

# Some Behavioral and Ecological Aspects of Assamese Monkeys (*Macaca assamensis*) in Makalu-Barun Area, Nepal

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## Abstract

Little is known about the habits, ecology, and population size of *Macaca assamensis* in Nepal. Its status and distribution within the Makalu-Barun area are sketchy at best, though, they have been sighted. In this study, the important behavioral characteristics of free ranging, non-provisioned and wild *M. assamensis* were documented as observed in Lakuwa forest of Makalu-Barun Conservation Area. The group-size, composition, age-sex ratio, time budget and habitat analysis of the area were determined. The question of crop raiding was dealt separately during the investigation of their general food habits. Four major behaviors were studied and find out that they spent 44% of time in foraging, 25% in walking or moving, 13% for grooming and 18% in sitting and resting. Due to habitat characteristics and seasonal influence monkeys seems to engaged more time in feeding.

**Keywords:** Habitats, Foraging, Grooming, Moving, Resting

## Introduction

The family Cercopithecidae (Old World monkeys) includes 14 genera and 70 species of monkeys. Of these, however, three species of primates, *Macaca mulatta* (Rhesus monkeys), *Macaca assamensis* (Assamese monkeys) and *Presbytis entellus* (Hanuman langurs) have been documented from Nepal (Chalise 1997). The rhesus monkeys were mostly studied in religious places (Southwick *et al.* 1982). The Hanuman langurs were studied at different locations in the wild (Bishop 1979, Chalise 1995). In some previous works, the availability of the Assamese monkeys are mentioned from the terri-

tory of Nepal (Roonwal and Mohnot 1977, Fooden 1982, 1986; Fa 1989). Therefore, little is known about their distribution, status and behavioral ecology in Nepal (Jackson, 1990, Jackson *et al.* 1990).

*Macaca assamensis* is perhaps one of the less common primate species in Nepal belonging to the genus *Macaca*. It belongs to the sinica-group together with *Macaca sinica*, *Macaca radiata* and *Macaca thibetana* (Saitou and Nei 1987). According to Delson (1980) and Fooden (1989), *M. assamensis* are similar in morphology to *M. thibetana* and *M. arcoides*, indicating that these three species might have had a common origin.

*Macaca assamensis* inhabits the foothills of the Himalayas and adjoining mountain ranges from west-central Nepal (83°) eastward through Sikkim, northern West Bengal, Bhutan, Arunachal Pradesh, Nagaland and in northern and eastern Burma, southern China, and the northern part of the south-east Asia (Hill and Bernstein 1969, Fooden 1989). An estimated 20,300 of these animals inhabit Indochinese protected areas (McKinnon and McKinnon 1987). They are killed for food and for crop pest control measures and have been included on the list of endangered species in this region.

Assamese monkeys live primarily in subtropical broadleaf-evergreen forests, and to a lesser extent, mixed deciduous and bamboo forest, utilizing many types of forest vegetation from semi-deciduous mixed wet to tropical dry deciduous forest, from monsoon to tropical evergreen Montana forest (Brockelman 1981, Wolfheim 1983, Ratajszczak 1988, Aggimarangsee 1992, Ahsan 1994). They spend a great deal of time in the high canopy and are rarely seen on the ground (Nisbett and Ciochon,

1993). The socio-ecology and general ecology of this species needs to be examined in detail as such information could be of great importance to the protection and conservation of this monkey species.

### Methodology

The Makalu-Barun National Park and Conservation Area (233,000 ha) was established in 1992 as Nepal's eighth national park and the first to include an adjacent conservation area. This area provides a unique landscape within a 40 km distance from the bottom of the Arun valley at 435m asl to the world's fifth highest peak of Mt. Makalu (8463m). The conservation area has a population of more than 32,000 with a majority of Rai and Bhotiya people. The study area, Lakuwa village forest lies on the southern fringe of the conservation area of the Tamku

village development committee (VDC). Lakuwa is a Rai village with 123 households and a large track of mountain forests in the north and west. Khunglewa, a tributary of the Sankhuwa River runs through the forest areas with steep slope and rocky topography, which constitute the monkey's habitat (Chalise 1997a, 1998).

