raiding behavior in Nepal and, as such conflict between local people and the macaque are on the rise, with an additional threat to the survival of present macaque population. In Nepal, crop damage is very common along the immediate periphery of National parks and protected area systems. Nevertheless, crop damage is not limited around or conservation area but also along the different habitat outside it (Chalise 2013, Wada 2005).

In Nepal, only three species of monkeys (Rhesus, Assamese monkeys and Hanuman langur) are recorded to date. The Rhesus monkeys (*Mcaaca mulatta*) are found freely ranging in wild as well as in urban religious places. The Assamese monkey (*Macaca assamensis*) reported from mid hills and high mountain forest of Nepal. The other species langur monkeys (*Semnopithecus entellus)* are found freely ranging in wild forest and marginal area of Nepal (Chalise 2013).

1.1.2The Primate Status and Phylogeny

Among the 185 species of primates listed in the world belong 28 species in Madagascar and about 50 each in Africa, S. America and Asia. Among the 52 Asian species, 44 species are recorded in south Asian countries (Sanjay et al. 2003). Primates are grouped again into Strepsirhines, the New World monkeys or Ceboides, Platerhines- Old World monkeys and Man or Hominoids. All apes are offshoot of Old World monkeys. Among the great apes orangutans, gorilla, chimpanzees resembles with other close relatives Human being in many capacities- social structure, taste,

mental and emotional development and physiology. The little known pygmy chimpanzee, that resembles more than 98% with human, shows much more similarities in locomotion, communication and sexual behaviors (Jolly 1985). However, only three species (Hanuman Langur, Rhesus and Assamese Monkeys) are recorded so far in Nepal with their subspecies though densities as a whole are unavailable (Chalise 2004a).

1.1.3Rhesus Monkeys

Rhesus Monkey is one of the best-known Simian species of family Cercopithecidae. They are distributed in Southeast Asia from northern Afghanistan in the east and south to the Godavari River in India, Thailand, Laos, Cambodia, Vietnam, Nepal, Bangladesh, Tibet and China in the west (Roonwal and Mohnot, 1977). It is most frequently kept in zoos even in smallest Zoological gardens. Rhesus monkeys are 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.

Rhesus monkey is heavily built with compact robust limbs. The silky hair is yellowish brown, the naked skin is brown to yellowish brown, and the large posterior callosities are bright red. No marked menstrual swelling occurs but skin of buttock becomes red during estrus period. An adult male of rhesus has a stoutly built body that may be up to 63 cm (25 inch) long and body weight 6.5-12 kg where as females are relatively small with body length ranging from 45-55 cm and body weight around 5.5 kg. Length of is up to the half of the length of body. The skin hangs in loose folds about the neck, breast, and abdomen.

Rhesus monkeys are characterized by a high degree of social flexibility. Four types of social groups can be described depending on the number of males in the group. They are one-male troop, multi-male troop, age-graded male troops and all-male band (Chalise, 2004b).

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. 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 whiles males 2-3 years after that. Females reach menopause at age 25 (Southwick *et al*. 1982).

Rhesus is ground feeder and is partly terrestrial and partly arboreal. Preferred foods include wild and cultivated fruits, berries, grains, leaves, buds, seeds, flowers, and bark. They roost peacefully in trees mid canopy to avoid their predators (Chalise, 1998).

1.1.4 Hanuman Langur (*Semnopithecus entellus*)

Langurs also called Dhendu Bandar are popularly named after the Hindu monkey-god Hanuman, and considered the sacred animal. It is the most widely distributed of the 19 non-human primate species found in the Indian subcontinent and is a highly adaptive species (Roonwal and Mohnot, 1977; Wolfhemin, 1983; Chhangani and Monhot 2004). 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. Head and body length of female is 40-68 cm and that of male is 51-78 cm. Approximate tail length is 69-101cm. Weight of adult female and male 11.2 kg and 18.3 kg 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. They feed on leaves, fruits, buds and flowers. They live in groups of 11-64, typically 1 male: multifemale, but occasionally multi-male: multi-female. They have a home range of 200-1200 ha. 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. When a new male takes over a troop, he systematically kills all the infants sired by the previous alpha male. Infanticide among Hanuman langurs has primarily been reported in one malegroup, possibly because having a situation where only one male breed facilitates the evolution of this trait (Newton 1986, 1988). After a gestation period of

168-200 days, females give birth to one infant. The infant is weaned after 13-20 months.

1.1.5Assamese Monkey (*Macaca assamensis*)

Assamese Monkeys of Nepal (so far named) is distinguished into a separate population as 'Nepal Population' from the existing two sub species *(M. a. assamensis and M. a. pelops),* based on the information on their coloration, head body tail length and its ratio, size variation and weight, etc(Chalise 2013). The other two existing species are from Assam, West Bengal and Garhwal, India and may be in Nepal too. Given its restricted extent of occurrence, threats on its population & habitat and small numbers in fragmented patches the status of this macaques is categorized as Nepal population and Endangered. It also rated the status of Endangered in distribution due to localization in Nepal only. The local vernacular names of this monkey are Pahare Bandar, Pupa, Timnyau, and KalaGanda (Chalise et al. 2013, Chalise 2001).*Macaca assamensis* is categorized as 'vulnerable' and is one of the protected mammal by the National Parks and wildlife ConservationAct 1973 of Nepal (Chalise 2013a). Choudhury (2008) referred to occurrences as low as 100m, but detail information neither deal nor discussed the finding.

Macaca assamensis is explored patchily in Nepal. Its status and distribution within the Makalu–Barun area is documented partially and some information is available from Langatang area. the legally protected animal Assamese monkey (*Macaca assamensis*)was first recorded in 1985 in Shivapuri Nagarjun National Parks and thereafter remained unknown long time (Wada 2005, Chalise et al 2005,Chalise 2013a). Assamese monkeys are shy, timid and less aggressive to human beings incomparisons to rhesus monkey. They are arboreal, terrestrial and omnivorous animals with multi-male and multi-female social troops (Chalise 2003). The Assamese monkey can be confused with the rhesus by general outlook and size but there is clear difference between them morphologically too. The orange red hue on the loins and rump is absent in this species while it also differs by general body coloration. It has darker fur in exposed area while whitish blonde-haired to ashy white in abdominal and inner parts. It has purple (eggplant color) snout particularly around the nose while crimsoned red to pinkish red around the eyes and chick (Chalise 1999a, 1999b). Local saying finely reflects the fur color difference within a group as

this species called 'Missal' means mixed group. The palm, sole and nails are dirty brown in color. The Ischial callosities in male are conspicuous from a distance and distinct in darker individuals. In higher elevation, the animals are with darker fur on back and whitish in abdominal parts resembling to Tibetan monkey. 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 2003, Chalise et al.2005).

1.2 Statement of the Problem

Monkeys and human beings are in the sense that a particular species of monkey is popularly considered the remote ancestor of present day human. As well as human and monkey share the same roof of evolution. Man-monkey association is as old as man's own existence. 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. The macaques inhabiting forests were markedly disturbed by the over-utilization of forests by humans who cultivate crops in fields, cut tree branches as food for domestic animals and collect firewood. It is because monkeys are very often causes of nuisance to local people leading to the seeds of accord between these two creatures. Human population growth and activities like deforestation, agriculture and urbanization lead to an ever-increasing encroachment on wildlife habitats. The interface of wildlife habitat and human use dominated landscape has become grounds for a wide range of human-wildlife conflict (Sinha et al.2004). Nagarjun forest of Shivapuri Nagarjun National Parks, Kathmandu is no far an exception to this fate resulting into man-monkey conflict which is likely to be intensified in future.

1.3 Objectives of the Study

The major objective of research was to ecological study of Rhesus and Assamese monkey in Nagarjun Forest of Shivapuri Nagarjun National Parks Kathmandu, Nepal

The specific objectives of the study were as follows:

- To explore the habitat utilization, behavior of monkeys and vegetation analysis.
- To find out the causes of human-monkey conflicts.
- To list out the local preventive measures to mitigate human-monkey conflict.

1.4 Rationale of the Study

Study of diet and behavior of a species is vital and foremost requirement to understand species ecological adaptation to the environment (Chalise 2001) and it is one of the most important requirements to design the conservation strategy for the species (Chalise 1999b, Gupta 2002). Knowledge on diet is also an important factor to be considered when examining the relationship between ecology and socio-biological problems (Chalise 2004a).

In the different part of the country human-wildlife conflict is increasing, among them monkey and human conflict is most, there is lack of awareness program and adjacent to the Nagarjun forest of SNNP, Kathmandu peoples are encountering the various problems with monkey. This study is, therefore, necessary to note their population, adaptability, conflicts and socio-economic problems so that it can be managed the problem of monkey and human conflict.

1.5 Scope and Limitation of the Study

This study covers about the monkey and human conflict in Nagarjun forest of SNNP, Kathmandu. It also focuses their ecology. The research work will help the local community of the study area, park management committee as well as district forest Kathmandu.

- Heavy tourist flow, domesticated cattle, dogs, security personals inside the parks and devotee disturbed the research work.
- The relevance of some study basically lies on the response of the respondents assuming they have truth.
- Regarding the extent of losses caused by the crops, respondents were found never to keep such data and hence questionnaire regarding the crop loss in terms of percent, monetary value were omitted.

2 LITERATURE REVIEW

2.1 Population Status and Distribution of Monkey in Nepal

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;Chalise, 1998). They are in larger number in religious jungles and temples like Pashupati, Swayambhu, Sankhu, Bajrajogini, etc.of Kathmandu Valley (Chalise, 1998).

Chalise (1999b) studied the behavior of Assamese macaques of Makalu-Barun Area, Nepal and find out that macaque spent 44% of time in foraging, 25% in moving, 13% in grooming and 18%time in resting.

According to the latest classification of Conservation Assessment and Management Plan (CAMP) workshop 2002, status of available primate species has been classified for Nepal (Sanjaya et al. 2003). 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 schistaceous* (Central Himalayan Langur) as Near Threatened. CAMP designated Assamese monkeys of Nepal 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. It is categorized as Endangered species. The conservation status of Rhesus monkey (*Macaca mulatta*) was assessed as least concern as it is widely distributed and abundant in its population. Rhesus and Langurs are common and the Assamese is strictly protected under the National Parks and Wild Life Conservation Act 1973, and has considered in the endangered status (Chalise, 1997 and 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, 2004a).Chalise (2004b) estimated a stable population of Rhesus monkeys species around 450 individuals in two religious places Pashupati and Swoyambhu area. Researcher suggested that clean water supply and restoration of natural habitat are urgently needed to manage these populations,

which research work was done on the title of a case of population stability of semi-provisioned, free ranging temple Rhesus monkeys of Kathmandu valley, Nepal.

Sinha et al. (2004) recorded a new species Arunachal macaque (*Macaca munzala*) from WesternArunchal Pradesh, Northeastern India which shares morphological characteristics independently with the Assamese macaque (*Macaca assamensis*) and with the Tibetan macaque (*Macaca thibetana*).Wada (2005) studied on distribution patterns of Assamese and Rhesus macaque in Nepal in1984. During his survey he found that Rhesus macaque dominated the tropical, subtropical and temperate forests below 3,000 m asl all over Nepal; Assamese macaques were patchily distributed along rivers in the tropical and subtropical areas and both species principally utilized forest. Discontinuous distribution of Assamese macaque was as a result of expansion of Rhesus monkey distribution in mid- and late- Pleistocene.

Nepal (2005) studied the habitat utilization of Rhesus monkey and its conflicts with people in Shivapuri National Park, Nepal. He found that the Rhesus monkeys were found to be distributed ranging from 1390 to 2300m in Sundarijal, Panimuhan and Rolche area of Shivapuri National Park with total population of 125 individuals during the study period. Habitat type utilization was found maximum toward tree shrubs area (44.82%) which was followed by rocky area (23.02%), smooth ground (14.60%), stream side (9.68%) and crop land (7.88%).

Kawamoto et al. (2006) studied the distribution of Assamese macaques in the Inner Himalayan region of Bhutan and their mtDNA diversity. He recorded no groups of rhesus macaques (*Macaca mullatta*) in his survey, in contrast with the survey results in the Nepalese Himalayas. He concluded that the macaques of the Inner Himalayan regions in Bhutan are Assamese macaques and that they appear to be of a lineage distinct from Assamese macaques in the Indo-Chinese region (subspecies *Macaca asaamensis assamensis*). On the basis of degree of mtDNA diversity, he also concluded that the Assamese macaques in Bhutan are of a more ancient ancestry than *M. a. assamensis*. He suggested the earlier speciation of Assamese macaques on the basis of greater mtDNA diversity than that of rhesus macaques.

Chalise and Ghimire (1998) studied on Assamese macaque of different parts of Nepal and found that macaque in the area spent most of the time in forest followed by rocky slope; they spent their most of the time on feeding activity followed by moving.

Maize, potato, rice, fruits and millet were the crop they damaged heavily in the area.Timmins and Duckworth (2011) studied about the distribution and habitat of Assamese macaque in Lao PDR; they made most of the record of Assamese macaque from hill evergreen forest above 500m and ecological overlap with Northern pig tailed macaque (*Macaca leonina*) and with Rhesus macaque (*Macaca mulatta*) is very limited in Lao PDR.

Chalise et al. (2013) studied on population, distribution and behavior of Assamese macaque inShivapuri Nagarjun National Park. Seven bisexual troops of macaque were recorded in subtropical forest of the national park and its marginal areas near to human settlement with average troop size 23.71. They found that 46% of time is invested by the macaque in feeding activity followed by 19% in resting, 16% in locomotion, 12% in sleeping, 6% in grooming and 1% in playing behavior. Young leaves and burgeoning twigs were primary source of food for winter.

2.2 Human-Primate Conflict

According to World Conservation Union, World Park Congress 2003, human-wildlife conflict occurs when wildlife's requirements overlap with those of human population, creating cost to residents and wild animals.

