

# 1. INTRODUCTION

## 1.1 General Background

Monkeys are included under the order Primates of subphylum Vertebrata and phylum Chordate. Monkeys, according to their geographical distribution, are categorized into two types: (i) New World monkeys, and (ii) Old World monkeys. New world (Central and South American) monkeys have two families i.e. (i) Callithricidae (e.g. marmosets), and (ii) Cebidae (e.g. spider monkeys, woolly monkeys, howlers, capuchins etc). Old World monkeys have single family Cercopithecidae, e.g. Rhesus, Mandrills, Langurs, baboons etc. (Parker & Haswell, 1995). Among the non-human primates, Four species of monkeys have been reported from Nepal; Rhesus macaque (*Macaca mulatta*), Assamese macaque (*Macaca assamensis* McClelland 1940), Terai Grey Langur (*Semnopithecus hector*) and Nepal Grey Langur (*S. schistaceus*) (Molur *et al.* 2003). Among them Assamese macaque is one of the less common primate species and is explored patchily in Nepal (Chalise 2010). The Assamese macaque (*Macaca assamensis* McClelland, 1840) is reported from mid-hill and high Montana forest but their ecological and behavioral detail is still poorly known (Chalise, 1999). Assamese monkey locally known as *Pahare Bandar* (Chalise, 2003, 2010). It resembles to the Rhesus monkey having a brownish-grey to yellowish-grey coat, which is uniform in pelage, lacks a pinkish face and absence of red bottoms (Chalise 2008). This macaque is reported to be endemic to Nepal and it has some taxonomic complexity as agreed by the CAMP (Conservation Assessment and Management Plan) workshop there by considered as Nepal population (Chalise, 2008, Chalise, 2011).

### 1.1.1 Taxonomy

The Assamese Macaque belongs to the family Cercopithecidae and subfamily Cercopithecinae of the order primates. Three subspecies of Assamese macaque have been reported until now and they are: Eastern Assamese Macaque (*Macaca assamensis assamensis*), Western Assamese Macaque (*Macaca assamensis pelops*) and Assamese Macaque “Nepal Population”. The Assamese monkeys of Nepal are considered “Nepal Population” by CAMP workshop 2003 due to taxonomic confusion (Molur *et al.*, 2003). This population is different from Assamese monkeys described up to now from South-East Asia in respect to the head-body length, tail length, T/HB ratio and weight. The body fur and facial coloration also differs in males and females than so far described population of this species. So, Nepali Assamese macaque should consider a new subspecies however; need further taxonomic investigation (Chalise, 2003). Nepal population of Assamese macaques inhabits between the elevations of 380 m to 2350 m in different parts of Nepal. They have body weight 15-18kg in males and 12-15 kg in females. Head and body length are around 2 ft long with tail length of 14 inches. Similar observation of differences was recorded for Langtang and Ilam specimen (Chalise, 2003; Chalise, 2005b). The fur coloration of Assamese monkeys observed in Nepal varies from dark-brown to blackish-brown on the back, and whitish blond to ashy white on the

abdomen. In the adult female, the cheeks and around the eyes are mostly crimson-red to pinkish red. These colors are absent in adult males, which are mostly whitish-yellow on the face, but dark violet or blackish color of skin around the nose. One or two adults seen in each group had overall darker (wet blond) and dark ashy fur coloration. The pelage coloration of infants and juveniles also varied, but they are generally blonder than the older individuals. The palm, sole and nails are dirty brown, while there off-white ischial callosities are conspicuous from a distance, especially in darker individuals. Female juveniles have more pinkish ear tips and faces than male juveniles (Chalise, 1999; Chalise, 2003).

### **1.1.2 Distribution**

The Assamese Macaque is recorded from Nepal, India (Mussoorie, Assam), Bhutan, Bangladesh, upper Burma, south China, Cambodia, Laos, Vietnam and north Thailand (Molur *et al.*, 2003). The Assamese monkeys of Nepal are considered 'Nepal population' and categorized as “Endangered” by CAMP Workshop 2003 due to taxonomic confusion and shrinking population in their typical natural habitat (Molur *et.al.* 2003). This population is different from the Assamese monkeys described up to now from South-East Asia in respect to the head-body length, tail length, T/HB ratio and weight. The body fur and facial coloration also differs in males and females than so far described population of this species (Chalise, 2003; Chalise, 2005a; Chalise, 2005b). In Nepal, Assamese Macaques are recorded from 380 m in Mulghat Tamor to 2350m asl in Langtang. They are found in the Basin of Arun River around Apsuwa confluence, Bhumlingtar, Heluwabeshi; Tamor River, Bagmati, Trishuli, Sunkoshi, Gandaki and Karnali River basin at higher elevation but warmer valleys. Thus, Nepal population can be located in subtropical hill Sal forests areas to mixed deciduous forest, temperate broadleaved forest with rocky outcrops and along the riverside steep sloppy forests of above altitude. The species confirmed from Kimni Acham, Dadeldhura, Ramdi Palpa, Langtang NP and Helambu area, Makalu-Barun NP and Bhumlingtar, Hariharpur and Nagarjun forests of Kathmandu. The population so far recorded in Nepal from different sites shows altogether 282 mature individuals while total population with different age and sex comprises up to 525 (Chalise, 2004; Chalise *et al.*, 2005a; Chalise, 2006).

### **1.1.3 Habit and Habitat**

The Assamese Macaque inhabits mountain, evergreen, bamboo, and deciduous dry forests, at elevations from 300 to 3,500 meters (980 to 11, 500 feet). The Assamese Macaque “Nepal Population” inhabits between the elevations of 480m to 2500m in different parts of mid hills of Nepal. The Assamese Macaque eats fruits, leaves, and insects but prefers young leaves. They also lick stones and eat aquatic larva and soil (Chalise, 2003).

#### **1.1.4 Population**

'Nepal population' of Assamese macaque is endemic in distribution due to localization only in Nepal (Molur *et al.* 2003). It is classified as Endangered due to restricted distribution and scattered population of mature individuals (Molur *et al.* 2003, Boonratana *et al.* 2008). The estimated total population of Assamese macaque in Nepal was 1,099 individuals in 51 troops in different habitat of mid-hills of Nepal (Chalise 2013). The isolated distribution of the Assamese macaque in Nepal seems insufficient for maintaining a viable population (Wada 2005).

#### **1.1.5 General Behavior**

Assamese monkeys are shy, timid and less aggressive to human beings in comparison to rhesus monkey. They are arboreal, terrestrial and omnivorous animals with multi-male and multi-female social troops. They come to the ground for easier and safe movement in the dense undergrowth from the tree middle canopy. They are mostly seen doing their social and other activities in the ground with sluggish movement. They predominantly leaf eater but will feed on petiole, gum, shoot, flower, fruits, seeds, bark and caterpillar while they do long foraging activities to find young sprout of grass, aquatic herbs and their pith, aquatic insects and larva, climb hanging greenish rocks to lick and eat a special type of ground soil. They raid crops in hills of Nepal mainly for maize, rice, wheat, millets and fruits. Astonishingly, they dig out potatoes, yam and sweet potatoes from the ground and uproot the new maize seedling to eat the seed. They raid not only banana but also rhizome of cardamom in the orchard farm of east Nepal. In the off-season, they come to nearby tree grooves of village and hide until human activities and when they feel secure, skillfully raid dry maize comb from courtyard storage. They have subgroups of close kith and kin and stay closely during foraging, grooming and in night-rest in a troop. It is observed that adult females, their infants and even male stay in body contact. In winter morning, to get warmth they stay in subgroups for longer period near night halt site and start daily activities after sunshine in their part. During summer, they start their daily activities earlier. The night halt sites are in rocky outcrops inaccessible by other animals, which is visible blackish leakage by their night toileting. They reach their by a slow and creeping walk through the bare rocks, sometime using only hands. The species seems less quarrelsome than rhesus monkey. Adult males tolerate to young males and infants even hug sometime and groom briefly. The recorded group size is 5 to 36 individuals in Langtang area while 7 to 50 individuals in Makalu area (Chalise, 1997, 1998, 1999, 2000, 2003).

#### **1.1.6 Conservation Status**

The National Parks and Wildlife Conservation Act, 1973 Nepal, has listed this animal as a schedule-I animal whose poaching is fully restricted (Chalise 2013). Similarly, the International Union for Conservation of Wild Flora and Fauna (IUCN) has listed this animal under Near Threatened (NT) animal (IUCN, 2011) while its trade in international market has been regulated by the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES) grouping under Schedule II animal (CITES, 2012).

### **1.1.7 Threats**

Nepalese Assamese macaque 'Nepal Population' faces conservation threats due to killing by farmers as a crop pest control measure (Chalise 1999a, 2010). Habitat destruction and fragmentation due to rapid road building activities and hydropower projects; high dependency of local people on forest resources (firewood, fodder and wild fruits collection, intensive grazing and selective logging) (Wada 2005) forest fire and landslide are the main prevailing threat for this species.

## **1.2 OBJECTIVE OF THE STUDY**

The broad objective of this research was to explore the Population, Behaviour and Human-Assamese monkey conflict in Ramdi area.

The specific objectives were as below:-

To explore the Population status of Assamese monkey in Ramdi area.

To explore the Behaviour of Assamese monkey in Ramdi area.

To explore the Human - Assamese monkey conflict in Ramdi area.

## **1.3 RATIONALE OF THE STUDY**

We know very few about Assamese monkey scientifically; it is because almost very fewer studies have been conducted in this area and its periphery. Due to their narrow habitat range, they are facing strong negative impacts these days. Anthropogenic activities like deforestation, agricultural expansion are the major threats to this animal. In this context the extensive study about Assamese monkey is needed to establish a baseline study for many parts of the country. Therefore, this research will provide additional information which will support conservation of Assamese monkey in the country.

## **1.4 Limitations of the Study**

- i. Sloppy forest and rocky surface of the study area created difficulties to follow the animal continuously for long period.

## 2. LITERATURE REVIEW

Subba (1998) studied the ecology and habitat of *Macaca assamensis* in Makalu Barun Conservation Area, Nepal. She found that trees with lesser height are not suitable for the night halt and daytime resting for the macaques. She also reported that Kaulo and Schimawallichhi are the most exploited tree species and Bilaune was the most common plant among the ground vegetation of the macaque's habitat. She concluded that the way in which primates use time and organize activity patterns is an important aspect of behavioral ecology.

Cooper and Bernstein (1999) studied the Dominance in Assamese macaques at a temple site in Assam, India and constructed rank hierarchies for agonistic, grooming and mounting matrices. They found a nearly linear agonistic dominance hierarchy does not correlate with the directionality of mounting or grooming.

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.

Bhattarai (2002) studied the general behavior and habitat utilization by Assamese macaque in Syafrubesi Area of LNP. He found that *Macaca assamensis* abundantly used broad-leaved conifer mixed forest and grassland with scattered trees of family Urticaceae. He recorded the time spent on sitting as highest as 33.3% followed by 29.6% on feeding, 28.2% on walking, 6.4% on grooming and 1.1% on mating.

Chalise (2003) studied body size, behavior and habitats of Assamese macaques (*Macaca assamensis*) in Nepal. He indicated some differences from the Assamese macaques of Makalu-Barun Area from those so far described from south-east Asia and suggested for the molecular genetic studies in order to resolve the taxonomic status.