VDC members, village chief, Khilakhiska community forest chairperson and other elders and youths were contacted for the information on crop raiding problem. The villager's meetings were also organized to assess the loss and to determine a solution. A questionnaire survey was conducted door to door to collect data of individuals' crop losses. The most severely affected fields were visited to assess the crop loss, damage procedure and to find out the location and distance between the forest and crop-field.

**Table 1.** Density and frequency of trees within the home range of study troop.

Name	Number	Percent	Plant / hectare	Non Fodder
1. <i>Elaeocarpus robustus</i>	33	23.40	94.29	X
2. <i>Schima wallichii</i>	25	17.73	71.42	
3. Bandare	9	6.38	25.71	
4. <i>Machilus odoratissima</i>	9	6.38	25.71	
5. <i>Castanopsis tribuloides</i>	8	5.67	22.85	
6. <i>Myrsine semiserrata</i>	8	5.67	22.85	
7. <i>Castanopsis hystrix</i>	6	4.26	17.14	
8. <i>Bombax ceiba</i>	6	4.26	17.14	
9. <i>Eurya acuminata</i>	6	4.26	17.14	X
10. <i>Callicarpa arborea</i>	3	2.13	8.57	X
11. <i>Melastoma malabaricum</i>	3	2.13	8.57	X
12. <i>Holarrhena</i> sp.	3	2.13	8.57	
13. <i>Machilus duthiei</i>	3	2.13	8.57	
14. <i>Sapium baccatum</i>	2	1.42	5.71	
15. <i>Macaranga pustulata</i>	2	1.42	5.71	
16. <i>Quercus glauca</i>	2	1.42	5.71	
17. <i>Syzygium cuminii</i>	2	1.42	5.71	
18. <i>Engelhardtia spicata</i>	1	0.71	2.86	
19. <i>Terminalia myriocarpa</i>	1	0.71	2.86	
20. <i>Castanopsis indica</i>	1	0.71	2.86	
21. <i>Mallotus philippinensis</i>	1	0.71	2.86	
22. <i>Lingustrum indicum</i>	1	0.71	2.86	
23. Charchare	1	0.71	2.86	
24. <i>Ficus auriculata</i>	1	0.71	2.86	X
25. <i>Terminalia alata</i>	1	0.71	2.86	
26. Jalame	1	0.71	2.86	
27. <i>Macaranga pustulata</i>	1	0.71	.86	
28. <i>Camellia drupifera</i>	1	0.71	2.86	
<b>Sum</b>	<b>141</b>	<b>100</b>	<b>399.97</b>	<b>46</b>

**Cut Tree** 1. Chilaune 2. Katus Dry 1. Simal

**Other Flora** 1. Badare 2. Khutunsi 3. Ageri 4. Jhigane 5. Kalo Bilaune 6. Sing Jhulo 7. Kaulo 8. Mutla Pat 9. Pahare Ghans 10. Nag Pate 11. Bhake Amilo 12. Malta 13. Mauwa 14. Tunma Ghans 15. Gothala Phul 16. Kacho Pat 17. Ghotoma 18. Bilaune 19. Dhakle Ghans 20. Churi Ghans 21. Amriso 22. Tungma 23. Kaulo (Jhakri Pat) 24. Babare Ghans 25. Bilaune 26. Kalikath 27. Pipihau 28. Kanchur 29. Kanchiruna 30. Bhamara Phul 31. Jilpau 32. Kudsimal 33. Orchids 34. Khaljamsi (white flower) 35. Nigalo 36. Chaulani Ghans 37. Dakle 38. Liso (epiphyte).