Direct contact with wildlife occurs in both urban and rural areas, but it is generally more common inside and around protected areas, where wildlife population density is higher and animals often stray into adjacent cultivated fields or grazing areas. One of the main challenges facing wildlife conservation in the twenty-first century concerns the increasing interaction between people and wildlife and the resulting conflicts that emerge (SilleroandSwitzer 2001). Conflict between wildlife and people is an important factor affecting the relationship between protected areas and the people who live near them (Stdusrod and Wegge 1995).Across the globe primates are the most frequently identified crop-raiding animals. From Africa to the Arabian Peninsula to Southeast Asia to Japan, primates come into conflict with humans due to the renowned crop raiding behavior of many species (Sillero and Switzer 2001). Conflicts often occur when non-human primates raid crops (Forthman 1986, Siex and Struhsaker 1999, Hill 2000). A large number of primate species raid crops, but it appears that terrestrial species are more likely to damage crops than arboreal species, and non-folivores are greater crop raiders than folivores. Amongst the Old World

monkeys, the most common, and better able to coexist with man, species are from the genera Macaca, Papio, and Cercopithecus,in particular the several species of baboon (Papio spp.), the rhesus monkey (*Macacamullatta*), and the vervet monkey(Sillero and Switzer 2001). 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 the Indian context the man-monkey relationship is remarkable. On one side people consume blood and flesh of monkeys as medicines, trap, kill and eat them as food, on the other side people keep them as pets, trained them to play, feed and protect them (Rajpurohit et al. 2006). Urbanized populations are provisioned frequently due to religious sentiment of people. So, human attitude towards monkey seems differ from area to area and species to species. Likewise, monkeys are not liked in the areas of massive agriculture, horticulture and other plantations since they damage the crops and orchards. In such areas they are considered pests (Roonwal and Mohnot 1977). In yet another situation monkeys have become commensalism and competitors of human being in and around villages, towns and cities. These are "Urbanized monkeys" (Rajpurohit et al. 2006).

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 Indian 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 fashioning 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 (Malik 2001).Crop raiding by Rhesus monkeys is one of the serious problems in Bandipokhara VDC, Palpa as in other parts of Nepal (Chalise, 1997).Assamese monkeys are found in the foothills of high mountains of Annapurna Conservation Area destroy cultivated crops occasionally and people occasionally kill these animals simply while chasing away them from the crops (Gurung 2002). 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). Many researchers studied on *Macaca assamensis* is second most common primate species, next toRhesus, in Arunachal Pradesh; it is found in all type of forests including bamboo forests starring from the foothills to an altitude of 2,000m; the population of the macaque species in the state is under threat due to destruction and damage being caused to its habitat; the macaque is being hunted by the tribal people of the state for food and for medicinal purpose.

2.3 Commensalism and coexistence

Primatologists describe the rhesus as one of the most commensal of all primate species (Sakha 1999). They have adapted exceptionally well to human encroachment and can be found living in villages, town temples, railway station, and even some isolated spots in large cities (Teas 1978). Chance and Jolly (1970) stated : Rhesus monkeys of today have taken advantage of an ecological niche provided by man in which food is plentiful and it seems likely that they have done so for the past five thousand years. Some of their success at co-existing with humans is due to Hindu, Buddhist and animist religion, all prevalent in the east. Monkeys are highly valued because of Buddha's camaraderie with a monkey during one of his incarnations (Majupuria, 1977). Monkeys in particular are revered in the Hindu religion. In literature, Hanuman is usually depicted as a langur (*Presbytis entellus*), a more arboreal species than rhesus. Langurs are still found in or around Hindu temples in India, where they are fed and protected. 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 and Carter 1999). Those associated with Hindu temples, especially Hanuman temples, are protected within temples grounds. The role of religion is theoretically one contributing factor to the commensal nature of rhesus monkeys (Southwick et al. 1965).

Rhesus often prefers to live along forest edges, close to human habitation, thus this species inhabits villages, towns, cities, road sites, temples and rail stations where it is highly adapted to the presence of humans. Southwick et al. 1965 estimated that only

2% of 802,000 rhesuses in North India resided in forests, while the other 78% resided in human habitations. Economic value of primates has focused on their importance as a source of meat in many areas of Central and West Africa and in Brazilian Amazonia, where annual consumption is estimated at 3.8million primates (Rowe 1996, Saj et al. 2001). Trading primate meat has also been pointed out as an important component of local economies in some African countries. For example, it has been estimated that the exploitation of primates in the Tai region of Ivory Coast represents a market value of $124,031- 136,688 per annum (Refische and Kone 2005). Saj et al. (2001) reported that agriculture area adjacent to aforest zone are worst affected by the vervet monkey. Farms located within 300m of a forested boundary incur the greatest risk of crop raiding. Surveyedgardens 200m from the forest edge received significantly less crop raiding than farms located 100m or 50 ($P = .040, \infty = 0.05$). They suggested that the development of non-agriculture 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.

2.4 Monkey Problem Management

Crop raiding is not a new phenomenon. Farmers have evolved resourceful strategies to fight back against the animals responsible for damaging their crops. The methods that are employed by an individual farmer are deeply influenced by the resources at his disposal. In developed countries farmers have considerable levels of capital and expertise to summon to combat crop raiding. In developing countries farmers have small incomes and little access to technology. A range of methods has evolved in such countries, relying on simple, manpower based techniques to tackle crop raiders. 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). Of all the non-destructive control measures, shifting of problem creating animals was found to be the best method (Southwick et al, 1982). Before the monkey scaled off in Aligarh, Utter Pradesh of India (Southwicket al 1965) had earlier suggested to shift some of the Rhesus Monkeys from the district. On account of their

oppressive behavior, some commensal monkeys from other parts of India have been shifted earlier (Imam and Malik2002), one of the world's largest monkey capture and release exercises, 600 monkeys from Vrindaban(Mathura district) were captured and released in different forest patches and suggested three measures to manage monkey problem, namely cessation of feeding by people, translocation and fertility control.

2.5 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). 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. In many areas of India where rhesus macaques are in contact with humans they are menaces: threatening or biting children and the elderly, stealing food from people, raiding crops and damaging property leading to decreased tolerance and persecution of rhesus macaques in some areas (Rao 2002). From study,Nepal is not immune to this activity, hunting and killing of rhesus in different region by farmers seeking relief from crop raiding (Ale and Gurung 1995).

Mitigating human-monkey conflict is necessary to prevent the change in attitudes towards macaques that could lead to further persecution and population decline. Translocationparticularly problematic rhesus monkeys or entire groups also is not a widespread option because there simply are not enough suitable forest patches in which large numbers of rhesus can live (Imam et al. 2002). Perhaps innovative engineering could lead to monkey-proof containers in which people can store household items and food and prevent local rhesus from raiding their kitchens. Deterrent fencing or other protective measures could also be established around gardens and agricultural crops to prevent rhesus macaques from crop raiding. 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).

2.6 Monkey Research in Nepal

Monkey research in Nepal was started around 1970s on Rhesus monkeys of urban areas mostly of religious places. An insight into the Rhesus monkeys of Nepal, for the first time was given by Southwick and other members of Earth Watch team. In 1978, Teas submitted a dissertation on Behavioral ecology of Rhesus monkeys in Kathmandu valley. Bajracharya (2004) studied the feeding behavior of Rhesus monkeys of Swoyambhu area focusing on provisioned food. In 1990, Dr. Paul Winkler started research on Langurs living around Ramnagar village of Chitwan and established a monkey research project in Ramnagar in 1991in collaboration with Natural History Museum, TU. Mukesh Kumar Chalise in 1995 did his Ph.D. on the comparative study of feeding Ecology and Behaviour of male and female langurs. Chalise (1997) surveyed the primates of Makalu Barun Conservation Area. In 1998 and 1999, the Assamese monkeys of Makalu Barun Conservation Area were studied (Chalise 1999b). Till now research on monkey is elaborated in different part of country from Tarai to High hills and study on population, ecology, feeding behavior as well as conflict with locals has been done. Experiments involving non-human primates (NHPs) include toxicity testing for medical and non-medical substances; studies of infectious disease, such as HIVand hepatitis; neurological studies; behavior and cognition; reproduction; genetics; and xenotransplantation. Most are purpose-bred, while some are caught in the wild according to the Department of Agriculture of USA. Most of the NHPs used are one of three species of macaques, accounting for 79% of all primates used in research in the UK, and 63% of all federally funded research grants for projects using primates in the U.S.(Conlee et al 2004). Lesser numbers of marmosets, tamarins, spider monkeys, owl monkeys, vervet monkeys, squirrel monkeys, and baboonsare used in the UK and the U.S. Licenses approving the use of great apes, such as gorillas, chimpanzees, and orangutans, are not currently being issued in Britain, though their use has not been outlawed ("Testing on apes 'might be needed'", BBC News, June 3, 2006.) but chimpanzees are used in the U.S., with 1,133 in research laboratories as of October 2006. NHPs are used in research into HIV, neurology, behavior, cognition, reproduction, Parkinson's disease, stroke,

malaria, respiratory viruses, infectious disease, genetics, xenotransplantation, drug abuse, and also in vaccine and drug testing. According to The Humane Society of the United States, chimpanzees are most often used in hepatitis research, and monkeys in SIV research. Because monkey are physiologically similar to humans, though their use is controversial. According to the Nuffield Council on Bioethics, NHPs are used because their brains share structural and functional features with human brains, but "while this similarity has scientific advantages, it poses some difficult ethical problems, because of an increased likelihood that primates experience pain and suffering in ways that are similar to humans. Some of the most publicized attacks on animal research facilities by animal rights groups have occurred because of primate research. Some primate researchers have abandoned their studies because of threats or attacks. Testing hair from Asian monkeys living close to people may provide early warnings of toxic threats to humans and wildlife. Rhesus monkeys are used extremely as an experimental animal in many primate centers, bio-medical 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).

3. MATERIALS AND METHODS

3.1 Materials

Following equipments were used during the field study.

a) Binoculars b) Measuring tape c) Digital Camera d) Data sheet
e) Topographic map of the study area f) GPS g) Stationary

3.2 Study Area

3.2.1 Location

Shivapuri-Nagarjun National Park (SNNP), near Kathmandu, Nepal, is comprised of two isolated forest tracts, Shivapuri and Nagarjun. Nagarjunforest,covers 16 square kilometers and is immediately adjacent to the northwest boundary of Kathmandu city. Geographically, Shivapuri is located between 27° 45' to 27° 52' north latitude and 85° 16' to 85° 45' east longitude and Nagarjun is located between 27° 43' to 27° 46' north latitude and 85° 13' to 85° 18' east longitude. It is spread over Kathmandu, Nuwakot, Dhading and Sindhupalchok districts of Central Nepal. This is the true representation of the mid hills in the protected areas system of Nepal (SNNP 2011). Study area Nagarjun forest lies at the boarder of Kathmandu, Dhading and Nuwakot Districts. Main range of the hill runs in the east west direction with the highest peak at Jamacho (2100 m asl), which rises abruptly from the floor of Kathmandu valley (1350m asl). Many spurs of the hill run in different direction forming gullies and narrow valleys. Previously Nagarjun was royal forest under Royal protection. In 2009, Nagarjun forest was included in Shivapuri National Park to provide extended habitat for wildlife population and as a representation of intact mid hill forest ecosystems whose representation is comparatively low in the protected area system of Nepal (SNNP 2011).

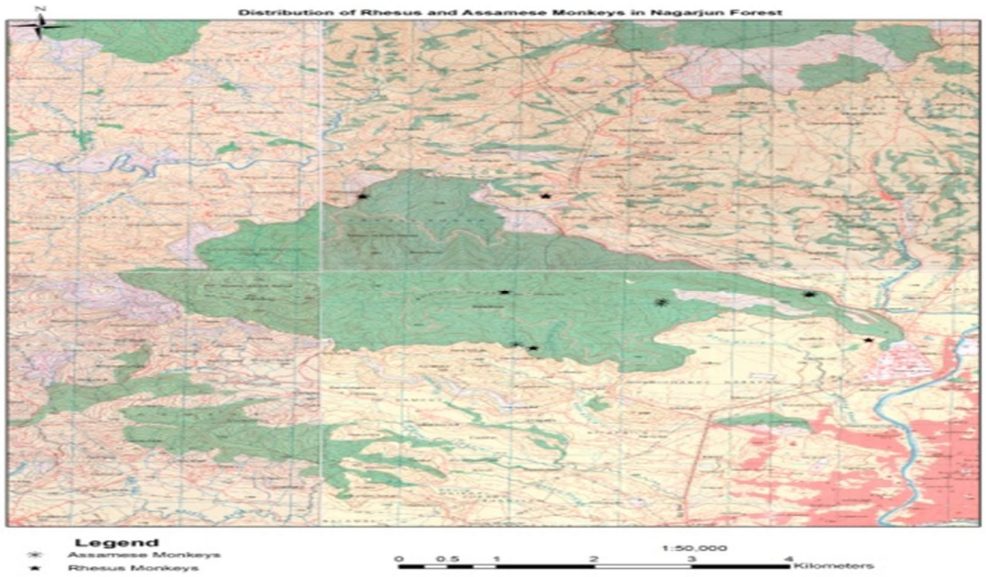

Figure 1: Map of Nagarjun Forest and distribution of Rhesus and Assamese macaque.

3.2.2 Topography

Soilcomposition of Nagarjun varies with different types of forest i.e. Schima consists of dry hard brown to blackish brown soil with less humus, dry oak forest consist of light blackish brown soil with some humus, mixed-broadleaf consists of humid light reddish brown to blackish soil with rich humus and pine forest consists of dry light brown to light brownish red soil without or with some humus (Kanai et al. 1970). The highest point is Jamacho, which is 2102 m above sea level sloping down to less than 1325m above the sea level at Baishdhara and Ichanguin Sothern side and to about 1350m above the sea level at Sanagaun in western side.

3.2.3 Water Resources

Study area occupied by few stream, spring falls, rivers, swimming pool and water tank. in the spring season near the mudhakhu check post and remaining side of the sloppy area some streams and springs falls is observed. In the Northern side there is a river "Chhahare khola"which is main sources of water for villagers."Bhanjayang Kharka" is another water surces located near the army area in the middle of the forest. In southern side water tank , fish pond and swimming pool is attraction of Baisdhara area.

3.2.4 Demographic Features

Human wildlife conflict (HWC) is mainly concentrated in two village development committee viz; Goldhunga and Jitpurphedi. In Goldhunga VDC there is 3806 households total population is 16174 (male 8325 and female 7849) while in Jitpurphedi VDC there is 1103 households total population is 5135 (male 2499 and female 2636). Total covered area of Goldhunga VDC is 664 hector in which cultivated land is 465 hector while Jitpurphedi is covered by 449 hector in which cultivated land is 449 hector. Wood /firewood used as a fuel for cooking in Goldhunga is total 808 households while 946households in Jitpurphedi VDC(CBS, 2011).

3.2.5 Climate

Nagarjun forest is typical Mahabharata hill and enjoys mostly sub-tropical type of climate andpartly temperate climate with rainy summer and dry winter (Chaudhary 1998). The southern side is sunny and evidently much dries than northern forest side.

The detail climatic data of the Nagarjun Forest were not available others relevant data is from nearest meteorological station at Panipokari, Kathmandu (27 °44”N and 85°20”E, and elevation at1335m) but the available data of rainfall is also used from Nagarjun station too.