Cooper *et al.* (2005) studied the reconciliation and relationship quality on a group of Assamese macaques living near the Tukeswari temple near Goalpara, Assam, India. They found that females reconcile most often with valuable and compatible social partners.

Wada (2005) studied on distribution patterns of Assamese and Rhesus macaque in Nepal in 1984. 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 parapatrically. Discontinuous distribution of Assamese macaque was as a result of expansion of Rhesus monkey distribution in mid- and late-Pleistocene.

Khatri (2006) studied monkey-human conflict in Vijayapur Area with the major objective of analyzing human- monkey conflict in Vijayapur Area Dharan, Eastern Nepal. He found that food scarcity; increasing population of monkey; monkey habitat loss;

internal migration; artificial provisioning and religious faith are the causes of increasing monkey problems.

Khaliwada *et al.* (2007) studied the population status of Assamese macaque in Kathmandu, Rasuwa and Dhading districts. They found that the macaques were patchily distributed in the fragmented forests in these areas where macaques have been continuously facing the problem of habitat encroachment by the local people.

Regmi (2008) studied on the population status, threats and conservation measures of Assamese macaque in Langtang National Park. They recorded nine groups of Assamese macaque in the national park having adult sex ratio 1: 1.92. They found that maize, potato, wheat, buck wheat and millet were the crop raided by Assamese macaque. Negative attitude of the farmers with respect to food security and habitat encroachment of Assamese macaque were the main threats for the species.

Chalise (2010) studied on Assamese macaque of Sebrubeshi of Langtang National Park, he 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.

Schulke *et al.* (2011) studied about the ecology of Assamese macaque at PhuKhieo Wildlife Sanctuary, Thailand. Unlike Zhou *et al.* they recorded that Assamese macaque spent large time of feeding on feeding fruit. They concluded that Assamese macaque spent about 40% of their activity time on the ground and in the lowest stratum of the forest; the canopy was used rarely and they spent a third of their activity time on feeding.

Sarkar *et al.* (2012) have done quantitative analysis of activity budget of the forest group of Assamese macaque in Jokai reserved forest of Assam and found that the study group spent more than one third (40%) of their total annual time for foraging purpose, followed by 25% on locomotion, 13% on resting, 10% on grooming, 9% on monitoring, 1% on play and 2% on sexual and other activities. They have recorded distinct seasonal variation in activities pattern.

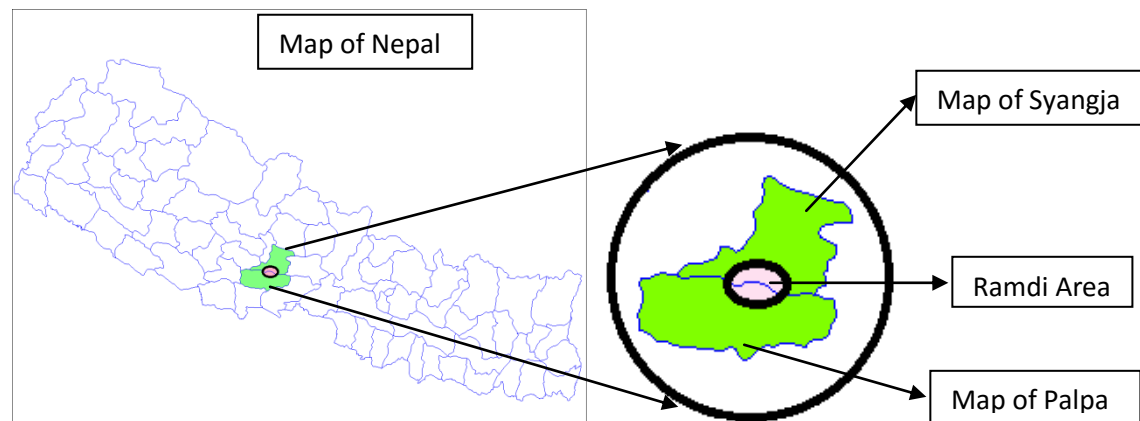
Chalise *et al.* (2013) studied on population, distribution and behavior of Assamese macaque in ShivapuriNagarjun National Park. Seven bisexual troops of macaque were recorded in subtropical forest of the national park and its marginal areas near to human settlement with average troop size 23.71. They 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.

### 3. MATERIALS AND METHODS

#### 3.1. Study area

##### 3.1.1 Location

Ramdi is located in Darlamdada and Khanichhap VDC in Palpa district and Malunga VDC in Syangja district.



(Source – Google Map 2016)

Figure 1: Location of Ramdi area.

**Palpa district** covers an area of 1,373 km<sup>2</sup> and has a population (2011) of 261180. The elevation lies between 200 m to 2000 m and the position lies between 27°40'N to 27°57'N and 83°14'E to 84° 02'E. The average temperature is 23°C, maximum temperature in summer is 35°C and Minimum temperature in winter is 3.7°C. Shivalik region contain 18% and Mahabharata mountain Range contain 82% of total area of the Palpa. The mid land mountain Region is a meeting place of sub-tropical and mountain forest (District Profile, Palpa, 2071).

**Syangja district** covers an area of 1,164 km<sup>2</sup> and has a population (2011) of 289148. The elevation lies between 366 m to 2512 m above the sea level. It lies at about latitude 27°52' to 28°13' North and longitude 83°27' to 83°46' east. The average maximum temperature in summer is 31.6°C and average Minimum temperature in winter is 6°C. The other main feature of this district is the Siddhartha Highway (District Profile, Syangja, 2071).

**Khanichhap** is a VDC in Palpa District in the Lumbini Zone of southern Nepal. Geographically it lies between 27°53'N 83°38'E and 27.89°N, 83.63°E. Population of Khanichhap VDC is 2094 (2011) (District Profile, Palpa, 2071).

**Darlamdanda** is a VDC in Palpa District in the Lumbini Zone of southern Nepal. This VDC shares its borders with Khanichhap VDC in the east, Nayar-Namtalesh and Chappani VDCs in the south, Yamgha VDC in the west, and Syangja district on the north.

The holy place Ramdi on the bank of Kali Gadaki River is located in this VDC. Geographically it lies between 27°55'N, 83°37'E / 27.91°N, 83.61°E . Population of darlamdanda VDC is 2097 (2011). The famous and unique Ramdi-pul (bridge) in the Palpa Syangja section of Siddhartha Highway is located here. It rains heavily in the summer. There is no irrigation facility so farmers have to depend on the rain (monsoon). The climate is very friendly to grow variety of fruits, vegetables, and grains (District Profile, Palpa, 2071).

**Malunga** is a VDC in Syangja District in the Gandaki Zone of central Nepal. Total area of malunga VDC is 8.96 km<sup>2</sup> and population is (2011) 3230 (District Profile, Syangja, 2071).

### 3.1.2 GPS Location and Elevation of Study area

Geographically, habitat of Assamese monkey is located between 27° 89' to 27° 90' north latitude and 083° 62' to 083° 64' east longitude. It's altitude range from 366m to 736m. It's boundaries in east is Ramdi, (Malunga VDC), Sunadi (Darlamdanda VDC) in west, Siddha Baba, Temple (Darlamdanda VDC) in North and Sera (Khanichhap VDC) in South. East, West, North, South GPS points are taken in study areas which cover total area of monkey habitat in Ramdi. GPS location and elevation of monkey habitat is also given below.

Table 1 GPS Location and Elevation of Study Area.

| S.N. | Location                   | North Point | East Point | Elevation (m) |
|------|----------------------------|-------------|------------|---------------|
| 1    | East, Syangja, Malunga     | 27.90390    | 083.64154  | 462           |
| 2    | West, Palpa, Sunadi        | 27.90335    | 083.62570  | 628           |
| 3    | North, Siddha Baba, Temple | 27.90767    | 083.63135  | 409           |
| 4    | South, Palpa, Sera         | 27.89248    | 083.63780  | 412           |

Highest elevation of monkey habitat is malengbari, which is located at khanichhap VDC ward no. 2, Palpa. GPS location and elevation of monkey habitat is given below.

Table 2.GPS Location of Highest Elevation of Study Area

| Location                         | North Point | East Point | Elevation(m) |
|----------------------------------|-------------|------------|--------------|
| Maleng Bari, Khanichhap-2, Palpa | 27.89438    | 083.62327  | 736          |

Lowest Elevation of monkey habitat is bank of Kaligandaki River, darlamdanda-6, palpa. GPS location and elevation of monkey habitat is given below.



Table 3.GPS Location of Lowest Elevation of Study Area

| Location                                  | North Point | East Point | Elevation(m) |
|---|-------------|------------|--------------|
| Bank of Kali Gandaki, Darlamdanda-6,Palpa | 27.90489    | 083.63191  | 366          |

### 3.1.3. Climate

Ramdi is typical Mahabarata hill mostly sub-tropical type of climate, partly temperate climate with rainy summer and dry winter. The southern side is sunny and much drier than northern forest side (District Profile, Palpa, 2071). The rainfall (mm) data for Ramdi was collected from 2014 A.D. There was no record of rainfall in the month of November. The least monthly Rainfall was recorded 6.5mm (April) which ranged to 458.7mm (July) (Figure 2). In July and August due to heavy rain monkey spent more time in resting and grooming.

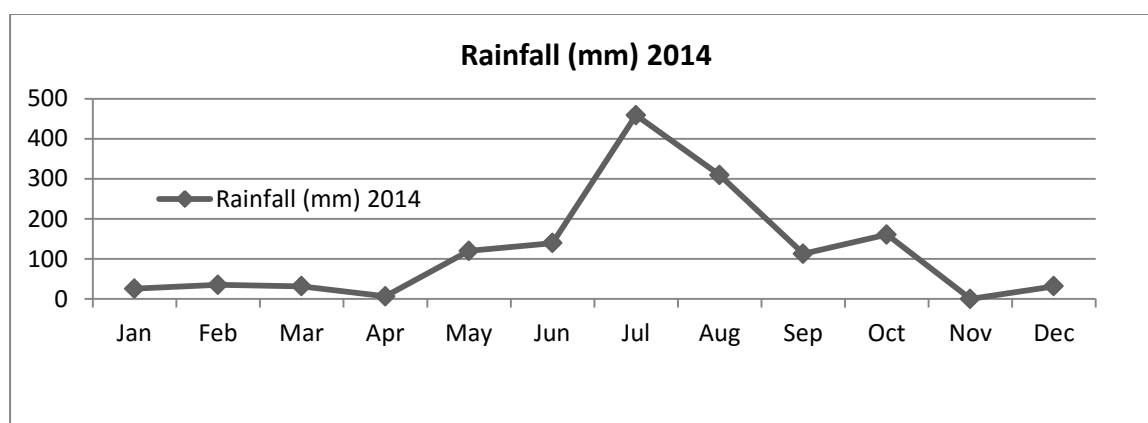


Figure 2: Monthly average rainfall of Ramdi Area from 2014 A.D. (Source: Department of Hydrology and Meteorology 2015)

The mean monthly minimum temperatures of the area from 2014 was recorded 15.45° C and the mean monthly maximum temperatures of the area was recorded 26.4 ° C (Fig- 3). December, January and February temperatures were the coldest months while April, May and June temperatures were the hottest months. In winter they are active in search of food due to lack of food in forest. The coldest and driest months are January, February, March, November and December in these months monkey spent more time in feeding and crop riding activities because less food was available in the forest.

