

Population Estimation of the Asian Elephants (*Elephas maximus*) in Bago Yoma, Central Myanmar

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ABSTRACT

A status survey, population evaluation and preparation of a conservation action plan for the Asian elephant in Bago Yoma, Myanmar was initiated. Line transects of indefinite width were used for estimating dung density in five forest reserves such as South Zamari, North Zamari, Yenwe, Idokan and Okkan in Bago Yoma. Free ranging captive elephants were selected for defaecation study. For estimating daily rate of decomposition of the dung piles, fresh dung piles were monitored. A dung encounter rate of 2.42 km⁻¹ was estimated, it varied across the regions from 0.8 to 4.2 km⁻¹ and it was higher in south Zamari 1 than in north Zamari. The mean defaecation rate for the region was 20.02 d⁻¹ and overall decay rate was 0.072⁻¹. The elephant density varied from 0.4 to 5 elephants km⁻² and the average density of elephant for Bogo was 1.6 animals km⁻². In relation to a specific usage zone for all the regions surveyed, south Zamari appears to more used and though North Zamari has relatively larger area than the other regions surveyed, it is less used by elephants. In the low utilization zone the near-absence of elephants was attributed to disturbance from logging operations.

Key Words: Dung Density, Population Density, Habitat Usage Pattern.

INTRODUCTION

After India, Myanmar has the largest remaining population of Asian elephants (*Elephas maximus*). These wild elephants are distributed over 13 distinct populations. Among them Bago Yoma (formerly known as Pegu Yoma) situated in central Myanmar, is a crucial area for many large mammals including the Asian elephant (Salter 1983, Hut 1993). In the past, the forest department had been capturing elephants from the wild to replenish the captive stock for timber extraction. Although the capture quotas are set each year supposedly on a sustainable basis, it is certain that the wild populations have declined substantially during this century. It is thus important for Myanmar to formulate an effective elephant conservation strategy.

Though Myanmar is rich in biodiversity, there have hardly been any studies or even simple surveys conducted of species distribution for most wildlife species. Estimating large mammals, in particular, elephant numbers and mapping their distribution thus becomes imperative, as the population estimates are only educated guesses. There have been several attempts to estimate elephant numbers, but these have no scientific basis. Estimating elephant numbers is very difficult as the visibility within the forests is very poor and the forests in which elephants occur are mostly inaccessible. It is with these objectives in mind, a status survey, population evaluation and preparation of a conservation action plan for the Asian elephant in Bago Yoma, Myanmar was initiated.

STUDY AREA

The Bago Yoma region (Figure 1), which is situated in the central Myanmar, lies between 18° to 20° N and 96° to 97° E. The region is a very extensive tract of hill country, composed of tertiary sedimentary rocks. The average elevation of the Yoma is about 1000m asl, the highest point in Bago Yoma being 1050 m asl. The entire area is characterised by steep slopes and narrow ridges. The region has very good drainage; the Pegu, tributaries of Yenwe Chang, and the Kun Chang are the major river sources. The wet season lasts from May to October and the average annual rainfall varies from 160 to 330 cm. The region is famous for reputedly being the most valuable block of teak forest in the world. Thus, the region has been subject to intensive management for logging for the past 130 years (Salter 1983). The vegetation is largely mixed deciduous forest, with semi-evergreen forests occurring in areas of high precipitation. Patches of evergreen trees consisting mostly of secondary growth are seen in a few places. Notable among the mammal species (Hut 1993) seen here are: Rhesus macaque (*Macaca mulatta* Zimmermann), Hoolock Gibbon (*Hylobates hoolock* Harlan), Phayres langur (*Trachypithecus phayrei* Blyth), Himalayan black bear (*Ursus thibetanus* Cuvier), Malayan sun bear (*Ursus malayanus* Raffles), leopard (*Panthera pardus* Mayer), tiger (*Panthera tigris* Linnaeus), elephant (*Elephas maximus* Linnaeus), hog deer (*Axis porcinus* Zimmermann), gaur (*Bos gaurus gaurus* smith), wild dog (*Cuon alpinus* Pallas), sambar (*Cervus unicolor* Kerr), tsaine (saing) or banteng (*Bos banteng* Wagner) and serow (*Capricornis sumatraensis* Blyth).

METHODS

Dung Density

In dense forests with poor visibility, as is the case with most forests in Myanmar, counting elephants by direct methods is extremely difficult. It was thus decided to use indirect methods to estimate elephant density (Barnes and Jensen 1987, Dawson and Dekker 1992, Santosh and Sukumar 1993). The method involves computing 3 parameters: dung density, estimating defecation rate and decay rate of dung piles to compute the density of elephants and thus the population size within an area.