The meteorological data of 2011, at Panipokhari station minimum temperature ranges from 20.3^0C(July) to 3.5^0C (January) (Fig 2) and maximum temperature ranges from 17.9^0C (January) to 30.2^0C (August) (fig 3). Thus maximum temperature of reaches to 30.2^0C and minimum temperature goes to 3.5^0C . Similarly relative humidity in the month of December is maximum (91.5%) at 17:45 pm and in May it is minimum (78.0%) at 8.45 am (Fig.4). Likewise rainfall in August was maximum i.e. 339.9 mm at Panipokhari station while it was maximum 552.8mm in the month of July at Nagarjun station. Minimum rain fall recorded in the month of March 13.4 mm at Panipokhari while in Nagarjun was 5.5mm. In January and December there was no rainfall in both of the station (Fig.5). The detail list of climatic data is given in Appendx I.

Minimum Temperature

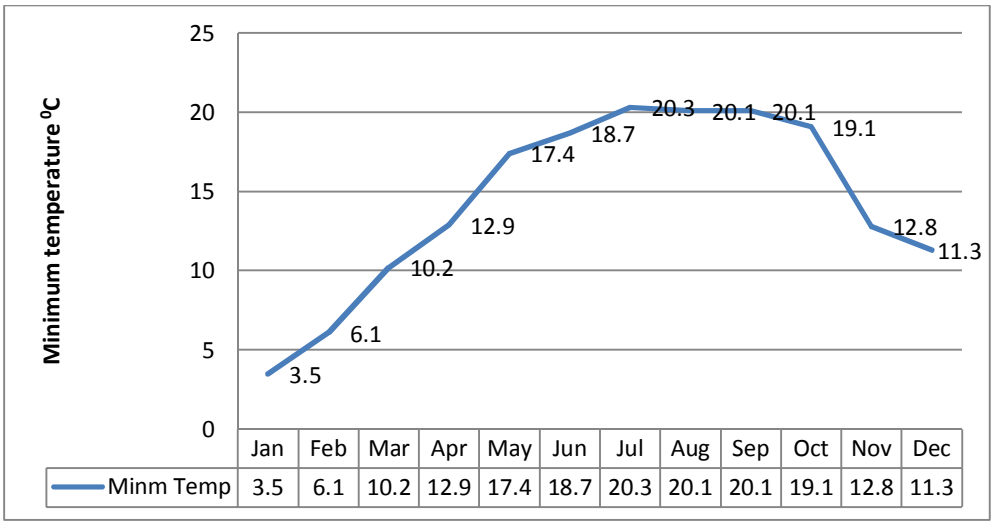

Fig 2: Minimum Temperature recorded in 2011*(Source:DHM)*

Maximum Temperature

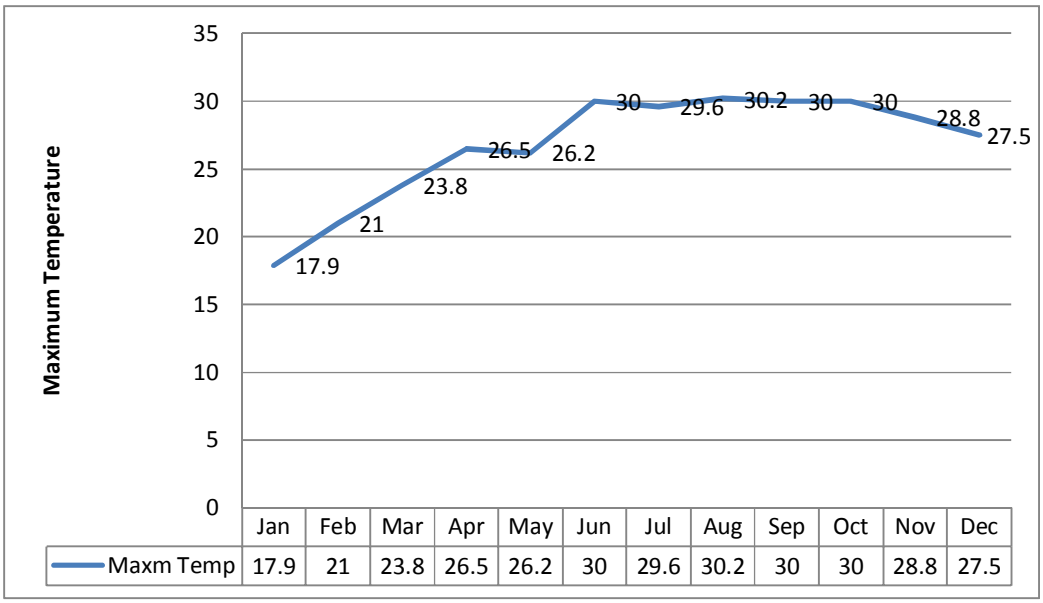

Fig 3: Maximum Temperature recorded in 2011*(Source: DHM)*

Relative Humidity

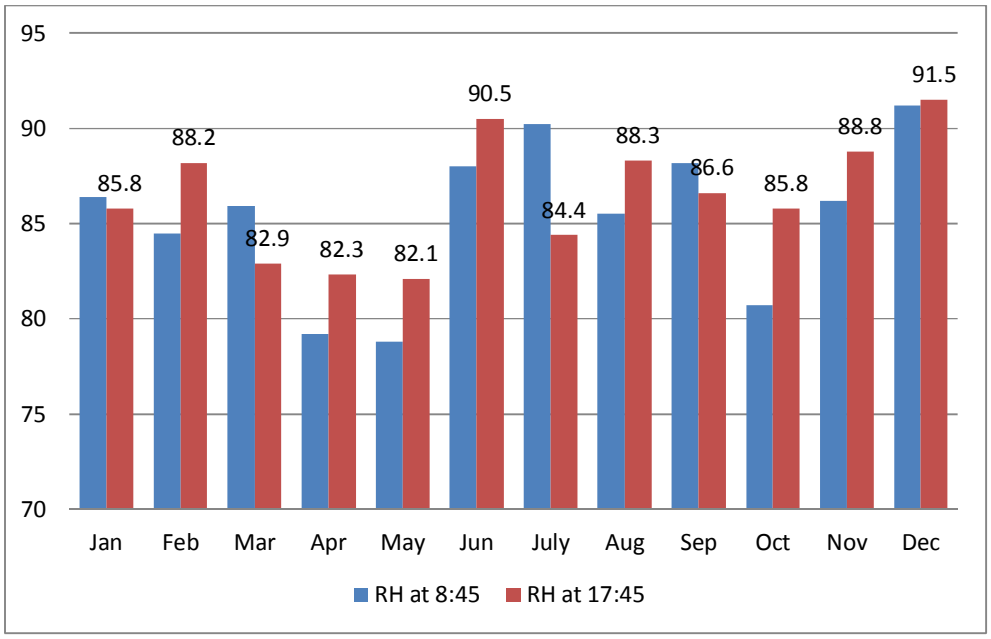

Fig 4: Relative Humidity (%) in 2011 *(Source: DHM)*

Precipitation

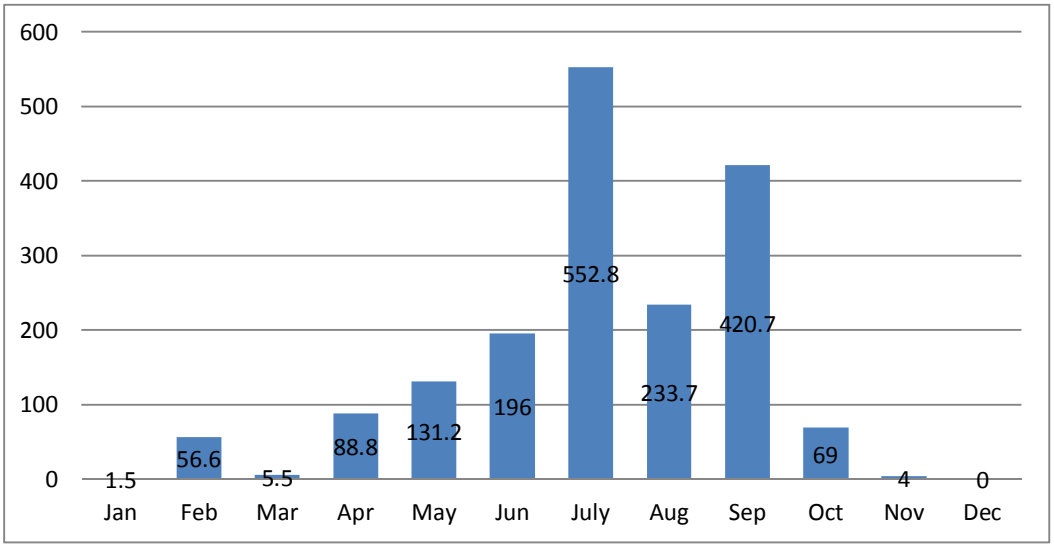

Fig 5: Precipitation (mm) in 2011 at Nagarjun *(Source: DHM)*

3.2.6 Biodiversity

3.2.6.1 Flora

Forests in Nagarjun can be categorized into four types: *Schima wallichii* forest, pine forest, mixed broadleaved forest (*Phoebe lanceolata,Machilus duthiei,Michelia kisopa* as major species) anddry oak forest (Kanai and Shakya 1970). Among the four types of forests recognized in Nagarjunhill, the *Schima wallichii,* forest constituted nearly 2/3rd of the total forest cover. GIS analysishas shown that coverage of *Schima wallichii* forest, mixed broadleaved forest, pine forest anddry oak forest in Nagarjun hill was 61.29%, 27.91%, 9.08% and 1.72%, respectively. There arefew small patches of grassy meadow(Nagarkoti 2006).

3.2.6.2 Fauna

Sixteen species of herpetofauna including *Naja kaouthia,Ophiphagus hannah,Trimeresurusalbolabris,Japulura variegate* are recorded from Nagarjun forest among them *Megophrys parva*is most common among amphibians and*Calotes versicolor* common among reptiles. Many Bird species including Kalij Pheasant (*Lophura leucomelanos)*, Yellownapes (*Picus sps.)*, Barbets (*Megalaima sps.),* Green-billed Malkoha (*Phaenicophaeus tristis*), Owlets (*Glaucidiumsps.*), Himalayan Griffon (*Gyps himalayensis)*, Harriers *(Circus sps.)*, Drongos (*Dicrurus sps.*)Thrush (*Monticola sps* and *Myophonus sp.)*Tits (*Parus sps.)*, Nuthatch (*Sitta sps.*), Bulbul (*Hypsipetes sps.*), Laughing thrush (*Garrulax sps.*), Babbler (*Pomatorhinus sps.*) and manyspecies of wablers (Shrestha 2001, Present study- Field Records using field guide for birds ofNepal (Grimmet et al. 2003)) are recorded inside Nagarjun forest. Two species of macaques are recorded in Nagarjun forest that is Assamese macaque (*Macacaassamensis*) and Rhesus macaque (*Macaca mulata*) (Wada, 2005). Other mammalian fauna inside the forest includes bats (*Hipposideros armiger,Megaderma lyra,Miniopteros schreibersii,Rhinolophus affinis,Rhinolophus macrotis,Rhinolophus pusillus)*(Malla 2000). Orange-bellied Himalayan squirrel (*Dremomys lokriah)*, Irrawaddy Squirrel (*Callosciurus pygerythrus)*, Chinese Pangolin (*Manis pentadactyla)*, Eurasianwild Boar (*Sus scrofa)*, Barking Deer (*Muntiacus muntjak)* and Sambar Deer (*Cervus unicolor)* (Chalise et al. 2013).

3.2.7 Tourism

Nepal has established an extensive network of protected areas to conserve biodiversity. Several problems relating to management of these protected areas have emerged, such as wildlife poaching and park-people conflicts (Bajracharya 2004). The park is a lonely park to represent mid-hill ecosystem of Nepal. It is famous for globally threatened wildlife, birds, and butterflies. It has subtropical to lower temperate forests and associated vegetation. The people around the park follow Hindu and Buddhist culture. Visitors can enjoy Aryan and Mongolian culture. SNNP has important pilgrimage destinations including NagiGumba, Bagdwar, Bishnudwar, Jamacho as well as ManichurMahadev, Kageshwori, Sundarimai, Baudeshwor, Tarkeshow, Pachali Bhairav and smaller destinations. Park is famous for hiking, camping, picnic as well as enjoying adventure tourism activities like climbing, canyoning, mountain biking and some other sports events(SNNP 2015). In 2013 AD, 17647 Nepalese and 2167 international tourist visited in Nagarjun forest (www.snnp.gov.np)

3.3 Methods

3.3.1 Preliminary Survey

A preliminary survey of Nagarjun forest, conducted in February 2011, noted the (blocks) most frequented by individual monkey troops. From February 2012 to March 2013, this research was concentrated on these blocks to determine the monkey's distribution, habitat preference, and areas negatively affected by the monkeys. During research period, I got chance to participate in "Studying and Monitoring Primate Behavior" a workshop for Asian Conservation Professionals May 2011 Singapore (See Appendix II). Further, involved in outreach education program from October 2013 to January 2014 (Appendix VIII (E). The research is evaluated by International Primatological Society and thus selected me for "Galante Family Winery Conservation Scholarship-2014" (see Appendix III). Likewise, our study and their data are accepted as an abstract by IPS (Rijal and Chalise, 2014) and participated to present the abstract /poster in Hanoi-2014 August (Appendix IV).

3.3.2Questionnaire Survey

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. 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, and library. The question format is given in appendix V.

3.3.3 Monkey Population and distribution

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. Within the home range of followed macaque troop on every site the habitat was categorized into five different types of microhabitat according to physiographic and biology of the area and identified for this study as follows:

I.Rocky area:covered with rock where no shrubs and trees; occasionally fungus, lichens and herbs were present.

II.Smooth Ground: Grassland, patchy grassland and bare land where rocks and higher plants were absent.

III. Stream side: having stream and their banks.

IV. Crop land: it is area for crops production or fallow due to crop raiding problem.

V.Tree-Shrub Area: covered by higher vegetation where sunlight penetration on the ground was partly or fully restricted by plants.

3.3.4 Total Count 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 as described by Chalise (1995).

Adults were those attained the maximum height and body maturity. Adult males were distinguished by large and hanging scrotal sacs. 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 foods and mostly following their kin.

Infants are those who still suck the nipple as their main food and following mother.

3.3.5Scan Sampling Method

By scan sampling, the behaviors of monkeys were recorded for one minute at intervals of 10 minutes (Altmann 1974, Martin and Boteson 1993, Chalise 1997) with the help of timer, and aided by binoculars. In the scan sampling, Observation started half an hour before sunrise and continued half an hour before sunset. Other events and interesting behaviors of any members of the groups were also recorded whenever they were noticed.