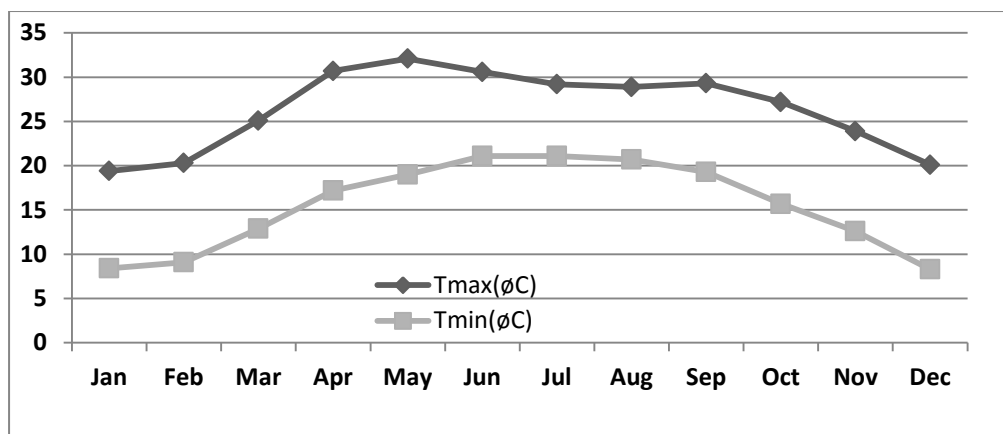


Figure 3: Monthly average Temperature of Ramdi in 2014 A.D. (Source: Department of Hydrology and Meteorology 2015)

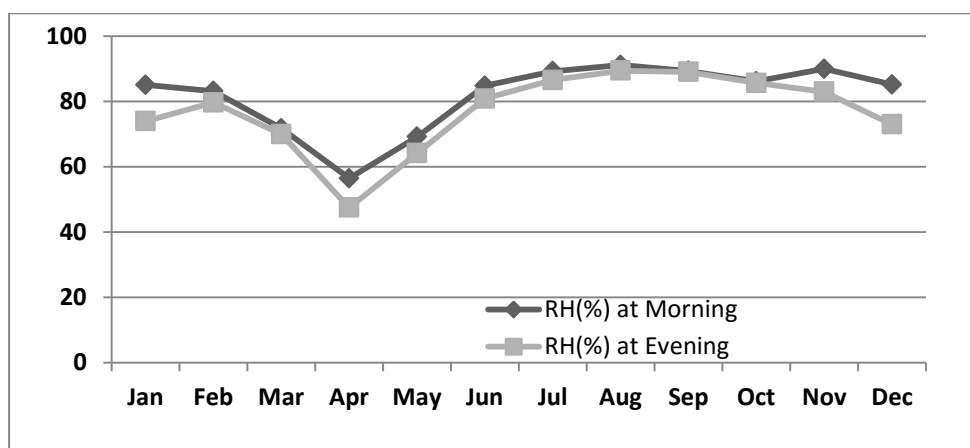


Figure 4: Monthly average Relative Humidity (RH) % of Ramdi in 2014 A.D. (Source: Department of Hydrology and Meteorology 2015)

The climatic data of the Ramdi area is not available. So, the nearest meteorological station at Tansen, Palpa were used for analysis. The data was collected for 2014 A.D. According to the climatic data, average monthly relative humidity (at morning) of the area ranges from 81.82% and average monthly relative humidity (at evening) of the area ranges from 76.93% (Fig- 4).

### 3.1.4 Biodiversity

#### 3.1.4.1. Flora

In Palpa District 52% of land is covered by forest. Some of the common flora of this study area are as follows: Sal (*Shorea robusta*), Chilaune (*Schima wallichii*), Siris (*Albizia procera*), Bhakkiamilo (*Rhus javanica*), Amala (*Phyllanthus emblica*), Bhalayo (*Semecarpus anacardium*), Harro (*Terminalia chebula*), Barro (*Terminlia bellirica*), Bel (*Aegle marmelos*), Fandir/Jamun (*Syzygium cumini*), Pipal (*Ficus religiosa*), Angeri

(*Berchemia edgeworthi*), Dabadabe (*Symplocos ramosissima*), Bar (*Ficus bengalensis*), Khanyu (*Ficus semicordata*), Khirro (*Sapium insigne*), Khasreto (*Ficus hispida*), Rajbrikshya (*Cassia fistula*), Simal (*Bombax ceiba*), Simali (*Marraya paniculata*), Kimbu (*Morus nigra*), Kera (*Musa paradisiacal*), Mango (*Mangifera indica*), Katahar (*Artabotrys uncinatus*) etc (District Profile, Palpa, 2071).

#### **3.1.4.2 Fauna**

In Palpa district different type of animals are found. Some species recorded are Rhesus monkey (*Macaca mulatta*), Hanuman Langur (*Semenopithecus entellus*), Common leopard (*Panthera pardus*), Barking deer (*Muntiacus muntjak*), Yellow Throated Martin (*Martes flavigula*), Jackal (*Canis aurens*), Squirrel (*Callosciurus* sps), Jungle cat (*Felis chans*), Procupine (*Hystrix indica*), Forest rat (*Bandicota* sps), Fox (*Vulpes vulpes*), Wild Boar (*Sus scrofa*), Hares (*Lepus* sps.), Mouse (*Mus musculus*) etc. Some commonly found bird species recorded are: Common maina (*Acridotherus tristis*), Cuckoo (*Cuculus* sps.), Common Koel (*Eudynamus scolopacea*), Black kite (*Milvus migrans*), Eagle (*Spilornis cheela*), House crow (*Corvus splendens*), House sparrow (*Passer domesticus*), Kalij pheasant (*Lophura leucomelanos*), Red Jungle Fowl (*Gallus gallus*), Oriental Turtle Dove (*Streptopelia orientalis*), Bulbul (*Pycnonotus cafer*), Woodpecker (*Picus* sps.), Warbler (*Phylloscopus* sps.) Black Francolin (*Francolinus francolinus*), Common Quail (*Coturnix coturnix*), Common Crane (*Grus grus*), Great Barbet (*Megalaima virens*), Vulture (*Gyps bengalensis*), Barn Swallow (*Hirundo rustica*) etc are found. The reptilian species includes Garden Lizard (*Calotes versicolor*), Indian Rat Snake (*Ptyas masosus*), Buff Striped Keelback (*Amphispma stolata*) etc (District Profile, Palpa, 2071).

### **3.2 Methods**

#### **3.2.1 Preliminary Survey**

A preliminary survey of the study area was done on January 2014 to find out the monkey distribution, habitat and monkey affected areas in Ramdi before starting of regular fieldwork. The survey process included field observation, interaction and pretesting of questionnaire with local people.

#### **3.2.2 Data Collection**

After finalizing the habitat and population of primate's detail research plan was formulated and accomplish as follows:-

#### **3.2.3 Population Count**

In order to determine the population of Assamese monkey (*Macaca assamensis* McLelland, 1840) in Ramdi, Palpa, Nepal. The methods of direct counting and long term monitoring were adopted for this study. Population surveys throughout the study area (8 km<sup>2</sup>) were carried out from all the accessible trails. The trails were walked slowly at c. 0.5 km/hr., covering a distance of 2 km per day. Observers paced along trails stopping every 200 meters to search the area for 1/2 hour by applying both visual and auditory cues

simultaneously. The topography of the region makes it difficult to undertake systematic surveys. When macaques were encountered, the following data were recorded: locality and its coordinates, detection time, duration of observation, activity and age-sex composition of the group. Age and sex were categorized properly with the help of a binocular. Counting was repeated 3 times to minimize the bias in distinguishing age and sex of the groups. Population density (D2) was calculated from the group density (D1) as:  $D2 = D1 \times \text{mean group size}$ , where  $D1 = \text{number of identified groups} / \text{area surveyed}$ . All areas were surveyed starting at 06:00 and finishing at 18:00. Palpa Troop 'A' and Syangja Troop 'B' was recognized through identify the every individual of the group. Population count of Assamese macaque throughout the Ramdi area was carried out from all accessible roads in 2014. The methods of direct counting and monitoring will be adopted for this study. Troop will be recognized through continues observation of adults with their specific identifying characters. The head count of monkey population was done with the help of binoculars. Repeated observation was made in focal troop to identify individually and to recognize their home range. 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, sub adult females, Juveniles and infants according to their body size, coloration and behaviors. The composition of the troop was differentiated into Adult males, Adult females, Sub adult males, Sub adult females, Juveniles and infants according to their body size, coloration and behaviors. According to these typical characters of each age and sex population of monkey was categorized in this study.

**Adults** were those attained the maximum height and body maturity. Adult males were distinguished by large sexual organs. Females were distinguished with small head and protruded nipple. (Photo -6)

**Sub adult or Young** 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 and depend on natural other foods and mostly following mother.

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

### **3.2.4 Behavioral Observations**

#### **3.2.4.1 Continuous Scan Sampling**

Behaviors were recorded using scan sampling method and continuous average group scanning. It is difficult to follow and watch all the members of group due to difficult geography of hills. Behaviors were recorded using the scan sampling method (Altman, 1974) and continuous average group scanning (Chalise, 1997, 1998, 2000, 2003, 2005). During this study, systematic scan sampling was carried out continuous in every minute for the focal troops. Behaviors like foraging, feeding, resting, moving and grooming were recorded during scanning period of data collection. Observed behaviors were recorded in protocol papers at a continuous record. Behaviors expressed by majority of focal animals at that instant period of scan were recorded as an event of that scan period.

#### **3.2.4.1 Ad-libitum sampling**

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

### **3.2.5 Human-Monkey Conflict**

#### **3.2.5.1 Questionnaire Survey**

Stratified random sampling method was used to select respondents for the study. Hence no. of respondents from whole the sample size was 100. Direct questionnaires were used because the mountainous topography and the land use patterns of the study area made alternative methods impractical. After visiting the 100 households were surveyed in Khanichhap, Darlamdanda VDC of Palpa district and Malunga VDC of Syangja district whose farms were found to be damaged by the macaques. The survey focused in estimating the crop damage per household yearly and getting the information on the methods of prevention applied by the farmers in the area.

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. Appendix III

#### **3.2.6 Vegetation sampling**

Random systemic sampling method was used for vegetation analysis (Singh *et al.* 2008). Quadrates of 10 x10m was alternatively plotted on the study area. Distance between quadrates was 200m apart from one another. In study area, nine quadrates were plotted in which tree species having diameter at breast height (DBH)  $\geq$  10cm was measured. Herbarium was prepared for identification of unidentified plant in the field and was identified at National Herbarium Center, Godawori, Lalitpur.

### **3.3 Data Analysis and Presentation**

The collected data was analyzed with the use of MS EXCEL 2007. Birth ratio of the macaque was calculated by dividing total number of infants by total number of adult females (Chalise *et al.* 2013) similarly sex ratio is calculated by dividing total number of adult male by total number of adult female (Chalise 2003). Household's questionnaires responses were carefully processed arranged to make sense to researcher for report writing. The collected data was edited, coded and tabulated. The editing was done thoroughly for analysis and interpretation. Both descriptive statistics (percentages, frequencies) and inferential statistics (probability value) were used to analyze the data. Charts, table, graphs and bar diagrams were used to present the data in most simplified and understandable form.