Line transects of indefinite width (Burnham et al. 1980) were used for estimating dung density in five

forest reserves of the Bago Yoma - South Zamari, North Zamari, Yenwe, Idokan and Okkan. In each reserve the census team split into six groups (each group consisting of 4 persons, including a field tracker). Transects of 2 km length were cut afresh and walked by a group to record dung piles.

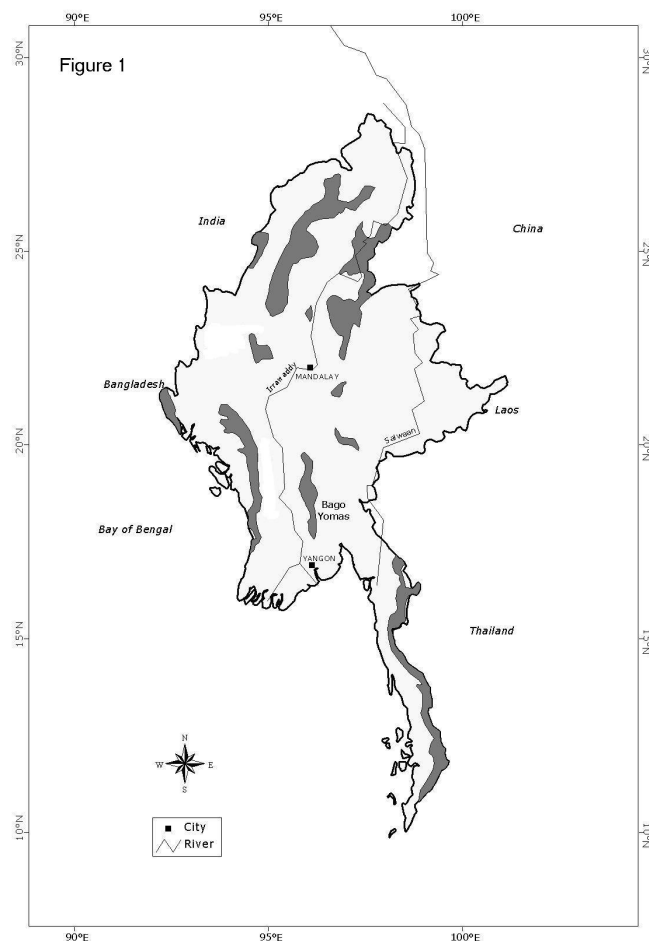


Figure 1. Location of Bago Yoma in Myanmar, and location of the survey region Bago Yoma is marked among the areas of elephant distribution in the country.

Defaecation Rate Experiment

The defaecation study was carried out in Myainghawan elephant nursing camp. The elephants from this camp were selected for the study as these elephant feed only on natural vegetation from the surrounding forest areas. The elephants are free from timber extraction work and kept here for training and veterinary care. For the defaecation observation the census team partici-

pants were divided in to 4 groups of 5 or 6 participants each. Each group observed five elephants (of total 32 elephants of different age and sex class) for defaecation rate of elephants, and a total of 48 hours (both day and night) was spent for observing each elephant.

Decay Rate Experiment

The estimation of the rate of decomposition of the dung piles was done by monitoring fresh dung piles. Fresh dung piles were marked during the defecation observations for subsequent monitoring. Four microhabitats were selected and in each habitat 25 dung piles were marked using bamboo stakes. Two trained staff of MTE continued to monitor the experiment after the departure of the census team.

Data Analysis

The density of dung piles, daily defecation rate and decay rate was estimated using GAJAH program (AECC 1995). The same program was used to compute the elephant density. The density of elephants was estimated separately for each reserve.

RESULTS

A total of 142 transects covering 284 km were surveyed, and 658 elephant dung piles accounting for a dung encounter rate of 2.42 km⁻¹ was estimated for the region (Table 1). Encounter rate varied across the regions from 0.8 to 4.2 km⁻¹ and it was higher in south Zamari 1 than in north Zamari.

Table 1. Forest reserves sampled for elephant density estimation during elephant survey in Bago Yoma.