Following behaviors were observed including other social activities of Rhesus and Assamese macaque in the study area.

I. Moving: The behavioral phenomenon in which monkey produces motion displacing from one place to another.

II.Resting: The state when Assamese rests with the body supporting upon the buttocks with hindquarters lowered on to a supporting surface.

III.Foraging: The behavioral activity in which monkey searches for food or wonders in search for food including eating any substance, geophagy, licking stone, drinking water and slight movement in search of food.

IV. Grooming: The behavioral phenomenon in which monkeys search their own fur or the fur of others for lice, bugs or diet which include rubbing, licking and scratching.

3.3.6Ad-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.

I. 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

II.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.

3.3.7Analysis

3.3.7.1 Vegetation Analysis

Vegetation Pattern of the Nagarjun forest was analyzed by laying down randomly, eight quadrates of size 25m × 25m. The plant local name was identified by the experienced local person while for unidentified plant Photographs was taken simultaneously, herbarium was made to preserve the unidentified vegetation.

Statistics used for this study to identify dominance and diversity of vegetation type are:

$$\text{Simpson's index of Dominance (C)} = \Sigma\left(\frac{ni}{N}\right)^2$$

$$\text{Shannon index of general diversity } H = -\Sigma\left(\frac{ni}{N}\right)\log\left(\frac{ni}{N}\right)$$

Where, ni = importance value

N = Total no. of importance value (odum, 1996, krebs 1994)

$$\text{Relative Density (R.D.)} = \frac{\text{No. of individual speces 'x'}}{\text{Total no. of species}} \times 100\ \%$$

3.3.7.2 Data and Presentation

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 were used to analyze the data. Charts, table, graphs, and bar diagrams were used to present the data in most simplified and understandable form. Arc GIS 10.2 was used to present the distribution of rhesus and assamese macaque in the GIS map of the study area (figure 1). (GIS map Source: NGIIP, Minbhawan, Kathmandu, Nepal). Habitat and microhabitat of followed troop was calculated in terms of time spent by the focal troop on that particular habitat as the total contact time 375hr.

4. RESULTS

4.1 Habitat utilization, behavior of monkeys and vegetation analysis

4.1.1 Population Status of Rhesus Macaque.

A total of 270 individuals of Rhesus Macaques (*Macaca mulatta*) were observed in the study area. The minimum numbers of Rhesus were reported from the Sanagaun where as maximum numbers were reported in Baisdhara.

Table 1: Rhesus monkey in Nagarjun Forest during study 2012-2014

Block	GPS Location	Altitude (m)	Troop No.	Total Number
Baisdhara	27^0 44.061'N; $85^0$18.038'E	1325	6	67
Fulbari	$27^0$44.680'N; $85^0$17.715'E	1365	3	21
Mudkhu	$27^0$46.0241'N;85^0 16.256'E	1444	5	65
Aathamile	$27^0$46.022'N; $85^0$16.250'E	1488	5	59
Ichangu	$27^0$73284 N $85^0$27087 E	1325	4	22
Jamacho	27^0 44.718' N; $85^0$16.026'E	2102	1	19
Sanagaun	$27^0$76300N; $85^0$25329 E	1350	1	17
Total				270

Among the 7 block troops, only one troop was selected from Baisdhara 'A' for study to meet objectives. The group composition of observed troop (focal) was of 32 individuals with Adult male (2), Adult female (7), Sub-adult male (5), Young adult female (3) Juvenile (10), Infant (5).

4.1.2 Habitat utilization of Rhesus Macaque

Habitat utilization was determined according to their time spent by the focal troop on that particular habitat as the total contact time 375 hr. the followed troop in Baisdhara 'A' was found to spent most of time towards the site A (water Tank 63.2%) and then time was spent in site B (19.1%) and Site C (17.7%). The rhesus monkey showed more time in higher vegetation (tree and shrub area) and presence of water for drink

another reason is that due to their opportunistic behavior they came near to the picnic spot to get provisional foods (Fig 6).

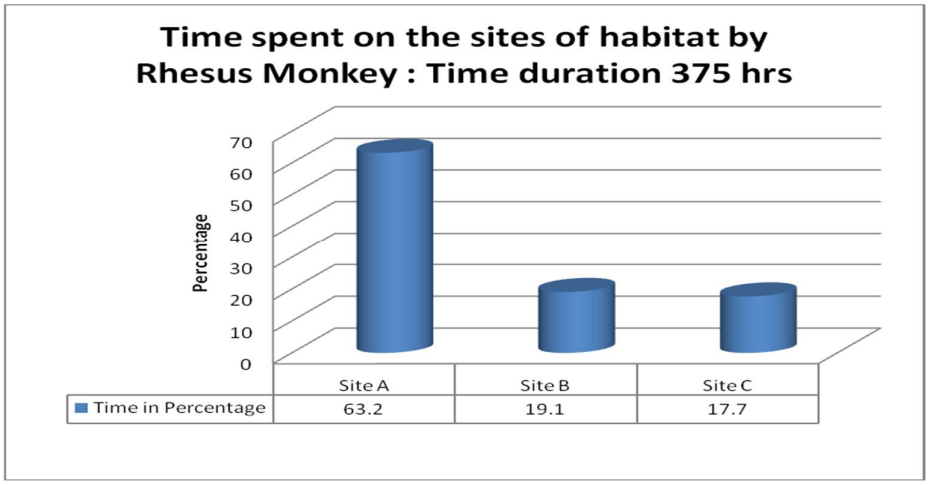

Figure 6: Time spent by followed troops of Rhesus.

Similarly, microhabitat analysis within the home range of followed troops was also done. On the total observation time, maximum time (45%) was found in tree shrubs then after rocky area (23%), Smooth ground (14%), stream side (10%) and Crop land (9%) (Fig. 7)

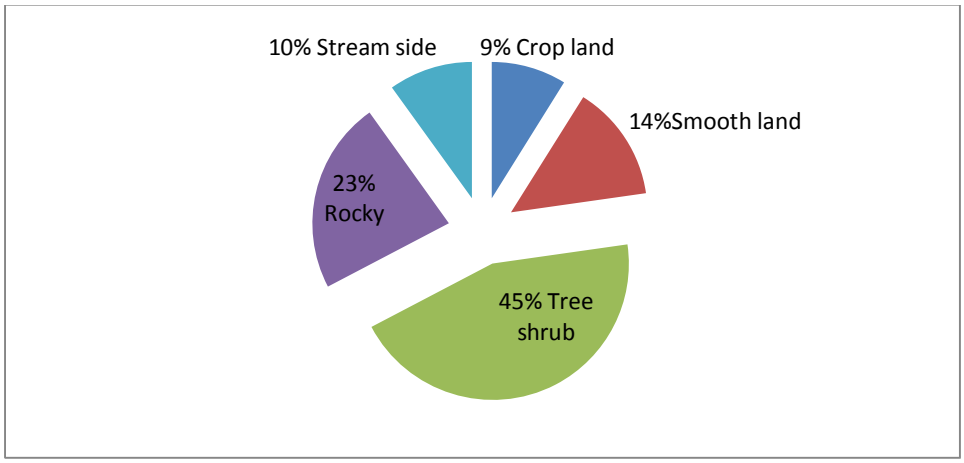

Figure 7: Time spent on different micro habitats by rhesus monkey.

Likewise, the utilization of microhabitat varies in different seasons. Rocky (40.78%) and smooth (37%) ground was utilized more in summer which was followed by spring and winter. Tree shrub (41.55%) and streamside (51%) were utilized more in

spring followed by summer and winter. Crop land (50.12%) utilized more in summer followed by winter and spring (Fig 8).

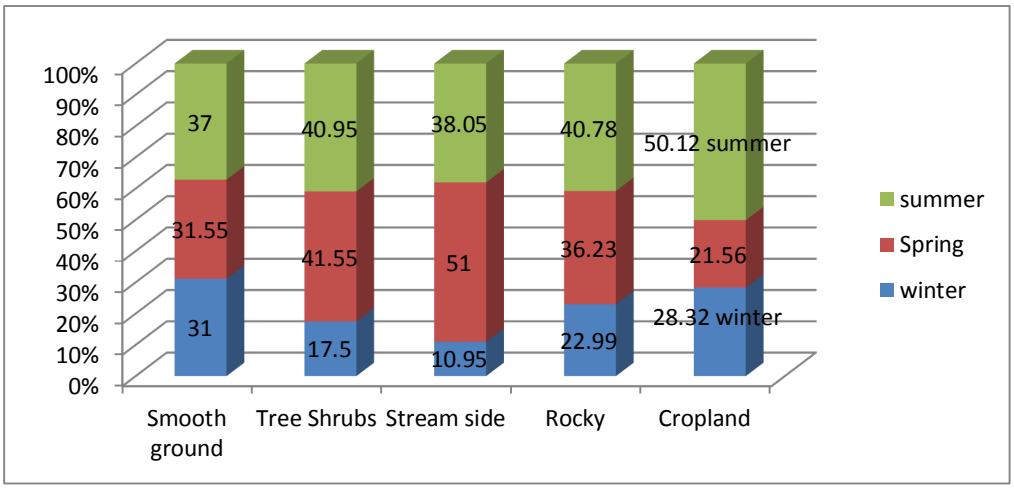

Figure8: Utilization of microhabitat in different seasons by Rhesus monkey in Nagarjun

4.1.3Population Status of Assamese Macaque

A total of 166 individuals ofAssamese Macaques (*Macaca assamensis*) were observed in the study area. The minimum numbers of Assamese were reported from the Ichangu and Jamacho where as maximum numbers were reported in Fulbari (Table 2).

Table 2: Assamese monkey in Nagarjun Forest during study 2012-2014.

Block	GPS Location	Altitude (m)	Troop No.	Total Number
Fulbari	$27^0$44.680'N; $85^0$17.715'E	1399	4	47
Raniban	$27^0$44.55'N; $85^0$16.89'E	1405	1	19
Simpani	$27^0$44.535 N $85^0$16.789 E	1400	3	41
Jamachho	$27^0$44.718N; $85^0$16.026'E	2102	1	11
Sanagaun	$27^0$76300N; $85^0$25329 E	1350	2	23
Ichangu	$27^0$73284 N $85^0$27087 E	1327	1	11
Water Tank	$27^0$44.685'N; 85^o 17.713E	1372	1	14
		Total		166

Among the 7 block troops, only one troop was selected from Raniban for study to meet objectives. The group composition of observed troop (focal) was of 19

individuals with Adult male (2), Adult female (5), Sub-adult male (4), Young adult female (5) Juvenile (2), Infant (1).

4.1.4 Habitat utilizationof Assamese Macaque

Habitat utilization was determined according to their time spent by the focal troop on that particular habitat. The followed troop in Raniban was found to spend most of time towards the site A (Army canteen 59.92%) and then time was spent in site B (20.1%) and Site C (19.98%) (Fig 9). More presence in army canteen showed that they were getting waste/provisional foods besides the natural foods and feel safety than other.

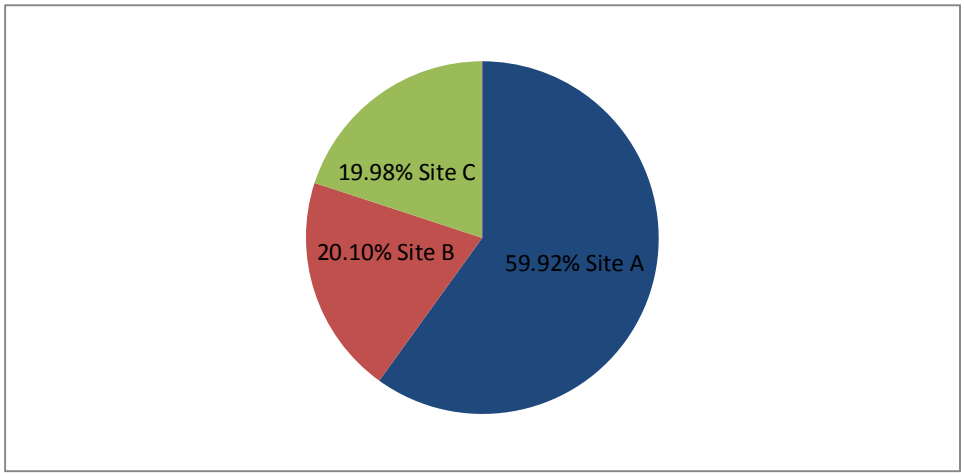

Figure 9: Time spent by followed troops of Assamese monkey in Nagarjun

Similarly, microhabitat analysis within the home range of followed troops was observed in 375 hours, where maximum time 65% spent in Tree shrub area which was followed by rocky area (17%), smooth land (17%) and crop land (1%) (Fig 10).

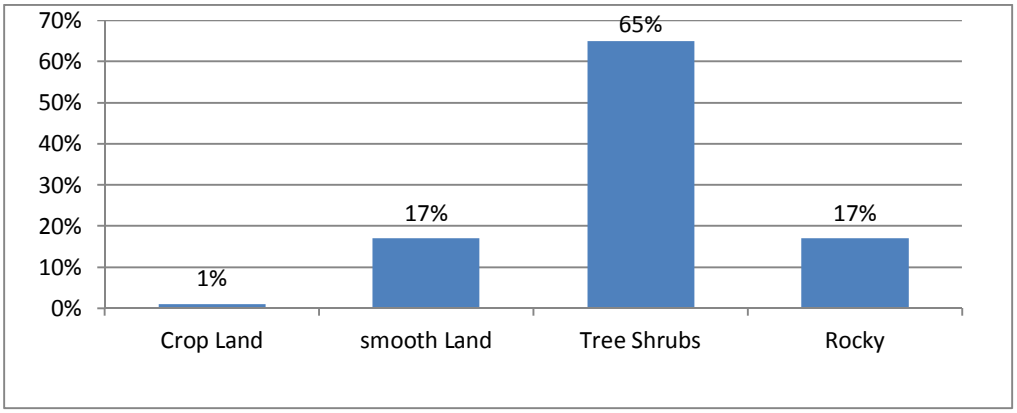

Figure 10: Time spent on different micro habitats by Assamese monkey in Nagarjun

Similarly, the utilization of microhabitat varies in different seasons. Rocky (40.02%) smooth ground (35.15%) was utilized more in summer which was followed by spring and winter. Tree shrubs (41.89%) were utilized more in spring followed by summer and winter. Crop land (50.01%) utilized more in summer followed by winter and spring (Fig 11).