## 4. RESULTS

### 4.1 Population

The methods of direct counting and long term monitoring were adopted for this study. 48 individuals in two different troops of macaque were counted. The mean troop size was found to be 24 (Range 21-27) individuals.

Table 4 Population status of Assamese monkey in Ramdi area.

| Categories       | Palpa Troop 'A' | Syangja Troop 'B' | Total Population |
|------------------|-----------------|-------------------|------------------|
| Adult Male       | 2               | 2                 | 4                |
| Adult Female     | 4               | 3                 | 7                |
| Sub adult Male   | 4               | 3                 | 7                |
| Sub adult Female | 6               | 5                 | 11               |
| Juvenile Male    | 4               | 2                 | 6                |
| Juvenile Female  | 4               | 3                 | 7                |
| Infant Male      | 1               | 1                 | 2                |
| Infant Female    | 2               | 2                 | 4                |
| Total            | 27              | 21                | 48               |
| Mean             | 24              |                   |                  |
| Sex ratio        | 0.57            |                   |                  |
| Birth Rate       | 0.85            |                   |                  |

#### 4.1.1 Group and Population density

A total 48 Assamese monkey were encountered which were living in 2 groups within the total visually accessible area of Ramdi. The mean group size was 24 individuals. The group density was 0.33 groups / km<sup>2</sup> with a population density of 6 individuals/ km<sup>2</sup>.

#### 4.1.2 Age – Sex Composition

Four age groups were identified as infants, juvenile, sub adult and adult (male and female) from two different troops. There were 12.5% infants, 27.08% juvenile, 37.5% sub adult, 8.33% adult male and 14.58% adult females (Table 4). The adult sex ratio (male: female) from age sex group separated troops was 0.57. Each female had 0.85 infants during the study.

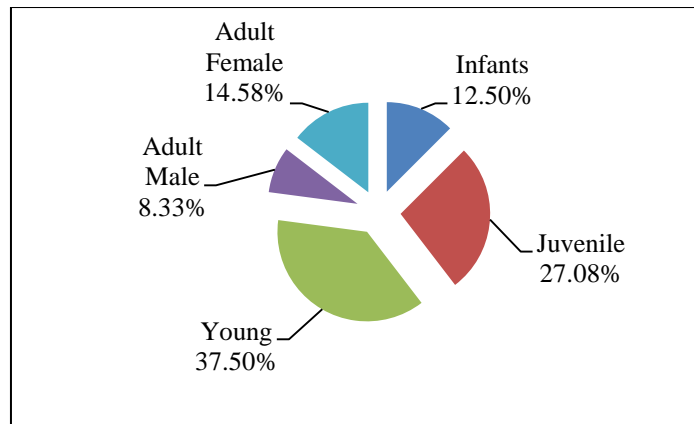


Figure 5: Age-Sex composition of Assamese macaque in Ramdi area in 2014.

Total population of Assamese monkey in Ramdi, Palpa was 48 individuals in two troops. Palpa troop 'A' consisted highest number of individuals 27, followed by Syangja troop 'B' 21.

#### 4.1.3 Adult Sex Ratio

The interpretation of the sex ratio is that for every male there are 1.75 females. Sometimes we express this as the ratio per 100. So, we could say 100 females for every 57 males. The adult sex ratio (male to female) observed during the study period was 0.57 (57 males per 100 females) i.e. 1:1.75. It is also use full to identify the population of male and female of the group.

#### 4.1.4 Female to Infant Ratio

Birth rate (infant to female ratio) was found 0.85 (85 infants per 100 females) during the study period.

#### 4.2 General behavior

The Palpa troop 'A' (n=27) of Ramdi was selected as focal troop so that identification of individuals and follow up the group made easier for studying general behavior of Assamese monkey in the area. Among the five types of behavior (Feeding, Moving, resting, foraging and social), feeding behavior was found as maximum 141 hours 39 minutes (43.96%) which was followed by resting behavior 83 hours 12 minutes (26.24%), social behavior 72 hours 23 minutes (21.99%), foraging behavior 12 hours 13 minutes (4.14%) and moving behavior 8 hours 40 minutes (3.65 %). The focal troop was connected for 318 hrs. 7 minutes in order to study the behaviors. Total time spent in jungle was 378 hours.



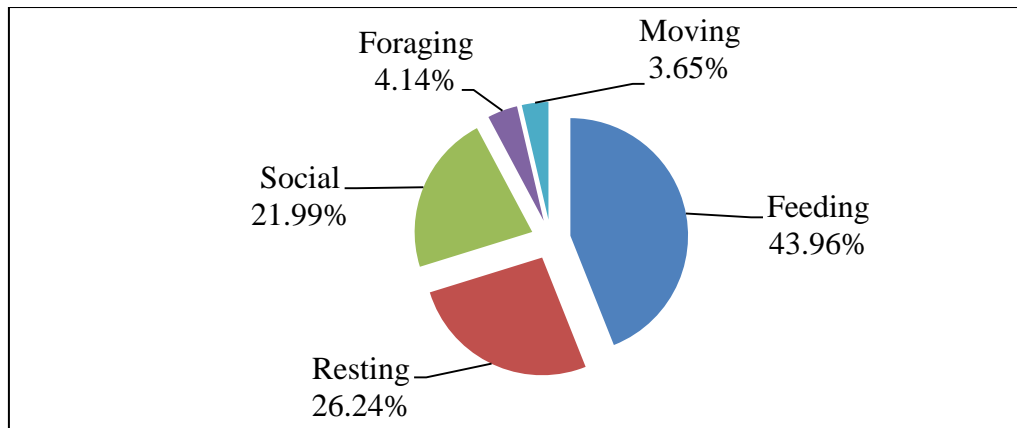


Figure 6: Percentage of time spent in major activities by Assamese macaque in Ramdi area in 2014.

#### 4.2.1 Some behavioral records from Ad-libitum sampling

Some interesting learning behaviors were recorded through Ad-libitum sampling; inspecting any new type of bird and animals encountered. Some reproductive behavior like male eating sperms, female eating vaginal plague after copulation; male sometime searching for vaginal plague of a female by raising tail, and the true copulation between adult male and female were followed by grooming for long period, but sometime after copulation male bitten the female and female run away etc. were recorded. Adult male grooming to infants, hugging and carrying them was also recorded throughout the study. Macaques spent their most of the diurnal time in middle canopy, they come on the floor for feeding purpose only and when they feel secured in the rocky cliff they rest and play on the floor. Behavior of the macaque inside the forest was also influenced by stray dogs, visitors and local peoples (to collect fodder and other resources). Visitor throwing stones and teasing, stray dogs chasing the macaque were recorded. Adult male defense with the dogs and adult females moved away carrying their infants. Artificial Provisioning of biscuits and vegetable items to the macaques, sometime chasing them by Catapult, stones and loud voice influenced their behavior. Some aggressive behavior between the macaque and dogs were too recorded during feeding (photo-4). Generally macaques moved to upper canopy when dog come near to them and sometimes macaques too chased the dogs. According to local people monkey kill pigeon and eat crops of its crop bag. They also eat food of pig which is mixed with meat and fermented rice. They search food in dumping site when they find food they clean the food by rubbing it into the rock and only after cleaning they eat food (Photo-1 and 2).

### **4.3 Human-Monkey conflict**

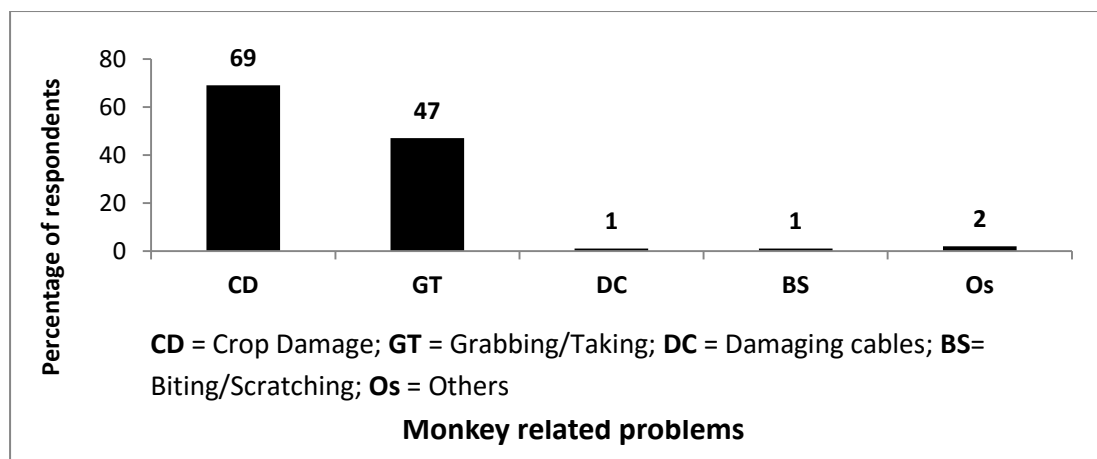
Among the three different species of monkeys reported from Nepal, only one species of Assamese monkey (*Macaca assamensis*) were found in the study area Ramdi.

#### **4.3.1 Monkey Damaging**

The categories of damage are two types that are partially damage and fully damage. Monkey damage crop by different ways, sometimes eating the harvestable part, sometimes premature dropping of fruits and flower buds and sometimes uprooting the whole plants. Majority of respondents i.e. 100% (N = 100) agree with the monkey as the damaging factor. They visits to human residential area and causes irritation to human welfare by raiding crops, garden fruits, grabbing and taking food materials, clothes, frightening children and women, moving over the roof of the house and disturbing night sleep etc. This is due to the distribution of monkey in small area of Ramdi.

#### **4.3.2 Monkey Problem**

The degree of monkey problem, most respondents (100%, N = 100), monkeys are creating high problem in their welfare. Monkeys are becoming increasing problem to human life in different ways. These shows the almost all respondents of the study side were found suffering from the monkey problems, though degree of damage level varies according the nature of monkeys, place of human settlements and distance from natural habitat etc. People from densely populated areas were mostly suffered from home raiding by monkey and causing irritation in their daily life where as people quite away from city area were found the problems crop raiding. Respondents of study site reported monkeys are affecting their welfare in different ways. It was found that although monkeys of these areas harass all residents, farmers, students and visitors, the degree of harassment varies between these groups. Residents are the affected as the monkey raid their crops, homes and gardens (69 %) and Grabbing or Taking (47 %) is also a great problem which lead to resulting in the cases of biting. It is my personal observation that women and children are harassed and bitten more than men, as monkeys are more aggressive towards those humans whom they think that they can easily dominate, and these are likely to be women and children.



**Figure 7** Monkey Related Problems (N = 100)

Ramdi Area, crop raiding was the major problem of study as reported by 92% of respondents. Similarly, house raiding by the monkey was the major problem in study 64% of the respondents.