Reserves	No. of transects	Distance covered (km)	Dung piles recorded (no.)
South.Zamari	36	72.0	309
North Zamri	35	70.0	62
Yenwe	36	72.0	122
Idokan	23	46.0	105
Okkan	12	23.5	60
Total	142	283.5	658

The dung density, defaecation rate and decay rates for different reserves are summarized in Table 2. The mean defaecation rate for the wet season was 20.02 (Standard Error, SE = 0.55) per day. Overall decay rate for 100 fresh dung piles was 0.072 (SE = 0.0035) per day. The elephant density varied from 0.4 to 5 elephants km⁻² and an average density of 1.6 (95% CI = 1.4 to 1.7) elephants km⁻² could be estimated for all the regions surveyed in Bago.

Elephant densities were calculated assuming the same defecation and dung decay rates for all reserves during the wet season. In South Zamari, three zones were identified based on differential utilization by elephants. The high utilization zone had an elephant density of 5 animals km⁻² within an area of 109.5 km², and the medium utilization zone (161.2 km² area) a density of 0.43 animals km⁻². The number of elephants in the two zones was estimated to be 613 individuals.

Table 2. Elephant density estimates in different reserves of Bago Yoma. Dung and elephant densities are expressed as number per km².

Reserves	Dung Density (SE)	Mean Elephant Density (95% CI)	Mean Number of Elephants (95% CI)
South Zamari 1	1380 (98.2)	4.95 (4.65-5.26)	542 (504-576)
South Zamari 2	121 (28.6)	0.43 (0.37-0.51)	70 (59-82)
South Zamari 3	-	-	-
North Zamari	151 (21.6)	0.54 (0.49-0.60)	388 (349-426)
Yenwe	300 (30.6)	1.07 (0.98-1.16)	852 (781-922)
Idokan	361 (42.2)	1.29 (1.18-1.42)	675 (613-737)
Okkan	392 (59.2)	1.41 (1.25-1.56)	56 (50-62)
Mean		1.62 (1.49-1.75)	Total 2583 (2433-2805)

In North Zamari an elephant density of 0.54 animals km^{-2} was indicated or a population of 388 for the 714 km^2 reserve. Yenwe Reserve, which has an area of 795 km^2 , had a density of 1.07 animals km^{-2} and the population size estimated for this reserve is 852 animals. The density for Idokan reserve is 1.2 elephants km^{-2} and the total number of elephants estimated for an area of 521 km^2 is 675 animals. In Okkan the estimated elephant density was 1.4 animals km^{-2} and total number of elephant is 56 animals for 40 km^2 . Overall a minimum of 2513 elephants for only few reserves in Bago could be estimated.

DISCUSSION

In the low utilization zone, the near-absence of elephants was attributed to disturbance from logging operations (from inquiries with MTE) and thus no transects were laid here. This would however not make any substantial difference to the estimates of elephant numbers in the reserve. In relation to a specific usage zone for all the regions surveyed, south Zamari appears to more used and though North Zamari has relatively larger area than the other regions surveyed, it is less used by elephants. With reference to the area, size and density of elephants (which could indicate the usage pattern by elephants of given area), the Okkan reserve estimates show more density compared to other regions surveyed. Except for north Zamari, the density estimates for all the regions are very high, which is almost equal to high elephant density regions in south India. The previously reported number of elephants for Bago Yoma is 700 animals; the present estimated mean density (1.6 km^{-2}) and number (2583) appear to be very high. Going by the facts of logging and other disturbances (Salter 1893, Htut 1994), only 800 elephants could be anticipated for the regions surveyed.

There could be several reasons for this difference. A major reason could be that the estimated decay rate, which is extremely high, is biased and not representative of regions outside reserves, which surveyed and also throughout the wet season. The experiment may have been carried out during an exceptionally heavy spell of rain and this may not be sustained throughout the wet season when the census was carried out. This would result in substantial over-estimation of elephant densities. The other important point to be noted is, two extreme dung decay rate were found for dry and wet seasons. Dung decay rate is very high during the

wet season, and it is low or slow for the dry season. Knowing the dung density and the decay rate of each stage of the decay is important. If dung decay rate of the old dung piles are very slow but fresh dung disappear faster than the old ones during the wet seasons, some of the old dung piles of dry season would also remain in the wet season and increase the dung density resulting in an over estimate of the number. The results could also be influenced by the fact that the surveys were carried out in the wet season. One way to overcome this problem is to carry out a series of decay rate experiments spread over the wet months and get a more realistic mean rate of decay. It may also be better to avoid carrying out censuses during the wet season and confine these entirely to dry months when the variation in dung decay rates can be expected to be substantially lower.

Obviously the density estimate made in selected reserves cannot be extrapolated to the entire Bago Yoma region. For this sampling has to be carried out in other areas of the region. Our estimate is thus a first minimum approximation and needs further refinement.

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