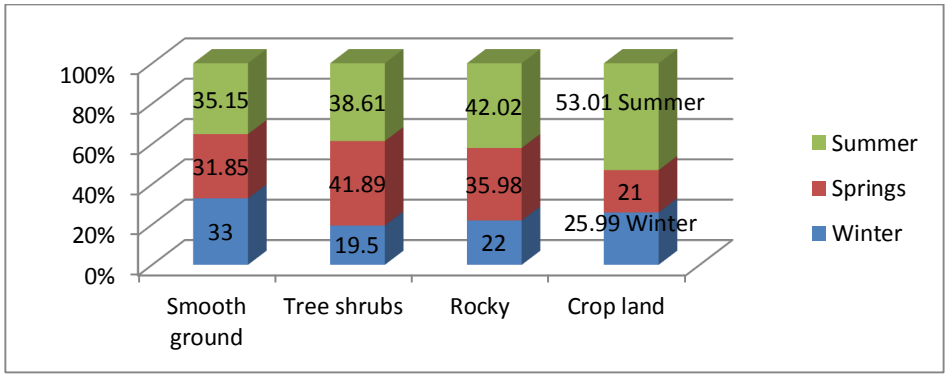

Figure 11: Microhabitat in different seasons by Assamese monkey in Nagarjun

4.1.5 Vegetation Analysis

In the Raniban and Fulbari Block of Nagarjun forest total eight Quadrats of 25m×25m was laid down for vegetation samplings. By this method 27 plant species with 196 numbers were recorded. This study showed that Chilaune (*Schima wallichii)* is the dominant plant species of Nagarjun Forest with relative density 30.89% followed Jhankrikath (*Machilus duthiei)* relative density 8.9% and Musure katus (*Castanopsis tribuloides)* relative density 8.34%. The detail list of vegetation is given in Appendix VI (a) and VI (b).

4.1.6 General Behavior

Total 950 events were recorded in each troop (Rhesus and Assamese) by scan sampling and it was found that 43% of their total time spent on foraging, resting (25%), locomotion (21%) and grooming (11%) in case of Rhesus monkey (Fig 12) while in Assamese monkey Foraging (42%), resting(25%), locomotion(23%) and grooming (10%) found(Fig 13).

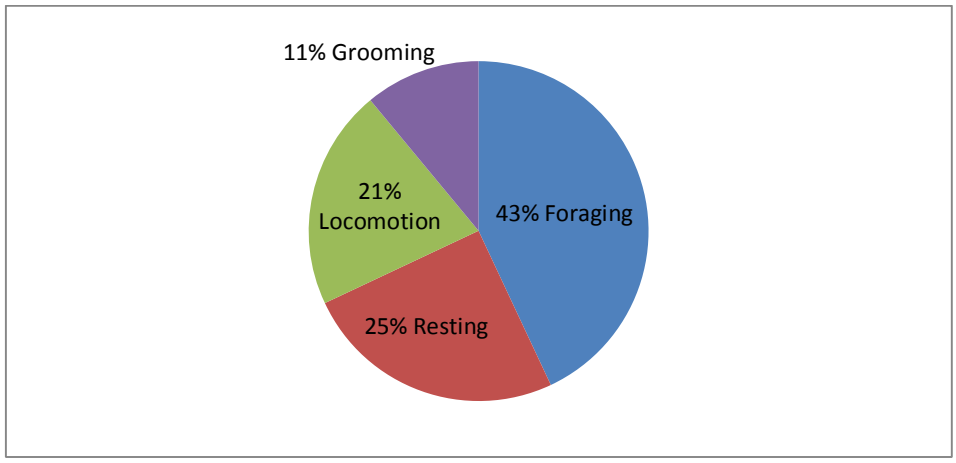

Figure 12: Annual activity budget of Rhesus monkey.

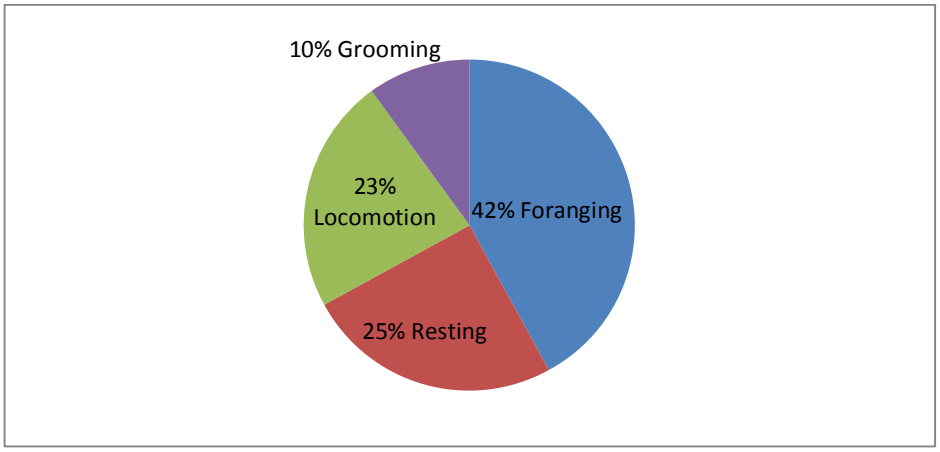

Figure 13: Annual activity budget of Assamese monkey.

4.1.7 Behavioral records from Ad-libitum sampling

Some interesting behavior of the rhesus and assamese macaque were recorded through Ad-libitum sampling; begging foods, sack the twigs of tree, looking the mirror, wearing cap, drinking residue of Juice bottle, Infants are playing like a copulation, adults male eating sperms, female eating vaginal plague after copulation, after grooming ready for copulation, some licking soil, aggressive macaque throwing fecal materials from the tree etc. were recorded in autumn season (Photograph, See Appendix IX (d). Behavior of the macaque inside the forest was also influenced by stray dogs, visitors, rock climbers, hikers, trekkers, picnickers and illegally entered local peoples (to collect fodder and other resources) and security personals too.

4.2 Human-monkey conflicts

4.2.1 Species of monkey Causing Conflict

Population of rhesus monkey is greater number in Nagarjun forest while assamese are in less number. Out of 200 respondents (villagers and visitors) in this area said translocated rhesus monkey (50%) causes more conflict while natural occurring rhesus monkey (30%) and rest of assamese monkey (20%) are problem creator in farmers field and involving in human attack and harassment (Fig 14).

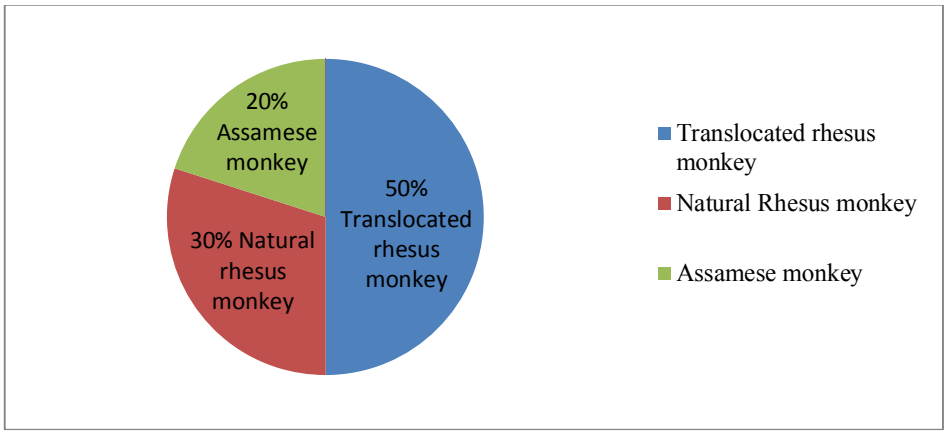

Figure 14: Species of monkey causing conflict

4.2.2Conflict due to monkey

From the total 170 respondents, total loss noted was 650.80 quintal, in which maize was highest proportion (57%) and the lowest proportion was pulses (1%). The crop raided by monkeys included wheat (28%), millet (5%), paddy (4%) but also vegetables ((3%) pumpkins, bean, potato, cabbage, cauliflower, etc) and fruits (guava, pear, pineapple, plum, etc) was 2% (Fig 15).

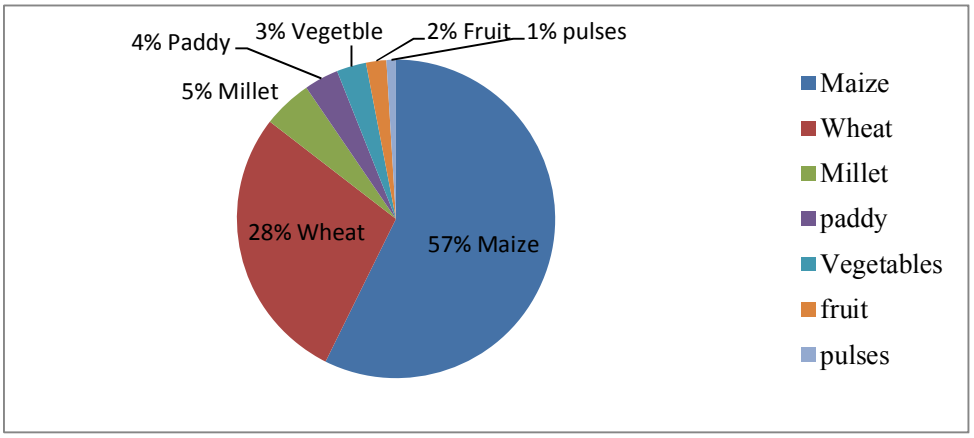

Figure 15: Crop raiding by Rhesus and Assamese monkey.

4.2.3Fallowing of crop land due to monkey problem

Most of the farmers of Goldhunga and Jitpuphedi were compelled to avoid cropping in their field because of the crop raiding by monkeys. Sixty nine percent of the respondents had to leave more or less of their land fallow due to monkey problem. Of the remaining 31%, more than half of the respondents said that even the problem of monkeys was very high they had not to leave land fallow (Fig 16).

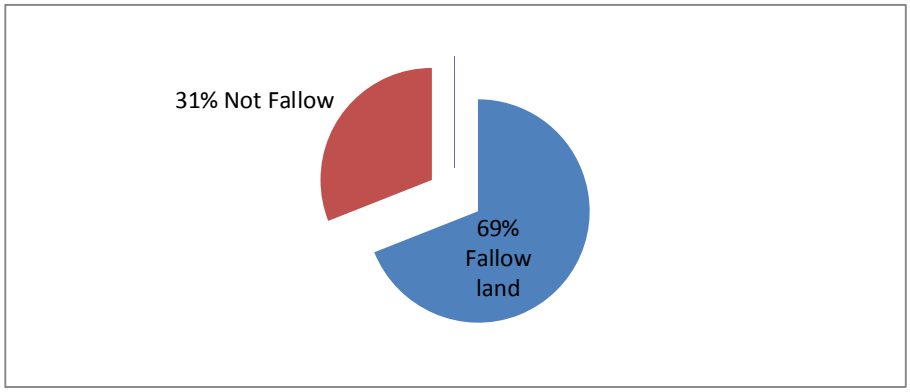

Fig 16: Showing fallow crop land due to monkey problem

4.2.4Aggressive interaction by monkey

Among 230 respondents (villagers, visitors, teacher, and student) 29% were reported human attacks and harassment which included Snatching (19%), Nail scratch (6%), Bite (2%), stealing (2%) and 71% were threat.

During field observation 150 events of aggressive interaction by monkey were noted down where Human attacks and harassment was 31% (which included Snatching (20%), Nail scratch (6%), Bite (2%), Stealing 3%) and remaining 69% were threat (Fig 17).

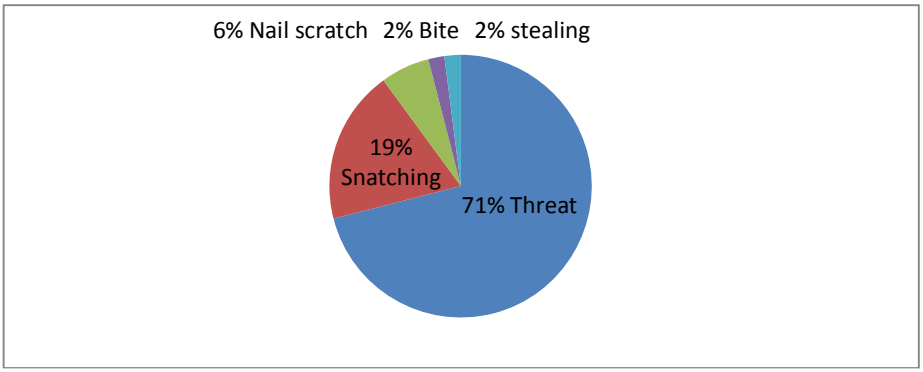

Figure17: Aggressive interaction by monkey to human

4.2.5 Aggressive interaction by human

During field observation 330 events of aggressive interaction by human beings towards monkey were noted down where shouting and chasing was maximum (40%) followed by stone and catapult (34%), charge threat (23%) and trapping and caging (2%), killing and poaching (1%) (Fig 18).

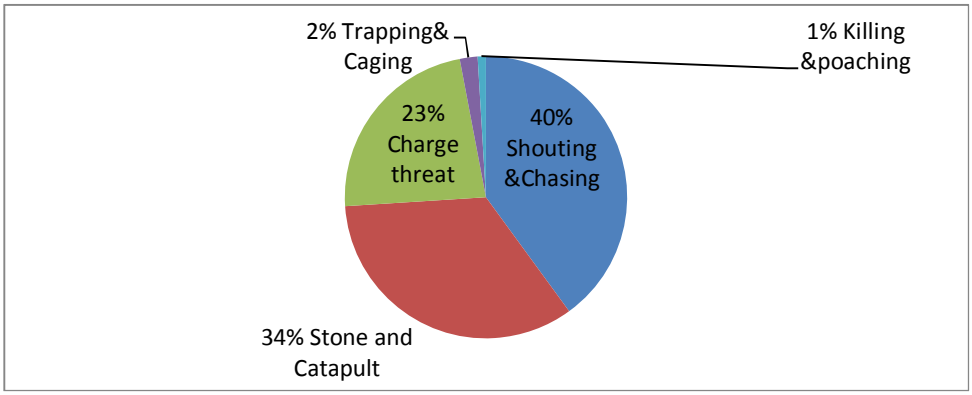

Figure18: Aggressive interaction by human to the monkey

4.3 Mitigation of human-monkey conflict

4.3.1Deterrent methods against monkey

Local peoples used various methods to protect their crops form the monkeys. About 31% of the people shouted and followed monkeys, about 25% of the people used stone and catapult and 15% using dog to chase monkey from the field, while 29% using other methods among this, Some of the people said that they used gun, to chase the monkey. Local farmers guarded their crop fields all over the day. (Photographs; Appendix VIII (a and b). Some of the people and restaurant owner given torture keeping in cage and released them painting the body and wearing human clothes (Fig 19).