### 4.3.3 Crop Damage

In Ramdi area agricultural lands are Bariland and Khetland. Bariland cover more area than Khetland. In khetland major crops are rice, maize and wheat. In bariland major crops are maize, wheat, vegetables, pulses and fruits. Majority of respondents (66%) who are directly involved in agriculture reported crop raiding as the major problem. Monkey damage crop by different ways, sometimes eating the harvestable part, sometimes premature dropping of fruits and flower buds and sometimes uprooting the whole plants. The people of Ramdi were found to mainly suffer from crop damage problem. It is the nearest area from monkeys' natural forest of Ramdi. Continuous grazing of animals, collection of fodder from the forest, depletion of natural regeneration due to improper management of forest had diminished the monkey palatable plant species in the forest, resulting in the movement of monkey towards nearby agricultural field to furnish their hunger. Crop mostly eaten includes maize (35%), Vegetables (20%), pulses (13%), fruits (13%), potato (6%), Rice (2%) etc. Maize (as reported by 35% respondents) and Vegetables such as beans, cabbage, cauliflower (as reported by 20% respondents) are reported to be worst affected. Besides, fruits such as banana, mango, litchi, nuts, guava etc. (as reported by 13% respondents), and pulses such as Lentils, siltuing, Gahate (as reported by 13% respondents), potato (as reported by 6% respondents), Rice (as reported by 2% respondents) were found to be damaged by the monkey in the study site. However crops like lady's finger, peas, soya beans, coriander, ginger, turmeric and chilly were less preferred by the monkey.

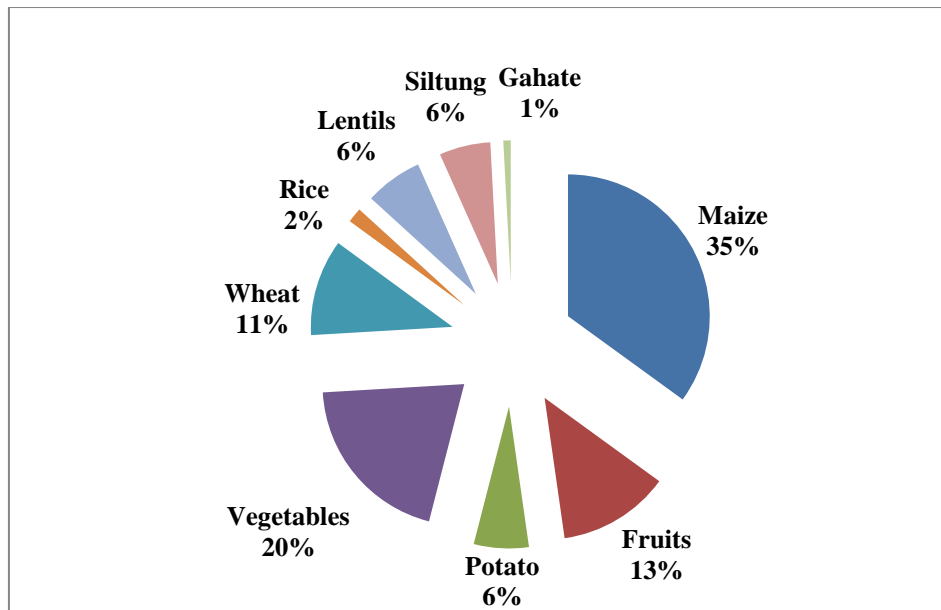


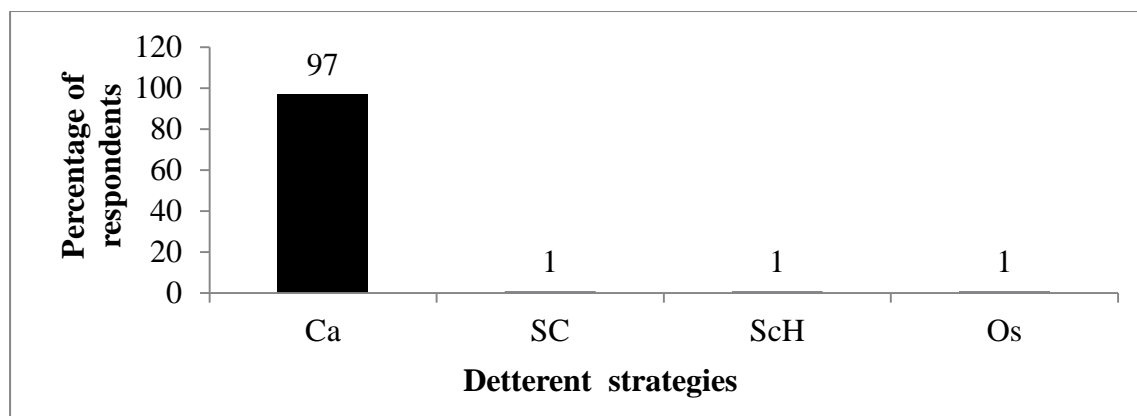
Figure: 8 Percentage of Crop Damage by Monkey in Ramdi Area in 2014.

#### 4.3.4 Harassment

Besides crop damage monkeys were frequently found to cause harassment by different ways. Women and children alone in the pathway were most suffered from monkey. Monkey bite, scratch, teasing, fell down while running is commonest problem. Movement along the roof of the houses, shaking of the water pipelines, knocking over and breaking the clay flower plots, dragging clothes off the line from, entering into the house through the window, door etc. Because of urbanization, there is lack of natural food for the monkeys. They frequently visit in these human settlements. Provisioning is high in these areas.

#### 4.3.5 Monkey prevention Strategies

People are found to use different methods to keep monkeys from entering their home, garden or personal space. They have the difficult task of simultaneously guarding vegetables laid out to dry, the garden, clothes on the line. Shopkeepers kept catapults and sticks within reach to protect their food stock. Women guarded their drying foods by shouting and throwing stones towards approaching monkeys. Boys were often observed chasing after monkeys with catapults. In fact, most boys and men throughout the entire study site were observed to have a catapult in their hands or back pocket.



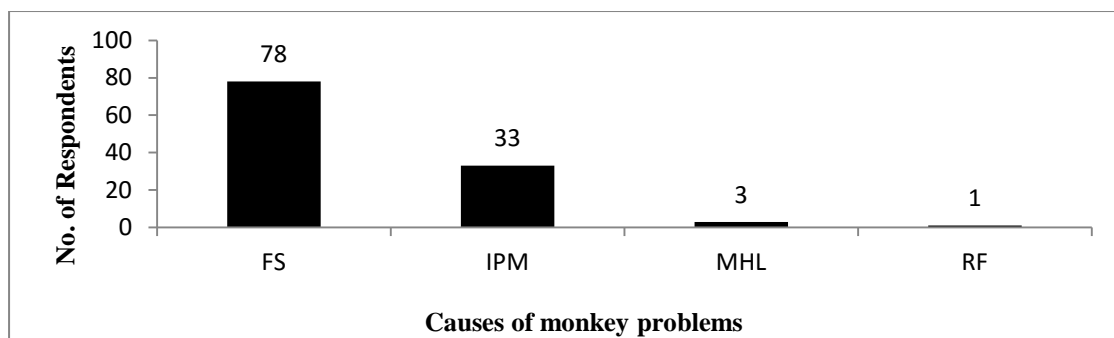
**Ca** = Catapult; **SC** = Scolding and charging; **ScH** = Screening opening of the house;  
**Os** = Others

Figure: 9 Various preventive Methods against Monkeys (N =100)

Stone throw-catapult was reported and observed to be most effective method to ward off monkeys as reported by the 97% respondents. This is because it can charge from long distances, cheaper, easily available in local markets and monkey also affected strongly. However, this can be only temporary means to protect against the monkey.

#### 4.3.6 Causes of Monkey Destruction

People of the study site reported that monkey problems are increasing to greater extent particularly from last 4 to 5 years back. Different people gave different arguments on the increasing problem. Food scarcity, increasing population of monkey, habitat destruction due to urbanization etc. was reported as the cause beyond this. Majority of the respondent agree on the food scarcity as the major cause. Due to food scarcity, they are forced to move towards people residential area where they can obtain their food materials. They raid the crop, garden, enter the home through opening and carry everything what they find. Further increasing human population is destructing their natural habitat. Community near to forest area is facing more problems from the monkey. They stay in the forest and frequently visit to community from there. When they find problem in community, they immediately enter into the forest for safeguard. Artificial feeding especially by local people, tourists, pilgrims and local visitors had attracted the monkey towards residential area. They show sympathy to monkey because of religious faith. The symbolize monkey as Hanuman. Because of this activity, monkeys are becoming increasingly not afraid of human. They frighten children and women and grab the food from there, as they feel they can easily dominate them.



**FS** = Food Scarcity; **IPM** = Increasing population of monkey; **MHL** = Monkey habitat loss; **RF** = Religious faith

Figure: 10. Categories of Causes of Monkey Being Destructive

Food scarcity as reported by 78 respondents of study area was the major cause for increasing problem of the monkey. The different cause reported by the respondents for increasing problem of monkey is related to each other.

#### 4.3.7 Frequency of Monkeys Entering Compounds

Monkeys have entered the compound of 100% respondents. The reported frequencies of intrusions are shown in the figure 19. Monkeys were also reported to have entered in the houses. Most respondent supposed that monkeys easily open unlocked screen doors and push open wooden doors. Most respondents i.e. 60% (N = 100) said that their compound is invaded by monkey 2-3 days, followed by daily, weekly etc.

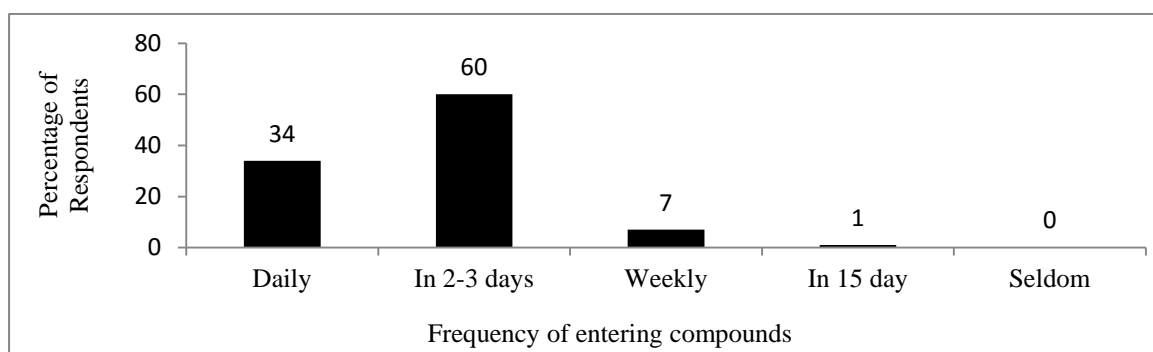


Figure: 11. Frequency of Monkey Entering the House Compound (N = 100)

#### 4.3.8 Provisioning

Regarding the questionnaire, have you ever given any food items to monkey, only 19% (N = 100) of the total respondents said they have given food for monkey. They had offered food items sometimes when there is wastage of leftover food, sometime as time passing, sometimes as symbol of hanuman because of religious faith. However regarding the questionnaire have you ever seen artificial provisioning by other, 37% (N = 100)

reported they had seen the artificial provisioning by other people. Tourists, pilgrims, local visitors were reported as the category of people practicing artificial provisioning.