The study areas were surveyed walking along the forest trail taken as a transect line. After several visits to different spots, areas with high primate availability were selected as "focal areas". Such focal areas were frequently visited on foot and the selected group, "focal group," was studied. The focal group members were classified according to age and sex (Chalise 1997). The duration of any behavior and activities were recorded on the protocol papers with the help of binocular and timer (stop-watch). The individual counting and identification of groups were repeated several times in one observation. The data obtained from this procedure gave insight for the determination of average group-size, composition and social structure of species. For the behavioral observations, continuous recording (or all-occurrence recording) technique was used (Martin and Bateson 1993). Two groups were regularly contacted for this study. Wayang group consists of 27 animals (5 adult males, 8 adult females, 1 subadult male, 3 young adult females, 4 juveniles and 6 infants) and the Sankhuwa group had 13 animals (2 adult males, 4 adult females, 1 subadult, 3 juveniles and 3 infants). In total, 142 Assamese monkeys were observed in 1997 and 83 in 1998 and 280 km were covered to search and follow the monkeys in the study site, walking 6.5 - 13.2 km each day. More than 160 hours were spent in the monkeys' habitats including nearly 40 hours on the botanical survey. To determine the tree density and the vegetation composition, 4 plots (30m x 30m) were established inside the home range of the focal group. Species having DBH of greater than 12 cm were listed and the human impact and the conditions of the trees were recorded. The 4 plots in the focal troop area covered nearly 0.36 hectares.

## Results

### Habitat analysis

Vegetation composition showed that 23 plant species (70%) were fodder and non-fodder plants like *Elaeocarpus robustus* (23.4%), *Eurya acuminata* (4.2%) and *Callicarpa arborea* (2.1%) comprised 30% (Table 1). Among the fodder plants the *Schima wallichii* was the predominant species. Monkeys utilised fruits from the tree Bandare and ranked third. Local people exploited almost all fodder plants for their livestock and pigs. Large amounts of orchids were used as pig fodder. The value of fodder plants further increases if they yield fruits that were used for human consumption and medicinal purposes. *S. wallichii*, Bandare, and *Castanopsis* species, which were the primary food sources of monkeys in the

area were used by the locals for commercial purposes. *Machilus* sp. *Quercus glauca* and *Macaranga* sp. were widely used for general household use, timber and furniture. Flowers of many plants are used as food items by monkeys, as well as, by local people. Similarly, bark of tree species yielding dyes, are in demand by both humans and monkeys. Therefore, competition for the exploitation of natural vegetation is high between human and primates. A composition of forest and fodder plants' diversity could be estimated from the preliminary list of plants (list available on request).

### Composition of troop

Some 83 individuals were observed in five troops with 12 adult males, 23 adult females, 4 subadult males, 4 young adult females, 12 juveniles and 17 infants (Figure 1). No solitary males were observed.

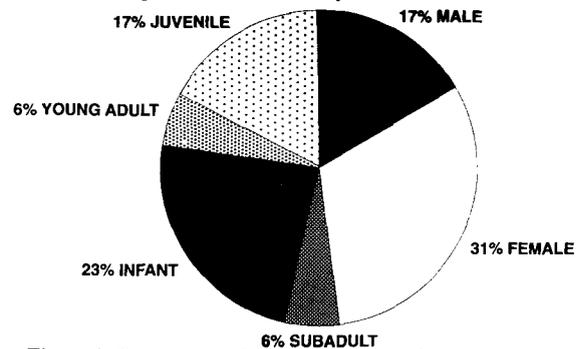


Figure 1. Composition of Assamese monkey in Lakuwa, MBCA, 1998

### Behaviors recorded

Adult males and females in the regularly contacted troops were observed for the four major categories of behavior: Foraging, Moving/Walking, Grooming and Resting/Sitting (Figure 2).

### Foraging

Foraging included eating or chewing or engulfing any substances solid or liquid, plants and plant parts or insects. Geophagy, insect-eating and drinking water were also included. Slight movements, to search food items in between feeding and active mouth was also included in the foraging category. The plant species and plant parts used by the monkeys are listed and were identified in the national herbarium, Godawari (Appendix- 1). The monkeys also licked a greenish rock hanging off of the large cliffs. The rock samples were collected and Geologists of Dept. of Mine and Geology identified that the greenish rocks are Malachite of metamorphic

gneiss containing high amounts of copper. Larvae belonging to Order: Trichoptera (Caddisflies group) and Family: Stenopsychidae eaten by monkeys were collected by turning several small stones in the running water of the Khonglewa River.