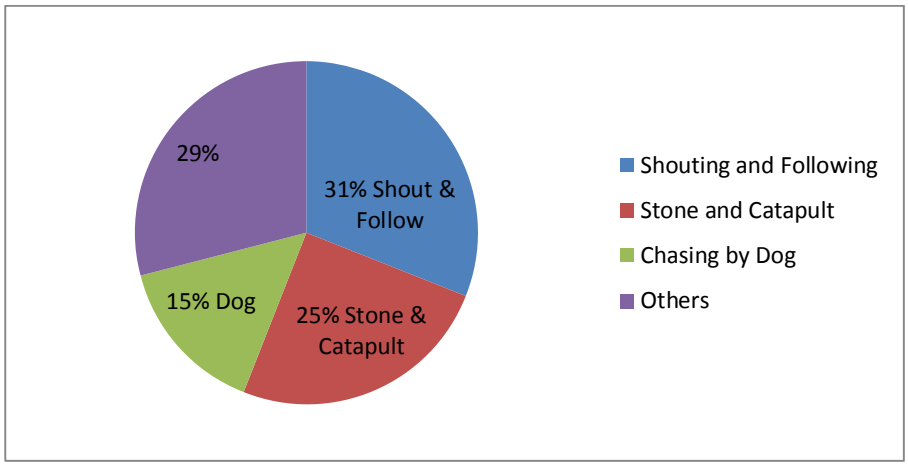

Fig 19: Technique used to chase monkey

4.3.2Remedial measure

People of Goldhunga and Jitpurphedi VDc had different thought about the remedial measure of monkey problem.Maximum people suggested financial support (47%) followed by killing (27%), Translocation (23%) and no response (3%) (Fig 20).

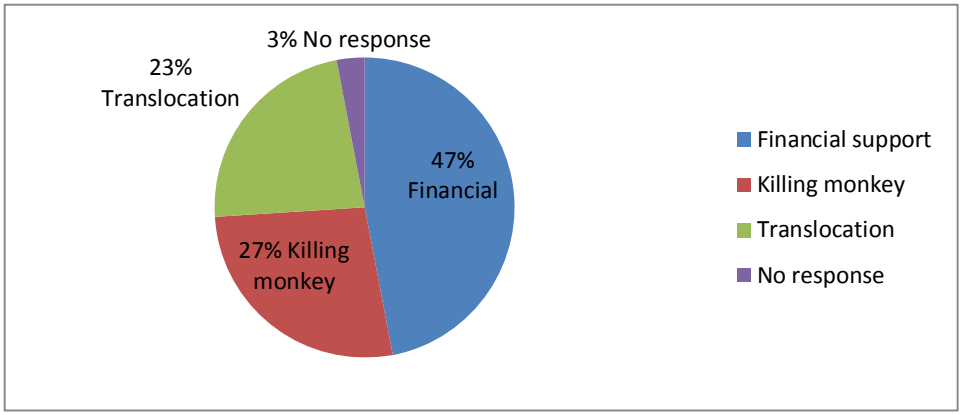

Figure 20: Remedial measures of monkey problem

4.3.3Trend of monkey problem

The problems faced by the local community due to increased monkey population within the area are becoming severe. The study and interviews with the respondents has showed that the macaque problem has increased from <50% in 2011 to 92% currently. Though the actual data base of total loss is lacking due to time constraints and insufficient data of loss prior to 2011, I have tried to access the problems due to

the monkey on the basis of focal discussion and local interviews with 300 persons (Fig 21).

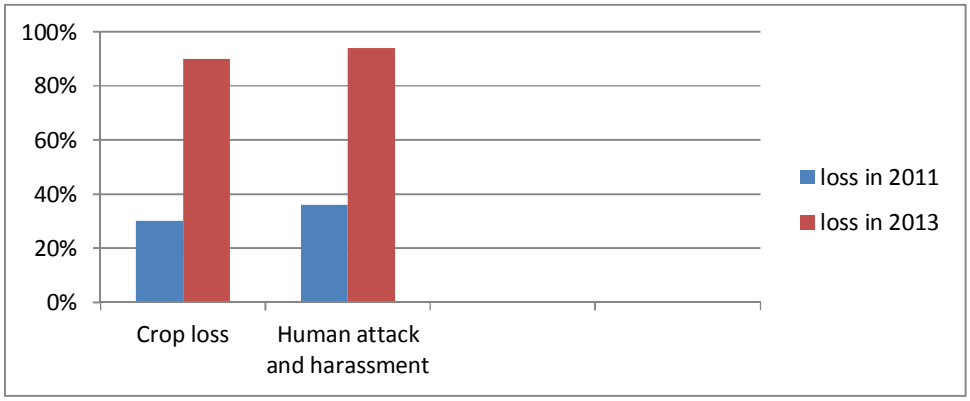

Figure 21: Trend of monkey problem in Nagarjun forest.

4.3.4Education outreach program

During research period, education outreach program was effective to know the conflict of human and monkey in their locality besides this our education systems in conservation also studied. Four different school was selected, among 400 respondents (Student and Teacher) 75% were suggested awareness Program is important for monkey -human conflict management, 15% suggested problem is caused by monkey while 10% not given any satisfactory answer about conservation (Fig 22). From this success program various mitigation about conflict of human and monkey is found out, these are included in recommendation.

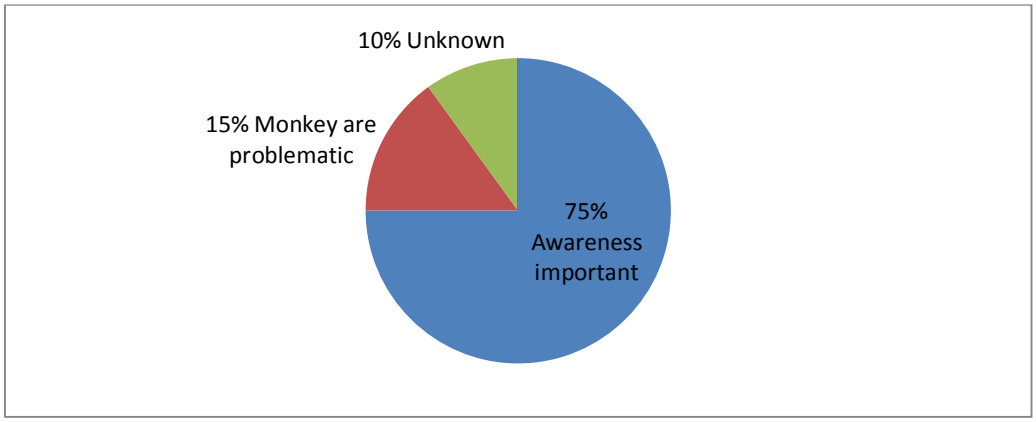

Fig 22: Opinion about monkey conservation in education outreach program

5 DISCUSSION

In the Nagarjun forest of SNNP, only two species named as Rhesus monkey (*Macaca mulata*) and Assamese monkeys*(Macaca assamensis*) were found. Rhesus monkey was found in highest number with total head count of 270, Assamese monkey population was found to be 166 while hanuman langur not found. The absence of Hanuman Langur may be due to the availability of small natural habitat and being less commensal to human (Khatri 2006). The Rhesus monkey was found distributed in all forest of the study area. But the troop with highest number of individual was found in the Baisdhara area. It may be due to the prevalence of human settlement near to the forest as Rhesus monkeys are more commensal to human. Khatri (2006) also found that the troop with highest number of population was found near to human settlements which were nearest from natural habitat than deep forest.Sajet al (2001) also reported the agricultural area adjacent to forest area worst affected by thevervet monkey. Farm located within 300m of forested boundary incur the greatest risk of crop raiding. 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 the Shivapuri National Park (ShNP) mainly near the edge of cropland and human settlements areas.Kattel (1993) added that rhesus monkeys were mainly found in *Schima-Catatopsis* habitat on the lower periphery and Oak-laurel (*Quercus Speciess*) inthe middle elevation adjacent to human habitations.Soti(1995) had mentioned that Rhesus monkey were in Kakani area of ShNP similar result that I found, rhesus monkey of Nagarjun forest were near to the human resident.

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. But in my study monkeys frequented more around the human settlement during rainy season as they could grab maize easily from the field and there were scarce fruits in the forest during rainy season for monkeys. In my study, it was found that 43% of their total time spent on foraging, resting (25%), locomotion (21%) and grooming (11%) in case of Rhesus monkey while in Assamese monkey Foraging

(42%), resting(25%), locomotion(23%) and grooming (10%) found. Rhesus monkey spent 43.3% of its total time in feeding. Nepal (2005) in Shivapuri found foraging for maximum time (42.69%). Ghimire (2000) reported 43.5% feeding in community forest troop of Nepal. Southwick (1967) reported that they spent 60% time on feeding. But Teas (1978) in Swoyambhu found that rhesus monkeys spent only 25% time on feeding. Panthi (1997) also in Swoyambhu reported 17.13% and Shakha (1999) in Pashupati reported 24% time on feeding. This study shows similarity with Nepal (2005) and Ghimire (2000) as the rhesus monkeys with wild habitat, natural feeding and similar climatic condition. Difference regarding the duration of feeding is due to the artificial provisioning by urban people in Swoyambhu and Pashupati. Similarly resting was found second (23.95%) to feeding, similar to Nepal (2005) 24.97%, Ghimire (2000) 21.82% but different from Teas (1978) 8%, Sakha (1999) 29% and Panthi (1997) 14.56%. Moving (21.5%) also was found similar to Ghimire (2000) 20.25% and Nepal (2005) 21.82% but slightly different (25%; 24%; 18.44%) than Teas (1978), Sakha (1999) and Panthi (1997). During the total observation period, the total grooming time was calculated as 11.25% in total spent time. Ghimire (2000) recorded 12.14%, Nepal (2005) 10.52%, Teas (1978) found 15%, Sakha (1999) found 16%, Southwick (1967) found 34% and Panthi (1997) found 15.36% grooming. Present study showed similarity with Ghimire (2000) and Nepal (2005) but different with others. This also shows climatic conditions, location and topography of the study area affect the grooming and other behavior of monkeys. In case of Assamese monkey where as Chalise (2010) recorded foraging 43.4%, moving 31.7%, sitting 18.5%, grooming 3.4% and stone licking 1.7% in LNP and Bhattarai (2002) recorded eating 29.20%, sitting 33%, walking 28.20%, grooming 6.40%, mating 1.1.%, aggregation 0.71% and play 0.40% in the same LNP.

Khatri (2006) found that 76% of the respondents of Vijayapur area of Dharan reported the crop raiding as the major problem. Similarly in the study of Mc. Court (2005), it was stated that 92% respondents of Hetauda were found to suffer 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. Chalise (1997, 2001, 2003) reported that crop depredation proportion by monkey 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%). Nepal (2005) in ShNP, Kathmandu found highest loss of maize (35%) followed by wheat(30%), millet(16%), mustard (6%), paddy (5%), fruits (4%), vegetables (1.92%). Aryal (2012) in Gulmi found highest loss of maize (21%) followed by wheat (20%), paddy (12%), fruits (10%), millet (9%), potato (9%), mustard (4%), Barley (2%) and pulses (1%). Crop raiding was found as major cause of conflict. Mostly, the crop raiding was seen in daytime. Villagers reported that the rhesus monkey are opportunistic in crop raiding whenever the field is ready to harvest or whenever they plant maize and potatoes and they raid palatable and edible crops. Even, unmanaged garbage along the road is another attraction for them to raid. Of the different crops raided by monkeys, maize is the highest loss because it is more palatable than others. 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. This is similar phenomenon which I got in my study, human attacks and harassment was 31% (which included Snatching (20%), Nail scratch (6%), Bite (2%), Stealing 3%) and remaining 69% were threat. Thus all these report showed that, monkey aggression towards human is mainly concerned with the food and human interference of the habitat. But the problem of monkey was increasing and majority of the people (69%) had to leave more or less of their land fallow due to monkey problem.

Monkeys were found to be frequented in the crop field occasionally. It was found that during the months of rainy season monkeys raided the crop even twice or thrice a day. But during autumn and spring monkeys were not appeared around the human settlement for many days. This fact is also supported by the previous findings. In my study, Population of rhesus monkey is greater number in Nagarjun forest while assamese are in less number. Out of 200 respondents (villagers and visitors) in this area said translocated rhesus monkey (50%) causes more conflict while natural occurring rhesus monkey (30%) and rest of assamese monkey (20%) are problem creator in farmers field and involving in human attack and harassment. In my study,

Crop raiding was found as major cause of conflict, in which maize was highest proportion (57%) and the lowest proportion was pulses (1%). The crop raided by monkeys included wheat (28%), millet (5%), paddy (4%) but also vegetables ((3%) pumpkins, bean, potato, cabbage, cauliflower, etc) and fruits (guava, pear, pineapple, plum, etc) was 2%. This fact is also supported by the finding of Chalise (1997, 2001, 2003). Chalise et al. (2001) 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%). Khatri(2006) in Vijayapur also recorded the damage of maize in highest extent (43%) followed by fruits (27%). Findings fromAryal(2012) in Gulmi, the damage of maize is highest extent (53%) followed by wheat(23%), paddy(16%) and other (8%). Koirala(2014) studied two troops of Assamese monkey in Nagarjun forest, in her findings Troop "A" not raided crops but Troop "B" raided 6% crop, as in my findings assamese monkeys are less problematic in comparison to the rhesus monkeys.

Adhikari (2013) in Lamjung district, studied the Assamese monkey; the damage of maize in highest extent (44%) followed by potato(27%), millet(13%), wheat(7%), paddy(4%), fruits(3%) and Vegetables(2%).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 in every hill parts of Nepal in summer and rainy season when natural fruits are not plenty enough in the forest areas. The amount and typesof raided cropscould also be depending upon the types of cultivated crops, availability of natural food, distance of cropland from the forest and number of individual in the monkey troop.

Fallowing of land to get rid from the problem of monkey was in high intensity, Local people could not yield sufficient food to fulfill their family need as raided by monkeys and fallowing of land. As perceived by local farmers, lack of natural food in the forest was the major cause compelling monkey to raid the crop. Instead of these monkey is found in garbage raiding near the resort and hotel along the road side of forest. Due to the heavy crop raiding habit of these monkeys, local farmers have tried repeatedly to decimate their populations at various locations. Besides, these monkeys

are also found in cities, eating from garbage dumps and potentially transmitting diseases to humans and vice versa. Consequently, a monoculture of unattractive crops might act as a buffer to discourage primate crop raiding (Naughton-Treves 1998). Alternative buffer crops could also be medicinal plant not raided by wildlife (Rao et al. 2002). However, it is important to be aware that eradication of all crop-raiding primates from an area, though perceived by farmers as the most effective protection method, is usually only a short-term solution, as other primate groups may quickly invade the newly available home range (Strum 1987).