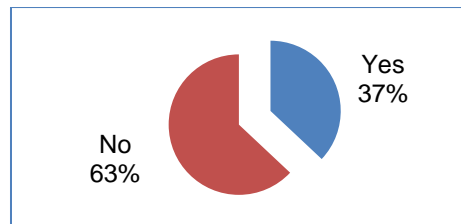
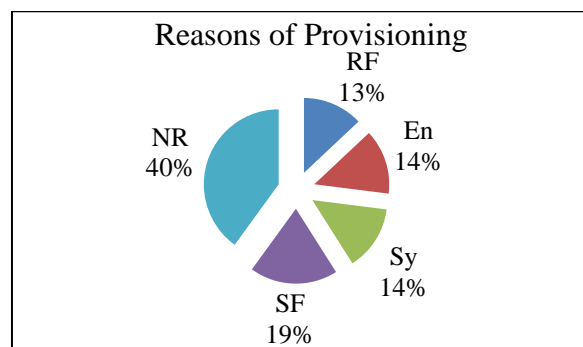


Figure: 12. Percentages of Respondents Knowing Provisioning by Other People.

Among 37% respondents who have ever seen artificial provisioning, 13 % respondents reported people give food to monkey because of religious faith, 14% respondents reported as a source of entertainment/enjoyment of feeding monkeys; 14% of respondents as a reason of love to these creature and sympathy for insufficient food in forest, 19% as utilization of wastage food materials and 40% respondents were not having the clear of reason of artificial feeding (Figure 13).



**RF** = Religious faith; **En** = Enjoyment; **Sy** = Sympathy; **SF** = Surplus food; **NR** = No Response

Figure: 13. Percentages of Reasons for Provisioning.

#### 4.3.9 Monkey Problematic Time

Respondents were asked at what time of day monkeys are most active and visit their compounds. About 59 % respondents (N=100) indicated morning time i.e. 5am-11am followed by 24% at day time i.e. 11am-3pm (Figure 14).

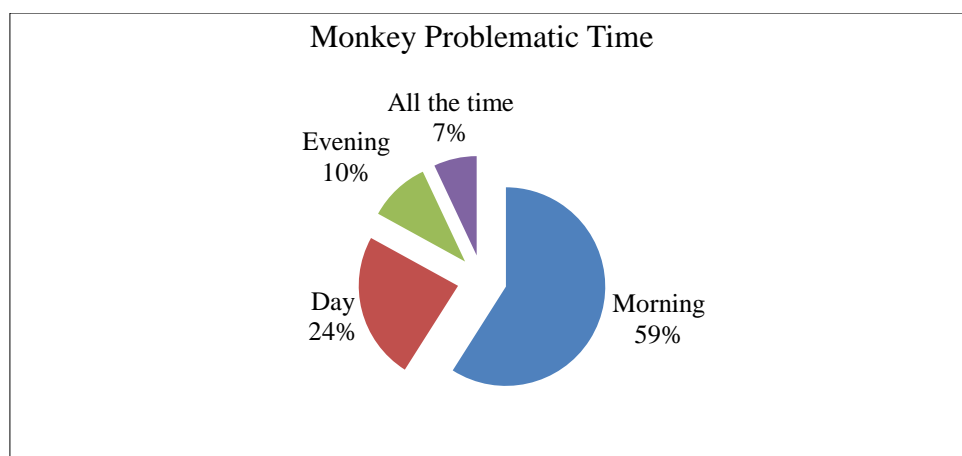


Figure: 14. Monkey Problematic Time

Monkeys are mostly activated in morning and create problem to local people. Monkey come 5 am in morning and start their foraging and feeding activities at houses, bariland and khetland. According to 59% respondent monkey are mostly active in morning time i.e. 5am-11am and they create great problem to local people. Monkeys are active for foraging in morning due to hunger because at night they rest and don't eat anything therefore they active at morning time and create problem to local people.

**Table 5: Tree species found in Habitat of Monkey in Ramdi**

| S. N. | Common Name | Scientific Name                       | No. | Average DBH | Average Height | Relative Density |
|-------|-------------|---------------------------------------|-----|-------------|----------------|------------------|
| 1     | Bilbile     | Unidentified                          | 21  | 101.48      | 947.62         | 23.07            |
| 2     | Bel         | <i>Aegle marmelos</i> (L.)Correa      | 12  | 54.83       | 691.66         | 13.18            |
| 3     | Kurau       | Unidentified                          | 11  | 25.63       | 327.27         | 12.08            |
| 4     | Khirro      | <i>Sapium insigne</i> (Royle)Trimen   | 9   | 46.11       | 611.11         | 9.89             |
| 5     | Botdhayero  | <i>Lagerstroemia parviflora</i> Roxb. | 6   | 26.16       | 366.66         | 6.59             |
| 6     | Raju        | Unidentified                          | 4   | 40.25       | 400            | 4.39             |
| 7     | Pehale      | <i>Litsea glutinosa</i> (Lour.)C.B.   | 4   | 13.5        | 350            | 4.39             |
| 8     | Phadiyar    | <i>Syzygium cumini</i> (L.)Skeels     | 4   | 58.25       | 825            | 4.39             |
| 9     | Khair       | <i>Acacia catechu</i> (L.f.)Willd.    | 4   | 178.5       | 1850           | 4.39             |
| 10    | Kyamuno     | <i>Careya arborea</i> Roxb.           | 3   | 45.33       | 716.66         | 3.29             |
| 11    | Chilauni    | <i>Schima wallichii</i> (DC)Korth.    | 3   | 117         | 1050           | 3.29             |



|    |         |  |    |        |      |      |
|----|---------|--|----|--------|------|------|
| 12 | Rohini  | <i>Mallotus philippensis</i><br>(Lam.)   | 3  | 16.66  | 300  | 3.29 |
| 13 | Anp     | <i>Magnifera indica</i> L.               | 3  | 112.33 | 700  | 3.29 |
| 14 | Sal     | <i>Shorea robusta</i> Gaertn             | 2  | 82.5   | 1550 | 2.19 |
| 15 | Sitafal | <i>Annona squamosal</i> L.               | 1  | 80     | 900  | 1.09 |
| 16 | Aangeri | <i>Lyonia ovalifolia</i><br>(Wall.)Drude | 1  | 56     | 900  | 1.09 |
|    |         | Total                                    | 91 |        |      | 100  |

According to the vegetation study, five major tree plant species contributed 64.81% of the total plant density. Out of total 91 trees of different 16 species, these five major species consists a total of 59 trees. One out of five major tree plant species were food plants of Assamese monkey. This indicated Assamese monkey home range in Ramdi area is scarcity of its food plants. There for level of Human-Monkey Conflict is high in Ramdi area because of scarcity of food.

## 5. DISCUSSION

### 5.1 Population

Among the four different species of monkeys reported from Nepal, only one species of Monkey Assamese monkey (*Macaca assamensis*) were found in the study area Ramdi. Ramdi is small highway settlement in Palpa and Syangja District along the Kaligandaki River, in west Nepal. It is contiguous with the temperate forest to the north and subtropical hill Sal forest (*Shorea robusta*) and riparian forest in the south. Elevations are quite low (around 420 m asl), however, due to the area's location in the mid hill's mountains in central Nepal, running east to west along the Himalayas, and lying north of Siwalik and the Churiya range of Nepal. It is very accessible and Assamese monkeys are easily observed there (Chalise M.K. 2003). Assamese monkey was found in highest number with total head count of 48. The mean troop size of Assamese macaque in Ramdi was found 24 (Range 21-27) individuals which lies within the range of Assamese macaque recorded in LNP that was 23.66 (Range 13-35) from nine groups of macaque (Regmi 2008) and near to the mean troop size in Lower Kanchanjungha Area in Eastern Nepal in which estimated group size was 26.714 (Regmi and Kandel 2013). But the mean troop size is more than the size estimated by Wada (2005) with range 5-34 (mean 19.1). The group density of this study was 0.33 groups / km<sup>2</sup> with a population density of 6 individuals/ km<sup>2</sup>. Regmi (2008) found the group density of the macaque 0.0790 groups/Km<sup>2</sup> with a population density of 1.8691 individuals/ km<sup>2</sup> in LNP. Similarly, from Lower Kanchanjungha Area the estimated group density and population density were 1.2253 groups/km<sup>2</sup> and 32.733 respectively for Assamese macaque (Regmi and Kandel 2013). Small forest area and easily available waste food resource from dumping side and provisioning by local people might be the reason for high rate of population density of the macaque in the study area.

There is less adult male population than adult female (sex ratio 0.57) and the ratio is very less than Chalise *et al.* (2013) i.e. 0.97. But according to Chalise (2003) adult sex ratio was 1:1.6 in MBNP in 1997. Each female has 0.85 infants during the study which is more than Chalise *et al.* (2013); according to them each female has 0.67 infants. Chalise, M. K. (1999) found Infant 24%, juvenile 17%, young adult 6%, female 30%, subadult 6% and male 17% in Makalu-Barun Area, Nepal. Regmi (2008) found 19% infant, 16% juvenile, 18% young, 16% adult male and 31% adult female among the total macaque population counted in LNP. In Ramdi there were 12.5% infants, 27.08% juvenile, 37.5% young, 8.33% adult male and 14.58% adult females (Table 4). Their population composition is different from other studies because of they are only the group in Nepal which live in religious place and they are habituate with people where they found waste food easily.

### 5.2 General Behavior

General behavior of primate is generally categorized in five classes of category i.e. Feeding, foraging, resting, moving and social (which includes grooming, playing, sexual behavior, vocalizations and agonistic interactions) and these classes of category is

generally used for the study of primate behavior (O'Brien and Kinnaird 1997, Riley 2007, Bowler and Bodmer 2011).

In this study behaviors are categorized in five classes i.e. feeding, foraging, moving, resting and social. In case of this study it is different from other studies because of that they are found in religious place and they are habituate with people this type of relationship is not found in other parts of Nepal. They feeds on waste food from dumping site of Ramdi area they doesn't have to forage for food in large area as the waste food is easily available. May be, due to this reason they could get greater percentage of time for resting and social activities (photo - 5) as compared to the previous studies. Besides this, it is found that Assamese Monkey spent 43.96% of time in feeding activities and spent only 4.14% in foraging activities and only 3.65% of their total time is spent in moving. In case of resting they spent 26.24% and in social activities they spent about 21.99% of their time. For Assamese Monkey food was easily available, so they have to spend less time in locomotion and foraging activities. Recorded pattern of time spent by Assamese macaque of Ramdi area in major behavioral categories is in accordance with other studies of Assamese macaque in Nepal i.e. they spent more time in feeding activity than other activities (Chalise 2003, 2010). Assamese macaque spent greater percentage of time in foraging and feeding activities; it is 43.4% in LNP (Chalise 2010) and 44% in MBCA (Chalise 2003); which is nearly equal to this study i.e. 43.96%. On the other hand the macaques spent 26.24% of time in resting followed by 21.99% in social followed by 4.14% in foraging and 3.65% in moving in this study which differs than the previous studies of macaque in Nepal (Chalise 2003; 2010). Chalise (2010) had recorded 18.5% in resting, 31.7% in moving and 3.4% of time in grooming behavior in LNP. Similarly, Chalise (2003) has recorded 18% in resting, 25% in moving and 13% in Grooming in MBCA. A study in Assam too reports that Assamese macaque spent more than one third (40%) of their total time for foraging and feeding purpose followed by 25% on locomotion, and 13% on resting (Sarkar *et al.* 2012). Feeding is the most crucial factor responsible for the variation in the time spent in different behavior (Sarkar *et al.* 2012). High locomotion and foraging activity cost more energy expenditure and therefore, the group re-allocates the time budgeting for higher resting activity, and allocates a less time for social activities like grooming and play activities (Sarkar *et al.* 2012).