The average amount of time spent for feeding was 44% of the total activity. The highest foraging percentages of monkeys were recorded upto 70.2% per day while least amount of time invested was 21.3% in 1998. The Assamese monkeys spent a proportionately greater amount of time in foraging than other activities. A seasonal influence in other behaviors may be expected as the research was conducted in the months of March and April that availed plenty of flowers and young leaves. Therefore, the time spent for foraging was likely higher at this time than other social behaviors.

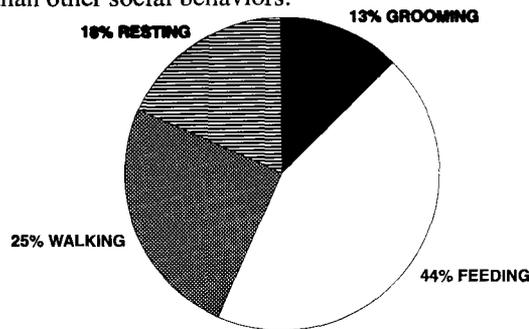


Figure 2. Major behaviors of Assamese monkey in Lakuwa, MBCA, 1998.

### Crop Damage due to Monkey species

Both rhesus and Assamese monkeys raided field crops. The Hanuman langurs (*Presbytis entellus*) visited the fields least. Villagers reported that among the three species, the Assamese monkeys damaged more

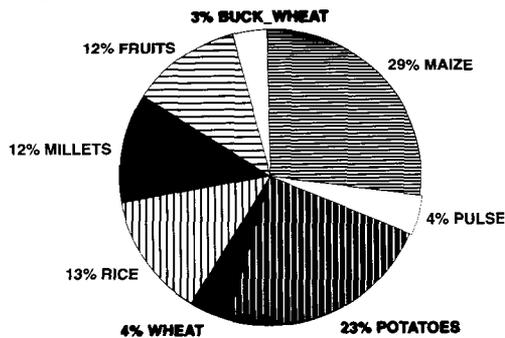


Figure 3 Percentages distribution of raided crops by monkey species in Lakuwa MBCA, 1997.

crops. The populations of rhesus were less than Assamese (Langurs: 59, Rhesus: 44, assamese: 142; Chalise in press). In areas, far from human settlements, the crop damage was higher because of lax

protection. Among the crop losses due to wild animals, 55% damage occurred through monkeys. They raid maize fields heavily (29%), potatoes (23%), rice (13%), fruits (12%) and finger millets (12%) (Figure 3). The tubers and fruits come to 35% of the total loss and cereals grain losses amounted to 65% in Lakuwa village.

### Moving/Walking

In this research, walking, running, chasing, jumping, climbing and playing and agnostic interactions with movement were categorized as moving. The monkeys were mostly sluggish in their movements. On one occasion (March 12, 1998) a total distance of only 0.5 km was covered in a period of 5 hours by the focal troop. The greatest amount of time in movement was recorded to be 40.9% of a total days activity while the lowest was 13.3%.

The adult monkeys made long and sharp alarm call to the hovering Himalayan eagle and ran to hide underneath shrubs or in a cave. Local residents reported predation by eagles on infants of monkeys.

### Grooming

While grooming, each area of skin was carefully and systematically cleaned and particular attention was paid to the face, shoulders and back, and scratches or wounds. Autogrooming was also included as grooming activity. The highest grooming time was observed to be 41.1% of a days activity and no grooming was recorded on one day.

### Resting/ Sitting

Sitting or lying on the ground or on the rocks and tree trunk or branches with eyes open or closed and leg stretched positions were considered as sitting category. The highest amount of sitting and resting behavior was observed to be 44.4% of a days activity and lowest was 0.7%. Sleeping sites were mostly along the rocky cliffs without vegetation, generally just above the steep bank of streams and rivers. There were more than five such places where focal troops halted for the night. Such places appeared nearly inaccessible to their predators. They used such places regularly sometimes (once same place was used consequently for five night halts) and some alternatively. They often climbed nearly one hour before night-fall to reach such cliff locations from lower elevations. Frequent grooming and short walking was common before reaching such resting places.

They huddled together in the evening and morning hours. They slept together in subgroups of up to 10 individuals, including adult males, females, juveniles and infants.