Although chasing of monkeyby shouting and following was found to be most effective and widely used measure. Local peoples usually guarded their crop field and chased monkey by shouting and following. Use of catapult and stone, use of dog to chase monkey, hitting tin boxes is common method applied, trapping and giving torture in cage and putting human clothes and someone painted their body to make different from others and released them. Khatri (2006) in Vijayapur found the use of catapult to frighten the monkeys to be most effective. McCourt (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. Aryal (2012) in Gulmi found that 30% shouted while 24% people used Catapult and stone to chase the monkey. Adhikari(2013) studied assamese monkey in Lumjung district, showed that 68% guarding and Shouted, 16% used stone and catapult, 12% used dog while rest of 4% hitting tin boxes and scarecrows to chase the monkey.

Chalise (2001) reported that farmer's suffering from monkey crop damage in eastern Nepal was considering planting chili, garlic and tobacco. From the study, some unpalatable crops for monkey were also reported, so to minimize the crop raiding problems. Ginger, garlic, chili, pidalu etc. were the major alternative crops planted by the local people. People should give priority for alternative farming like mushroom cultivation, planting of chili, lady's finger, ginger, garlic etc. Alternative crop was found to be effective to lessen the loss by monkey.

From the study, conflict between human and monkey was found to be increasing thus the hostility will be more in future. Though significant number of people said that increasing of monkeys population was responsible for heighten the problem but no any scientific data of the population of monkey is available inhabiting on the forest of

Nagarjun in the past. Thus it can be speculated that problem of monkey may have increased due to the encroachment of natural forest by local people with increase of human population and lack of awareness.

The reintroduction and introduction of a species to an entirely new site must be carefully thought out so that the released species doesn't damage its new ecosystem or harm populations of any local endangered species (Olden et al. 2011). Reintroduction of captives should not be considered a solution to the problem of surplus captive animals and a shortage of facilities. Releasing captive born animals without preliminary ground work and follow-up may turn out to be inhumane as well as seriously jeopardize the wild population (Kleiman 1989). However, this release is a part of conservation effort. In study area, individuals or organizations frequently capture monkeys and release them in Nagarjun forest. Due to lack of proper habitat and their ability to integrate into a troop, these translocated monkeys seek provisional food, so they are constantly roaming around human residences and garbage raiding. Before these translocations occurred there was no such problem with the native monkeys, either rhesus or assamese. Without properly assessing the carrying capacity of the habitat, translocations are wrong and almost certainly will increase the negative interactions between the monkeys and the local people (Imam et al. 2002).Here, adults and children simply have no idea about conservation of primates, or do they show any compassion towards animals. Lack of arms and no provision of killing the monkeys, increase of population of monkey, crop field very near to forest etc were other major components responsible to heighten the problem of monkey as responded by the local farmers.

In the study area, different traditional preventive measures were applied to deter monkey, local people of Goldhunga and Jitpurphedi started signature campaign and forced to the local government for compensation and transfer of monkey from their territory. Osho Tapoban, the internationally known meditation center, published an advertisement about to eradicate monkeys from their area. Thus, successfully finished outreach education program in 400 School children including class teacher and science teachers in 4 different schools of this area from October 2013 to January 2014.From this program 75% students/teachers delivered their views; awareness is important for the conflict management of human and non human primates while 15% students claimed monkey are the problem creator and rest of 10% did not answer

satisfactory for theconservation. Since it is highly inspired by **"Little Green Guards"** mobilized Primate conservationist and has implemented children's conservation education and evaluation programs in China, Vietnam and Madagascar (Tan et al. 2013).My efforts in outreach education program was evaluated and got chance to participate in **Developing effective education and Outreach Skills workshops –Vietnam,** organized on August to September-2014. The invitation of workshop is given in Appendix VII.

6. CONCLUSION

- In the study period Feb 20012 to March 2013in Nagarjun forest of SNNP, Kathmandu, the population of Rhesus and Assamese monkey was found 270 and 166 individuals with altitudinal range from 1325m to 2102m.
- Habitat utilization was found to be concentrated towards the lower altitudinal range with great influence of human habitation and crop land.
- Habitat is more preferred in the area having more chances of crop, garbage, provisional food, safe from predator and tall trees for safe roosting.
- Both diversity and dominancy index showed the good vegetation condition but the natural feeding plants were lacking and it is not sufficient.
- Suitable composition of habitat have provided by natural vegetation, topography and edaphic factorse.g. rocky area, smooth ground, streamside, tree-shrub area and cropland.
- The activity budget of rhesus and assamese monkeys in Nagarjun forest was very similar. Among four major activities macaque spent greater percentage of time in foraging behavior followed by locomotion, resting, and grooming.
- Both species spent more time on average in the croplands during the summer. At this time the forest is the least productive and the crops have matured.
- Both species, but especially the rhesus monkey, were opportunistic crop raiders. To obtain food with less effort, rhesusmonkeys are frequently foundat the periphery of human habitation.
- Surveys show that problematic interactions between the monkeys and humans nearly doubled from 2011 to 2013.
- Most of the monkey/human interactions involved with translocated rhesus monkeys. It suggests that these monkeys could not integrate into the natural troops.
- Although, surveys suggested that more people would prefer to be financiallycompensated dueto the monkeys, 50% percent of respondents want the monkeys removed from foresteither by eradication or translocation.

- 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: monkeys believing as a sacred animal

    >Lack of awareness about wildlife among people

- From the respondents and outreach education program some recommendation is collected to mitigate human and monkey conflicts.

7. Recommendation

We can't isolate from ecosystem, every species is important in the "ecosystem services." But, due to increments of human population, pressure on monkey natural habitat, it has resulted in the conflict between man and monkeys. The strategy should be aimed at reducing and mitigating conflict. Based on the finding of this research work, following recommendations can be made for the management and conservation of protected Assamese macaques and common Rhesus macaques in Nagarjun forest of Shivapuri Nagarjun National Parks, Kathmandu, Nepal.

7.1 Short-term Strategies

- Monkey unpalatable crops such as spinach, lady's finger, winter beans, coriander, ginger, turmeric, chili etc is useful crops especially in the area where exists high crop raiding by the monkey.
- Not to tease or kill monkey and don't use domestic or stray dogs to chase monkeyShould also be checked.
- Collection of fodder and grazing by domestic livestock's of the surrounding villages should be minimized in the habitat of wildlife and primates.
- Students (child) and women should walk in a group while moving through the monkey problematic areas.
- Further human settlement in and around the habitat of the monkeys should be discouraged.
- There should be proper management of garbage along the road side near the forest.
- Provisional food / feeding thinking as sacred view should be avoided to the monkey.
- Medical service and timely anti rabies vaccination for the victims of monkey bite should be provided by local government.
- To increase natural food of monkeys, forestation of fruiting and flowering plant should be carried out to minimize their raid in crop field.
- Participatory conservation works and awareness program should be done with local people and tourist.

- Relocate or translocate them in suitable habitat from human settlements.
- Need more researches on the ecology and behavior of Primates.

7.2 Long-term Strategies

7.2.1 HabitatImprovement

The natural habitat of monkey should be improved in the community forest especially by planting the Monkey palatable plants eg. Bar (Ficus benghalensis), Pipal (*Ficus religiosa)*, Amala(*Phyllantus emblica)*] and also to provide provision of drinking water in their habitat.

7.2.2 Conservation of Natural Forest

Local people browse and collect fodder for their cattle's and illegal destruction of palatable plants of monkey causes lack of food in natural. So, this activity should be checked for the conservation of Natural forest.

7.2.3 Conservation program

Local Government, District forest Office or National Park's people should launch the conservation program at the target groups 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.

7.2.4 Awareness Program

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

- ❖ About zoonotics disease transferable from monkey to human and vice versa.
- ❖ About Artificial Provisioning and its Consequences.
- ❖ About behaving with monkey.
- ❖ About likes and dislikes of monkey etc

7.2.5 Establishment of Research center

From this centre following works should be implemented.

- ✓ Monitoring of population and study of conflict to make proper management.

- ✓ Awareness program for the conservation of wildlife animals can be carried out such asAssamese macaque (a nationally protected and CITES II species) is important to conserve.
- ✓ Near the village and urban area "Big cats" seems as problematic so it can be a predator of rhesus monkey for food chain.
- ✓ Can provide different strategy for the " ecosystem-services"

7.2.6. Development of Eco-tourism centre.

As the area around the National park is also a growing tourist area, by increasing awareness and empathy toward wildlife in local residents an increased conservation ethic could result in a strengthened tourist trade.

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Appendix–I: Climatic parameters in the year 2011

Months	Panipokhari station					Nagarjun Rainfall (mm)
	Temperature (°C)		Humidity (%)		Rainfall (mm)	
	Maximum	Minimum	8:45	17:45		
January	17.9	3.5	86.4	85.8	0	1.5
February	21.0	6.1	84.5	88.2	17.0	56.6
March	23.8	10.2	85.9	82.9	13.4	5.5
April	26.5	12.9	79.2	82.3	111.4	88.5
May	26.2	17.4	78.8	82.1	157.6	131.2
June	30.0	18.7	88.0	90.5	372.9	196.0
July	29.6	20.3	90.2	84.4	423.1	552.8
August	30.2	20.1	85.5	88.3	339.9	233.7
September	30.0	20.1	88.2	86.6	239.2	420.7
October	30.0	19.1	80.7	85.8	73.2	69.0
November	28.8	12.8	86.2	88.8	81.7	4.0
December	27.5	11.3	91.2	91.5	0.0	0.0

(*Source: DHM*)

Appendix: II Studying Primate Behavior in Singapore.

CERTIFICATE OF

Accomplishment

Wildlife Reserves Singapore,
Wildlife Reserves Singapore Conservation Fund
and
San Diego Zoo Global
acknowledge

Bishwanath Rijal

for the completion of

Studying and Monitoring Primate Behavior:
A Workshop for Asian Conservation Professionals

1 - 15 May 2011

Chia L. Tan, Ph.D.
Scientist, Head of Asia Regional Program
San Diego Zoo Global

Fanny Lai
Group CEO
Wildlife Reserves Singapore

Hosted by:

In collaboration with:

Appendix III: **Galante F. W. Conservation Scholarship-2014**

March 18 2014

Bishwanath Rijal
Central Department of Zoology
Tribhuvan University
Kathmandu, Nepal

Dear Bishwanath,

Thank you for your application for the International Primatological Society's Galante Family Winery Conservation Scholarship for 2014.

The IPS Conservation Committee has finished its deliberation and I can attest to the fact that it was a very difficult decision because we had several worthy applicants.

I am very pleased to let you know that you have been selected to receive the Award! The Committee was very impressed with your potential and we know that this Award will help you in your endeavor to protect the primates of Nepal and generally contribute to the field of primate conservation.

This letter will be useful in your application for relevant visas. Dr. Steve Schapiro, IPS Treasurer, may be contacted to transfer the funds to your account for arranging your travel and expenses.

Congratulations, Bishwanath. We wish you great success with your plans – and we look forward to following your career in primate conservation!

Respectfully,

Janette Wallis, Ph.D.
Vice President for Conservation
International Primatological Society

Appendix IV: Abstract Presented in IPS-2014, Hanoi.

XXX (no-need to enter paper number)

ECOLOGICAL STUDY OF RHESUS AND ASSAMESE MACAQUES AND THEIR CONFLICT WITH HUMANS IN NAGARJUN FOREST, KATHMANDU, NEPAL

B.N. Rijal, M.K. Chalise

Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal

Presenter's Email: bishwarijal@yahoo.com

We examined the ecology of macaques in Nagarjun forest (16 km^2) in Kathmandu, Nepal from February2012 to March 2013. Our study sites included adjacent forests of Jitpurphedi and Goldhunga Village Development Committees, where local residents reported conflicts with two macaque species, *Macaca mulatta* and *M. assamensis*. Using the direct count method, we determined the population of *M. mulatta* and *M. assamensis* to be 270 and 166 individuals, respectively. We found that edible plants were not sufficient to support the macaque populations. Consequently, the macaques were observed to consume garbage, provisioned food and agricultural crops. Crop-raiding by the macaques was common (71% of survey respondents). Maize (57%) and wheat (28%) were reported to be the worst affected crops, whereas pulses were the least. Shouting and chasing (40%) as well as using stone and catapult (34%) were the common methods of deterrent against the macaques. Additionally, there were considerable reports of human attacks and harassment (29%). Translocated *M. mulatta* individuals were more problematic to the local humans than naturally occurring ones. Our findings further showed that the macaque problem has increased from <50% in 2010 to 92% currently. Financial compensation was suggested to be an effective measure to reduce human-macaque conflict in these areas (47%). This study was partially funded by WWF Nepal.

Keywords: macaques, crop-raiding, human-wildlife conflict, Nepal

Appendix -V: Questionnaire format for respondents

Nagarjun Forest of SNNP

Date: ……

Name: …… Age…… Sex: M/FDistrict: ……VDC ……Village ……Ward No……Occupation: ……..

A. Conflict Caused by Monkey:

1. How many members are there in your family? ……
2. How much land do you own? Khet: ……..Bari: ……..Pakho: ……..
3. Which crops do you grow in your field?

Name of Crops	Plantation	Harvesting	Name of Crops	Plantation	Harvesting
Maize			Potato		
Paddy			Vegetables		
Wheat			Fruits		
Millet			Others		
Mustard					

4. Do animals or birds damage your crops?

   Yes [ ] No [ ]

   If yes Name: - Local Name:

5. Does the monkey raid crops?

   Yes [ ] No [ ];

   If yes which monkey species

   Name: …… Local Name: ……

6. Which crop does the monkey raid most?

   Crop:

Maize …….. Pathi /Kg. Paddy …….. Pathi /Kg.

Wheat …….. Pathi /Kg. Millet …….. Pathi /Kg.

Mustard …….. Pathi /Kg. Potato …….. Pathi /Kg.

Vegetables …… Pathi/Kg. Fruits……. Pathi/Kg.

Others …… Pathi/Kg.

7. Which year: Every year …… last year ……This year ……Never……..
8. Time of raid: Early morning/Noon/Afternoon/Evening/Night
9. Proximity of damage field to the jungle: 100m/200m/500m/1000m/2000m
10. What is the preferable stage to raid the crops?