Some reproductive behavior like male eating sperms, female eating vaginal plague after copulation; male sometime searching for vaginal plague of female by raising tail, and the true copulation between adult male and female were followed by grooming for long period etc were recorded as reported by Chalise (2003) and Chalise *et al.* (2013).

Sleeping sites of Assamese macaque were typically rocky cliffs in MBCA and LNP, they provide some security against carnivores (Chalise 2003); this study also supports this fact. Assamese Monkey always used rocky cliff as night settlement site, the rocky cliff were near the Ramdi area so that they had good night settlement site and food source in the area.

### 5.3 Human-Monkey Conflict

The troop was found near to human settlements because the study area is surrounded by forest which is natural habitat of monkey. Assamese 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. Crop raiding, grabbing and taking of food materials, clothes, damaging cables, biting/scratching etc. were the common problems reported by the respondents. Among them; crop raiding reported by 69% respondents (N = 100) was highlighted as the commonest problem. Grabbing/taking of food materials and clothes (reported by 47 % respondents), damaging electric cables moving over it (reported by 1 % respondents); biting/scratching (reported by 1% respondents) and others were the monkey related problems in the study area. Patty Mc. Court (2005) 92% respondents of Hetauda were found to suffered from crop damage from monkeys. 87% of respondents complained the harassment by monkey by taking food spilling or eating from the kitchen, porch or roof.

Mc Court (2005) in Hetauda found 85% household members were frightened by monkey usually as a result of charge threat, chase, facial grimace or vocalization. In her report 37% household reported that someone in their house had been either directly or indirectly harmed by monkey with different events of injuries such as fell down (23), scratch (12) and bite (6). Ojha (1976) found 90 victims who received 104 wounds and most of bites were during food snatching from house and mother monkeys protecting her infants. Thus all these report showed that, monkey aggression towards human is mainly concerned with the food and human interference of the habitat. In Ramdi area only two cases of bite are found in children only and different events of injuries such as fell down (4), scratch (3) are also found. In Ramdi these events are very few in number comparison to previous studies.

Among the different crop, maize damage (35%) is found to be highest followed by vegetables (20%). These are among the most palatable crops grown in the Ramdi Area. This fact is also supported by Chalise (1997, 1999, 2001, 2003). Chalise *et al* (2001) and Chalise and Johnson (2005) reported that crop depredation proportion by monkeys is different in different crops. In MBCA they recorded highest loss of maize (32%) followed by potato (24%), rice (14%), fruits (12%), millets (11%), wheat (4%), buckwheat (2%) and pulses (1%).

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

Artificial provisioning causes change in diet of monkey, change in home range and habitat, change in behavior (Southwick *et al.*, 1976, Lee *et al.*, 1986). In Ramdi area monkey are habituate by provisioning of waste foods therefore they come and create conflict. Due to this their diet, home range, habitat and behavior were also change.

Among the different preventive methods, use of catapult to frighten the monkeys was found to be most effective. In Ramdi area the use of stone throw catapult (97% respondents) as monkey prevention methods. Mc Court (2005) also reported the use of stone throw catapult (84 respondents), close door (44 respondents), stick wave (26 respondents), shout (22 respondents) other (9 respondents) in Hetauda as monkey deterrence methods.

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

Food scarcity (as reported by 78% respondents; N = 100); increasing population of monkey (as reported by 33% respondents); monkey habitat loss (as reported by 3% respondents; Artificial provisioning (as reported by 37% respondents) were reported as the causes of increasing monkey problems in Ramdi area.

This is the first scientific research in Ramdi area. It play important role in conservation, habitat management and conflict management of Assamese monkey in this area. So the main contribution of this research is conservation of Assamese monkey in its natural habitat without any conflict with local peoples. It is different from other studies because of that Assamese monkey are found in religious place and they are habituate with people this type of relationship is not found in other parts of Nepal. Home range of Assamese monkey is very small due to which monkeys are always foraging in houses, croplands and gardens of Ramdi areas. Monkey spent maximum time in temples, highways, dumping sides, croplands, gardens, compounds and roof of the houses in search of food. Due to this monkeys are habituate with human beings. Their behavior is changed from shy, timid and less aggressive to aggressive and attacking form which causes conflict with man. Their food habit is also change from natural food to manmade food, packed junk food and waste food and they also eat meat which is mixed with fermented rice and they kill pigeon for its crop bag where they found undigested food. They habituate with human and learn different activities from them. So these types of behaviors are new which is different from other studies.

## 6. CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion

Only Assamese monkeys (*Macaca assamensis*) were found in Ramdi area. Ramdi area may be suitable habitat for Assamese monkey (*Macaca assamensis*). Assamese monkey was found in highest number with total head count of 48. The mean troop size of Assamese macaque in Ramdi was found 24 (Range 21-27). The group density was 0.33 groups / km<sup>2</sup> with a population density of 6 individuals/ km<sup>2</sup>. There is less adult male population than adult female (sex ratio 0.57). There were 12.5% infants, 27.08% juvenile, 37.5% sub adult, 8.33% adult male and 14.58% adult females.

In this study behaviors are categorized in five classes i.e. feeding, foraging, moving, resting and social. Assamese Monkey spent 43.96% of time in feeding activities and spent only 4.14% in foraging activities and only 3.65% of their total time is spent in moving. In case of resting they spent 26.24% and in social activities they spent about 21.99% of their time. Waste food was easily available from temples, hotels, houses and dumping site, so they have to spend less time in locomotion and foraging activities.

Human- Monkey conflict in the study sites was found to be a serious social and environmental problem. This may be due to nearest areas from the natural habitat, artificial provisioning in these areas, availability of palatable crop, safe site for protection, resting and grooming. Among the different problems due to monkey, crop raiding problem, Grabbing and taking food, clothes, harassment was found mostly in Ramdi. Several temples are located here, where people feed monkey. Due to provisioning, the feeding behavior monkey was found changed. They are now lazy, so they stay mostly in these areas and due to good nutrition population go increasing. So, monkey conflict is high in these areas. The monkeys enter communities at all the day and raid garden and agricultural fields, take/eat/destroy food items and other household materials. Catapult is the most effective means of deterrent monkeys for local people. Not all attitudes towards monkeys were unfavorable. Love and sympathy for the monkey, enjoyment towards watching monkey behavior in wild and worship of Hanuman God were also expressed.

### 6.2 Recommendations

To minimize the conflict and conservation of monkey, the following points should be recommended in Ramdi area.

- Provisioning done by the people in residential area should be avoided immediately.
- VDC should provide monkey proof garbage bins at temple sites and in highway in Ramdi area.
- VDC should manage/move/remove local dumpsites.
- The natural habitat of monkey should be improved in the community forest especially by planting the monkey palatable plants and also provide drinking water in their habitat.

- People should be made aware about conservation of Assamese monkey.

Ramdi Area of Palpa and Syangja district is historically and religiously very important place in Nepal. Many people visit this place from national and international level, So, the monkeys habitat are to be protected for monkeys watching which will be the source of recreation for the visitor.

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## PHOTOGRAPHS



Photo-1 Monkeys feeding waste food at dumping side in Ramdi



Photo-2 Female monkey clean orange cover for feeding it.



Photo 3 - Female having sub caudal sexual swelling.



Photo 4: Adult males showing aggressive behavior and attention.



Photo 5: Adult male resting.



Photo 6: Monkey entering into houses.



Photo 7: Crop raid by monkey in the rice and vegetables field.



Photo 8: Monkey eating manmade food.



Photo 9: Monkey moving on roof of houses.

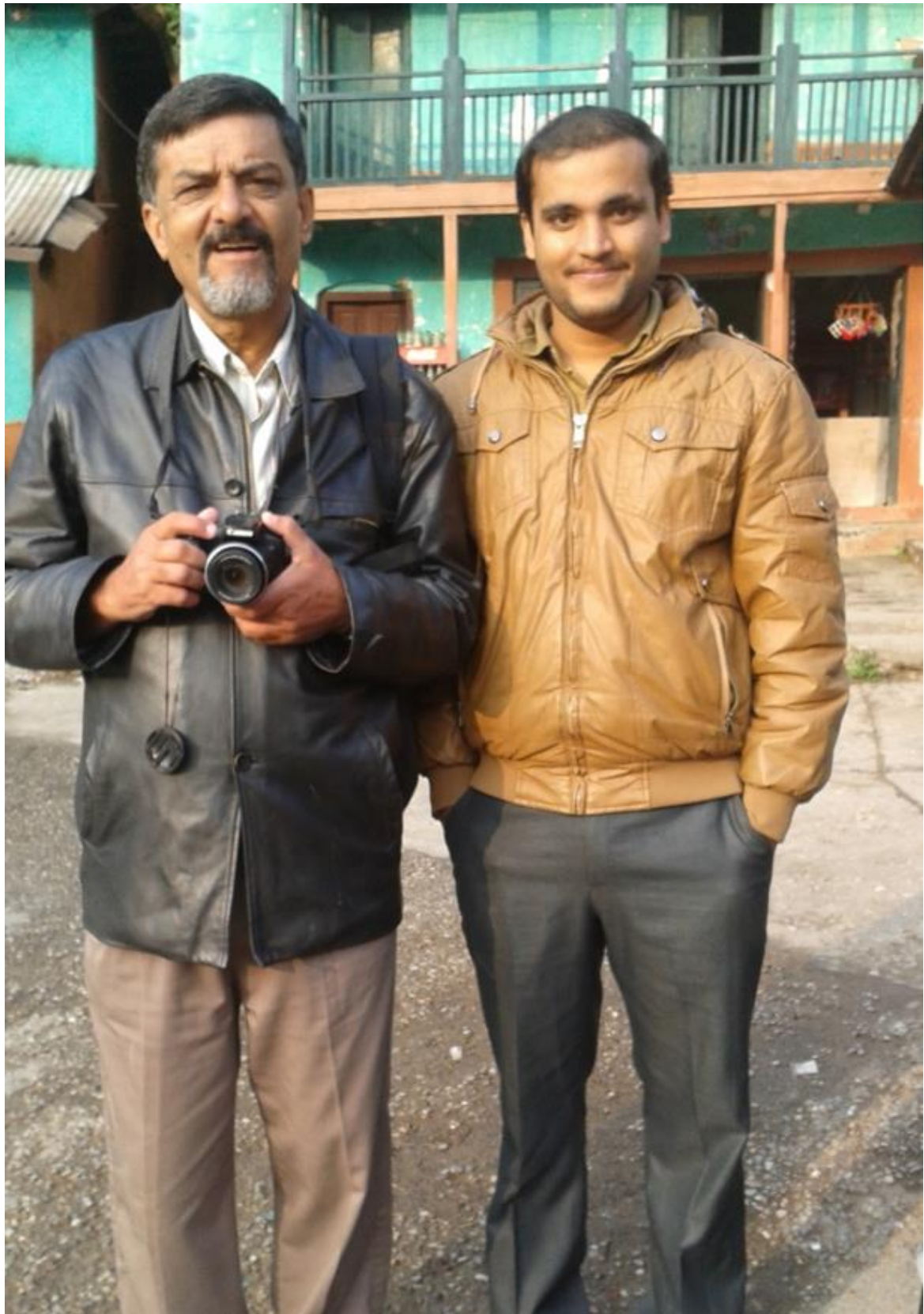


Photo 10: At Ramdi for the field work.