## Discussion

The Assamese monkeys of the studied area live in complex bisexual groups of multi-males and multi-females and different aged juveniles and infants. The size of the groups ranges from 9-50 individuals in Nepal whereas it varies at other study sites. Carpenter (1942) mentioned that typical size of undisturbed group of *M. assamensis* was about 12-26 individuals in Thailand. Also, in Thailand, Fooden (1971) estimated 10-50 individuals, while Southwick *et al.* (1964) reported 10-25 animals in India. Adult sex ratios have been reported to 1:2.3 (Fooden 1982), or even 1:1.7 (Southwick *et al.* 1964).

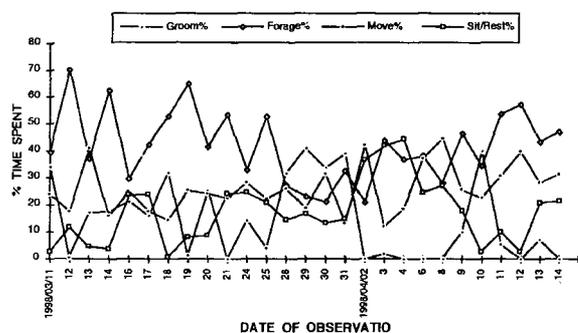


Figure 4. Distribution of time percentages per day for four major activities patterns of Assamese monkeys in Lakuwa, MBCA, 1998.

The regularly contacted groups were a group with 12 members (1997), Wayang group with 27 members (1998) and Sankhuwa group with 13 members (1998). In these troops, the behaviors were somewhat different. Grooming in the Wayang troop was as high as 41.1% of time and on the same occasion sitting occupied a higher than average percent of time while foraging and moving were less than average (Fig. 4). On another occasion, grooming was not recorded at all in that troop, while foraging was higher than average. Foraging times of up to 70.2% in one day were recorded, consequently other behaviors were very low. When foraging was relatively low, only the grooming behavior was considerably higher, while walking and sitting were lower in time percentages. During high moving (40.9%) days, foraging was somewhat higher (37.2%) than average, while other behaviors were subdued. On low movement days, the monkeys engaged in other activities to a greater extent. At times when the sitting behavior was simi-

lar to that of moving, and both were high, grooming and foraging were lower. When sitting was almost nil (0.7%), they had higher grooming (32.1%) and foraging (52.9%) behavior and less movement (14.3%).

Aggimaragsee (1992) categorized the behaviors of all age sex classes of Assamese monkeys into seven activities, where monkeys spent 31.2% in rest, 27.2% travel, 16.8% feeding, 15.4% playing, 8% grooming, 1.1% aggression and 0.3% sexual activities. In Thailand *M. assamensis* diet contained a high proportion of fruits, leaves, flowers, and almost no barks and insects (Aggimarangsee, 1992). In Bangladesh, however, its diet contains mostly leaves (46%), flowers (31%) and fruits (23%) (Ahsan 1994). According to Roonwal and Mohnot (1977), they also consumed insects and probably some vertebrates like lizards (Fooden, 1971). Studying a provisioned group of free-ranging Assamese monkeys in Golpara, India, Sarkar and Bhattacharjee (1996) reported that during 182 hours of focal animal sampling the monkeys used 36% of their total time for feeding, 30% for resting, 20% grooming and 15% locomotion. In previous study (Chalise 1997), geophagy or earth eating and stones licking phenomenon were observed and categorized separately. Geophagy comprised 3% of total activities, while 44% feeding, 29% walking, 15% resting and 9% grooming was recorded. However, in this study, all types of eating, licking and drinking phenomenon were included in the feeding category and comprised 44%, while 25% of time was spent on walking, 18% resting and 13% grooming (Figure 2). At the same site, Subba (1998) conducted a study based on 10 minutes scanning and resulted with similar trends (foraging 43%, 22% walking, 18% resting and 17% grooming). The slight differences in time spent on a few behaviors likely due only to the methodology. The larvae and insects consumed supplement protein in the primates diet and soil related materials counteract phenolic substances of their foods that are a common phenomena in non-human primates in different ecological zones (Chalise 1995).

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