Crop	Raiding Stage	Season	Crop	Raiding Stage	Season
Maize	Sprouting	……..	Potato	Sprouting	……..
	Young shoot	……..		Young shoot	……..
	Milky	……..		Young	……..
	Ripen	……..		Ripen	……..
Millet	Sprouting	……..	Vegetable	Sprouting	……..
	Young shoot	……..		Young shoot	……..
	Milky	……..		Grown up	……..
	Ripen	……..		Old	……..
Wheat	Sprouting	……..	Fruits	Sprouting	……..
	Young shoot	……..		Young shoot	……..
	Milky	……..		Juicy	……..
	Ripen	……..		Ripen	……..
Paddy	Sprouting	……..	Others		
	Young shoot	……..			
	Milky	……..			
	Ripen	……..			

11. What is the frequency of monkey interference in crops?

Name of Crops	Frequency/ Months	Name of Crops	Frequency/months
Maize	……..	Mustard	……
Paddy	…….	Wheat	……
Millet	……	Vegetables	…….
Fruits	…….	Others	……

12. Any land left fallow because of the crop raiding of monkey?

Khet …….Bari……. Pakho ……

13. Any other kinds of nuisance activities/harassment besides crop raiding?

Yes [ ] No [ ]

If yes, what kinds?

Biting [ ] Disease transmission [ ] Accidents [ ] others……

14. What are the preventive methods that you are using to control?

Guarded by man/ woman/young/Children/Dog/Scarecrows/ Noising/Fencing/Poison/Fire cracker/Hunting/Others …….

15. Have you asked to Government/forest official for compensation or other solution?

Yes [ ] No [ ] Unknown [ ]

16. What will be the suggestive solution? …….

17. What are the benefits from Parks/forest? Fuel wood/fodder/timber/cattle grazing/Employment/others …….

18. What do you think about the establishment of Parks/ forest in your area?

Beneficial [ ] Harmful [ ] Unknown [ ]

19. What do you think about the wildlife of this parks/forest?

i) Should be protected ii) translocated iii) killed

20. Are you happy with the present park/forest management system?

Yes [ ] No [ ]

21. What do you expect from the parks/forest authority?.....

22. Remaining any suggestions and problem? …….

B. Conflict Causes by Human Beings

1. Problematic efforts noted down as following format.

Date	Caused by		Type				
	Local people	Visitors	Chase out	Shout	Charge Threat	Stone throw/Catapult	Others

2. Questionnaire to National Parks/Forest visitors:

i. Have you seen any problems to monkey caused by human beings?

Yes [ ] No [ ]

If yes, what type of problems a) chasing b) Beating c) killing d) capturing?

ii. Have you any experience of problems caused by monkey inside the forest during your visit?

Yes [ ] No [ ]

iii. You yourself faced or seen to others? ……

iv. How defended? ……

3. Questionnaire to local people.

i. Have you seen any troubles caused to monkey?

Yes [ ] No [ ]

ii. If yes what types?

a. Encroachment b. Beating c. Capturing d. Killing

iii. If encroachments weather

a. Habitat destructions b. Food destructions. c. Resting place destruction.

Appendix VI (a): Vegetation Data

List of Plants found in Fulbari and Raniban Block of Nagarjun forest

Plot No	Local Name	Scientific Name	Total number	Parts eaten
1	Chilaune	*Schima wallichii*	4	leaf,young leaf,fruit
	Nasi	*Stranvaesia nussia*	5	leaf
	Bedulo	*Ficus sarmentosa*	2	young leaf , fruit
	Gobresalla	*Pinus wallichiana*	3	seedlings
	Hadebayar	*Zizyphus incurva*	1	Young leaf, seed
	no of sps.: 5		15	
2	Chilaune	*Schima wallichii*	2	Non edible
	Musure kattus	*Castanopsis tribuloides*	1	Fruit,flower
	Khari	*Celtis australia*	1	Fruit
	Jhankrikath	*Machilus duthiei*	3	Fruit
	Maledo	*Macaranga indica*	1	Leaf
	Dhalekatus	*Castonopsis indica*	4	Young leaf,seed
	Hadebayar	*Zizyphus incurva*	1	Youg leaf, seed
	Uttis	*Alnus nepalensis*	4	Non edible
	Setikath	*Myrsine capitellata*	2	Young leaf
	Phalat	*Quercus spp.*	10	Seedlings
	Firfire	*Acer oblongum*	6	Seedlings
	Mahuwa	*Engelhardia spicata*	2	Fruit
	no of sps: 12		37	
3	Saur	*Betula alnoides*	8	Young leaf
	Chilaune	*Schima wallichii*	7	Non edible
	Khania	*Ficus semicordata*	2	Fruit
	No. of sps. 3		17	

4	Musure kattus	*Castanopsis tribuloides*	5	Fruit,flower
	Setikath	*Myrsine capitellata*	3	Seedlings
	Lakuri	*Fraxinus floribunda*	3	Young leaf
	Jhankrikath	*Machilus duthiei*	4	Fruit
	Khari	*Celtis australia*	2	Fruit
	Kapro	*Ficus lacor*	2	Young leaf , Bud
	Dhalekatus	*Castonopsis indica*	2	Fruit , flower
	Mayal	*Pyrus pashia*	1	Young leaf
	Hadebayar	*Zizyphus incurva*	2	Fruit, flower
	Uttis	*Alnus nepalensis*	4	Non edible
	no of sps. 10		28	
5	Chilaune	*Schima wallichii*	9	Leaf, Young leaf, Fruit
	Jhigani	*Eurya acuminate*	4	Young leaf
	Jhankrikath	*Machilus duthiei*	5	Fruit
	Musure katus	*Castanopsis tribuloides*	4	Fruit, flower
	Setikath	*Myrsine capitellata*	3	Seedlngs
	Gobresalla	*Pinus wallichiana*	1	Seedlings
	no of sps: 6		26	
6	Chilaune	*Schima wallichii*	15	Leaf, Young leaf, Fruit
	Laligurans	*Rhododendron arboretum*	1	Flower
	Bhalayo	*Semecarpus anacardium*	1	Non edible
	Pipal	*Ficus religiosa*	1	Fruit
	no of sps: 4		18	
7	Chilaune	*Schima wallichii*	22	Leaf, Young leaf, Fruit
	Lapsi	*Choerospondias axilllaris*	2	Fruit
	Musure Kattus	*Castanopsis tribuloides*	2	Fruit, Flower
	Gogan	*Sauraula nepaulensis*	2	Young leaf

	no of Sps: 3		28	
8	Khari	*Celtis australia*	7	Fruit
	Chilaune	*Schima wallichii*	4	Leaf, Young leaf, Fruit
	Jhakrikath	*Machilus duthiei*	5	Fruit
	Lakuri	*Fraxinus floribunda*	4	Young leaf
	Sano tusaro	*Colquhounia coccinea*	2	Young Leaf
	Setikath	*Myrsine capitellata*	2	Seedlings
	Dhale katus	*Castonopsis indica*	2	Seed
	Khanyu	*Ficus semicordata*	1	Fruits
	no of sps: 8		27	

Appendix: VI (b) Density and Frequency of Vegetation in Fulbari and Raniban of Nagarjun Forest

S. N.	Local Name	Scientific Name	Total	Density	Relative Density	Frequency	Relative frequency
1	Chilaune	*Schima wallichii*	59	0.0118	30.89	75	13.043
2	Jhankrikath	*Machilus duthiei*	17	0.0034	8.9	50	8.7
3	Musure kattus	*Castanopsis tribuloides*	16	0.0032	8.34	62.5	10.87
4	Phalat	*Quercus spp.*	10	0.0020	5.24	12.5	2.17
5	Setikath	*Myrsine capitellata*	10	0.0020	5.24	50	8.7
6	Khari	*Celtis australia*	10	0.0020	5.24	25	4.35
7	Uttis	*Alnus nepalensis*	8	0.0016	4.19	25	4.35
8	Dhalekatus	*Castonopsis indica*	8	0.0016	4.19	37.5	6.52
9	Saur	*Betula alnoides*	8	0.0016	4.19	12.5	2.17
10	Lakuri	*Fraxinus floribunda*	7	0.0014	3.66	12.5	2.17
11	Firfire	*Acer oblongum*	6	0.0012	3.14	12.5	2.17
12	Nasi	*Stranvaesia nussia*	5	0.0010	2.62	12.5	2.17
13	Gobresalla	*Pinus wallichiana*	4	0.0008	2.09	25	4.35
14	Jhigani	*Eurya acuminate*	4	0.0008	2.09	12.5	2.17
15	Hadebayar	*Zizyphus incurve*	4	0.0008	2.09	37.5	6.52
16	Khanyu	*Ficus semicordata*	3	0.0006	1.57	25	4.35
17	Mauwa	*Engelhardia spicata*	2	0.0004	1.05	12.5	2.17
18	Lapsi	*Choerospondias axilllaris*	2	0.0004	1.05	12.5	2.17
19	Kapro	*Ficus lacor*	2	0.0004	1.05	12.5	2.17

20	Bedulo	*Ficus sarmentosa*	2	0.0004	1.05	12.5	2.17
21	Sano tusaro	Sano tusaro	2	0.0004	1.05	12.5	2.17
22	Gogan	*Saurauia napaulensis*	2	0.0004	1.05	12.5	2.17
23	Bhalayo	*Semecarpus anacardium*	1	0.0002	0.52	12.5	2.17
24	Pipal	*Ficus religiosa*	1	0.0002	0.52	12.5	2.17
25	Laliguras	*Rhododendron arboretum*	1	0.0002	0.52	12.5	2.17
26	Maledo	*Macaranga indica*	1	0.0002	0.52	12.5	2.17
27	Mayal	*Pyrus pashia*	1	0.0002	0.52	12.5	2.17
Total	No of sps: 27		196			625	

Appendix VII: Outreach education program in Vietnam

SAN DIEGO ZOO GLOBAL

June 21, 2014

Dear **Mr. Bishwanath Rijal**,

Thank you for applying to the *Training in Primatology Series* (*TIPS*) program. After careful review of your application and consideration of your professional development needs, I am very pleased to offer you a position in the 2014 *TIPS* workshop, *Developing Effective Education and Outreach Skills*. Congratulations!

The workshop will take place in Danang, Vietnam from August 18 to 27, 2014. As stated in the announcement, there will be no tuition fees involved for your participation. However, please be reminded that you are responsible for the following:

- Air travel between Nepal and Vietnam,
- Entry visa to Vietnam,
- Travel medical and emergency insurance, and
- Lodging and meals during the workshop period.

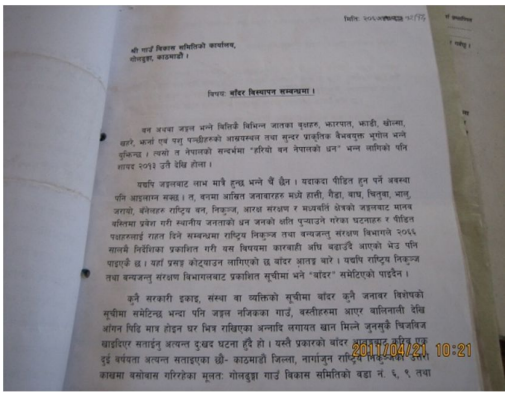
To accept this training offer, please reply by **July 4**. I wish you the very best for your conservation and research efforts!

Sincerely,

Chia L. Tan, Ph.D.
San Diego Zoo Global - San Diego Zoo Institute for Conservation Research
15600 San Pasqual Valley Road
Escondido, CA 92027-7000 U.S.A.
Tel: +1 760-291-5425 Fax: +1 760-291-5428
E-mail: ctan@sandiegozoo.org

APPENDIX VIII a): Humans Activities around the Nagarjun

Advertisement to eradicate monkeyfrom Nagarjunref: Kantipur daily 9th feb 11

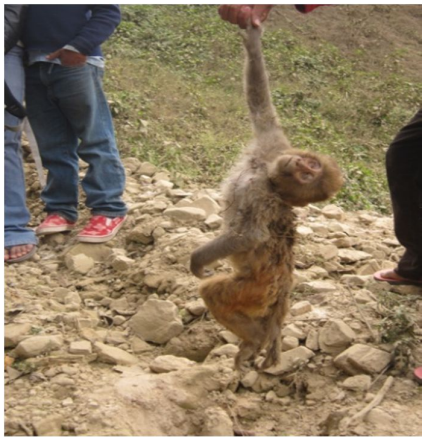


Application to shift monkey, Ref: Golddhunga VDC

Monkey Cage in forest

Body painted and given torture to monkey

Monkey killed by dog



Monkey killed by man

Appendix VIII (b): Human activities around the Nagarjun forest

Fire wood collected from forest

Catapult to the monkey

Cattle grazing near the forest

Fodder clearing from side of forest

Destruction of private forest

Maize crops near the forest

Appendix VIII (C): Monkey activities around the Nagarjun

Pumpkin(*Cucurbita pepo*) eaten by monkey

Peach(Prnus persica) eaten by monkey

Maize eaten By monkey

Garbage raiding by monkey

Showing Monkey bite at Mudakhu

Raiding in roof top garden

Appendix VIII (d): Monkeys around the Nagarjun Forest

Monkey opening tape water

Monkey in the herbs area

Feeding provisioning foods

Monkey troops in crop field

Monkey licking soil

Adult male Assamese monkey

Appendix VIII (e): Some photos around the Nagarjun Forest

Keeping Fences in house

Keeping glass fences in house

Researcher in Nagarjun forest

Interviewing with villagers

Interviewing with' 'Acharya Baje" at Mudakhu

Forest in Fulbari area of Nagarjun

Appendix VIII (f): Outreach education at different School

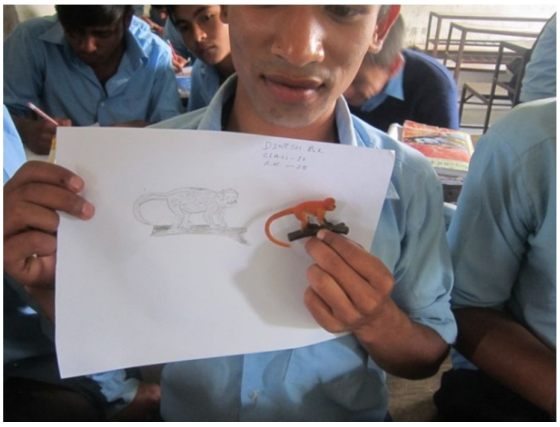
Budhanilkantha School, Budhanilkantha.

Jitpurphedi Higher Secondary, Jitpurphedi

Nagarjun T. Higher Secondary School

Nagarjun School, showing different Primates

Primates Drawing Competition program



Drawing of a primate at school