## APPENDICES

### Appendix I: Data sheet used to count Population

| Place | Time | Age- Sex composition |    |   |   |   |       | Remarks |
|-------|------|----------------------|----|---|---|---|-------|---------|
|       |      | AM                   | AF | Y | J | I | Total |         |
|       |      |                      |    |   |   |   |       |         |
|       |      |                      |    |   |   |   |       |         |

AM = Adult male, AF= Adult female, Y = Young, J = Juvenile, I = Infant

### Appendix II: Data Sheet used for behavioral observations.

#### Behavioral Observations

Sheet no:                      Date:                      Weather:  
 Scan Time:                      to                      Place:

| Time | Behavior | Remarks |
|------|----------|---------|
|      |          |         |

### APPENDIX III: Survey questionnaire on Human - Assamese monkey conflict

#### Respondents Details

Date: .....

Name of respondent: ..... Age: ..... Gender: .....

Education: ..... Address: .....

Q.N. 1) Have you seen the monkeys in Ramdi area?

- Yes                       No

Q.N. 2) What types of monkeys have you seen?

- Hanuman Langur (Dhedu)                       Rhesus (Rato Badar)  
 Assame Monkey (Paharae Badar)

Q.N. 3) In which part is they seen mostly?

- Northern belt of Ramdi                       Eastern belt of Ramdi  
 Western belt of Ramdi                       southern belt of Ramdi

Q.N. 4) Are they seen in all the months?

- Yes
- No

Q.N. 6) what is the estimate number of monkeys?

- Below 30
- 30-40
- Above 40

Q.N. 7) Do they create any disturbances in the village?

- Yes
- No

Q.N. 8) If Yes, What type of disturbances/ damages do they create?

- Grabbing/Taking foods and cloth from house
- Disturbing night sleep by running on the roof of the house.
- Damaging the cable network and electric connection
- Teasing girls and babies
- Damaging crops in the field
- Snatching and Biting
- Others, specify please.....

Q.N. 9) Among the different problems listed above, which you think the most severe one? Please specify.....

Q.N. 10). Have you grown any crops in your field? Yes ...../No.....If yes, which crops do you grow mainly in your field? .....

Q.N. 11) Do monkey raid crops in your field? Yes..... /No.....If yes which monkey causes the dame, specify please.....

Q.N.12) From where do they come?.....

Q.N.13) What is the approximate distance between your field and monkeys' habitat?

- <50 m
- 50-200 m
- 200-400m
- 400-600 m
- >600 m

Q.N. 14) Which crop do the monkey prefer to raid?

| Crop    | Stage of the Crop | Plant parts Utilized | Amount in kg or Path/Muri |
|---------|-------------------|----------------------|---------------------------|
| Maize   |                   |                      |                           |
| Millet  |                   |                      |                           |
| Potato  |                   |                      |                           |
| Mustard |                   |                      |                           |



|            |  |  |  |
|------------|--|--|--|
| Fruits     |  |  |  |
| Vegetables |  |  |  |
| Others     |  |  |  |

Q.N. 15) How much crop is approximately lost from monkey damage each year?

- <5%   
 5-15%   
 15-30%   
 30-60%   
 >60%

Q.N. 16) At which time they mostly raid the crops?

- Morning   
 Afternoon   
 Evening   
 All the time

Q.N. 17) Which age groups of monkeys are more destructive?

- Juveniles   
 Infants   
 Sub-adults   
 Adults   
 All age stage

Q.N. 18) Can you lists the plant species, which are least, preferred by the monkey?

.....

Q.N. 19) Did you leaved the land fallow due to monkey problem? Yes...../No...If yes, how much ropani/kattha land you leave fallow? Specify please.....

Q.N. 20) What is the trend problems due in monkey compared to last five year?

- Increasing                   
 Decreasing                   
 Same

Can you specify what may be the cause for such trend?

.....

Q.N. 21) Does monkey had attacked anyone in your tole? Yes...../No.....If Yes, when, where and to whom? Specify please.....

Q.N. 22) Where the monkey most prefer to stay more and why?

- Deep in the forest
- In the periphery area of the forest
- In the temples
- Near to arable crops
- Near people residence
- Others, specify please.....

Q.N. 23) What are the main causes that make the monkeys to be destructive?

- Increasing population of monkey
- Food scarcity in natural forest

- Habitat destruction due to urbanization
- Internal Migration
- Suitable Habitat
- Others if any specify please.....

Q.N. 24) Have you ever practiced artificial provisioning? Yes..../No.....If yes, what kind of food you offer to monkey and for what reasons? Specify please.....

Q.N. 25) Have you ever seen artificial provision to monkeys by other? Yes..../No.....

- If yes, who are they?
- Domestic visitors
- Tourists from foreign countries
- Pilgrims
- Researchers
- Others, specify please.....

Q.N. 26) What is extent of conflict between monkey and human in your perception?

- High    ■ Medium    ■ Low    ■ Unknown

Q.N. 27) What is the frequency of monkey entering your compound?

- Daily    ■ 2-3 days interval    ■ Weekly    ■ Fortnightly  
 ■ Monthly    ■ Seldom    ■ Others

Q.N. 28) Have you ever seen the people who utilized the food left/touch by monkeys?

.....

Q.N. 29) What are the measures that you apply to be safe from their destruction?

- Making them frighten by using catapult or stone
- Scolding and charging
- Fencing all around the houses
- Providing food for them in particular area
- Providing poison bait
- Others, specify please.....

Q.N. 30) Can you suggest which deterrent method is most effective for monkey?

.....

Q.N. 32) Did you complain about monkey problems? Yes..../No...If yes, where? If no, Why?.....

Q.N. 33) Do you think local people are also responsible to increase conflict? Yes..../No...  
If yes, How then.....

Q.N. 34) Do you have kill the monkey till now?Yes...../No..... If yes, for what reason,  
specify.....

Q.N. 35) Do you think, monkey need to be protected? Yes...../No.....

Q.N. (36) How can be this conflict resolved without affecting monkey habitat and  
protecting human losses? Give your opinion.....

Q.N 37) Do you have knowledge about disease transmission between monkey and  
human? .....

Q.N. 38) What will you do if you were bite/scratch by the monkey?  
.....

Q.N. 39) What are your perceptions?

- a. Collecting fodder from forest affects monkey's habitat. (Yes.... /No.....)
- b. Scratch/bite from monkey may transfer disease from monkey to human and vice versa. (Yes...../No.....)
- c. Monkey dominates children/women's easily and generally harasses them. (Yes...../No.....)
- d. Artificial provisioning is changing the behavior of monkey inviting more conflicts. (Yes...../No.....)
- e. Teasing, eye contact with monkey makes them more aggressive towards human. (Yes..... /No.....)

#### Appendix IV: Plant species found in Habitat of Monkey in Ramdi

| S.N | Common Name | Scientific Name             | Life form |
|-----|-------------|-----------------------------|-----------|
| 1   | Jamuno      | <i>Syzygium cumini</i>      | Tree      |
| 2   | Simal       | <i>Bombax ceiba</i>         | Tree      |
| 3   | Saj         | <i>Terminalia alata</i>     | Tree      |
| 4   | Barro       | <i>Terminalia bellirica</i> | Tree      |
| 5   | Harro       | <i>Terminalia chebula</i>   | Tree      |
| 6   | Amala       | <i>Phyllanthus emblica</i>  | Tree      |
| 7   | Pipal       | <i>Ficus religiosa</i>      | Tree      |
| 8   | Bar         | <i>Ficus benghalensis</i>   | Tree      |
| 9   | Lakuri      | <i>Fraxinus floribunda</i>  | Tree      |

|    |              |                                    |         |
|----|--------------|------------------------------------|---------|
| 10 | Khiluwa      | <i>Polygonatum</i> sps.            | Tree    |
| 11 | Guyalo       | <i>Callicarpa arborea</i>          | Tree    |
| 12 | Bilauni      | <i>Maesa montana</i>               | Tree    |
| 13 | Aasuro       | <i>Justicia adhatoda</i>           | Shrubs  |
| 14 | Bhorla       | <i>Bauhinia vahlii</i>             | Shrubs  |
| 15 | Bhogate      | <i>Maesa macrophylla</i>           | Shrubs  |
| 16 | Hatti Paile  | <i>Pterospermum acerifolium</i>    | Shrubs  |
| 17 | Simali       | <i>Vitex negundo</i>               | Shrubs  |
| 18 | Banmara      | <i>Eupatorium odoratum</i>         | Shrubs  |
| 19 | Rudhilo      | <i>Nyctanthes arbor-tristis</i>    | Shrubs  |
| 20 | Dhudhilo     | <i>Ficus neriifolia</i>            | Shrubs  |
| 21 | Khirri       | <i>Cucumis anguria</i>             | Shrubs  |
| 22 | Aaigeru      | <i>Scurrula parasitica</i>         | Shrubs  |
| 23 | Gandhe       | <i>Ageratum conyzoides</i>         | Herbs   |
| 24 | Kuro         | <i>Bidens pilosa</i> Var.          | Herbs   |
| 25 | Dubo         | <i>Cynodon dactylon</i> (L.) Pers. | Herbs   |
| 26 | Tapre        | <i>Cassia tora</i>                 | Herbs   |
| 27 | Kurkure      | <i>Blumea lacera</i>               | Herbs   |
| 28 | Banso        | <i>Digitaria ciliaris</i>          | Herbs   |
| 29 | Khar         | <i>Imperata cylindrical</i>        | Herbs   |
| 30 | BhiringiJhar | <i>Elephantopus scaber</i>         | Herbs   |
| 31 | Niuro        | <i>Dryopteris cochleata</i>        | Herbs   |
| 32 | Unyu         | <i>Dryopteris filix-mas</i>        | Herbs   |
| 33 | Babari       | <i>Mentha arvensis</i>             | Herbs   |
| 34 | Kalisinki    | <i>Cheilanthes</i> sps.            | Herbs   |
| 35 | Magar Kance  | <i>Begonia rubella</i>             | Herbs   |
| 36 | Ban Kafal    | <i>Myrica esculenta</i>            | Herbs   |
| 37 | Pyauli       | <i>Reinwardtia indica</i>          | Herbs   |
| 38 | Ganauni      | <i>Ageratum conyzoides</i>         | Herbs   |
| 39 | Dhayaro      | <i>Woodfordia fruticosa</i>        | Herbs   |
| 40 | Baans        | <i>Dendrocalamus strictus</i>      | Herbs   |
| 41 | Aarpuk       | <i>Acacia pennata</i>              | Climber |
| 42 | Gurgino      | <i>Tinospora cordifolia</i>        | Climber |
| 43 | Purino       | <i>Ampelocissus sikkimensis</i>    | Climber |
| 44 | Barakeuli    | <i>Stephania glabra</i>            | Climber |