

DISTRIBUTION OF WILD ASIAN ELEPHANTS (*ELEPHAS MAXIMUS*) IN PHU LUANG WILDLIFE SANCTUARY, THAILAND

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ABSTRACT

The distribution of wild Asian *Elephants Elephas maximus* in Phu Luang Wildlife Sanctuary was determined by checking footprints and dung. The location of fresh elephant footprints and dung found in the area were plotted on a map. Three groups of elephants were identified within three watershed areas which covered areas of 200, 150 and 100 km², respectively. Ranges of the three groups of elephants overlapped partially in areas of hill evergreen forest. Regular trails, as well as salt licks, used by these three groups were mapped. Other animals sighted in the study area, such as gaur and hornbills, were also recorded.

INTRODUCTION

Asian Elephants are distributed in a wide range of forest habitat types, including dry dipterocarp, deciduous, evergreen, semi-evergreen and bamboo forests (SUKUMAR, 1989; SANTIAPILLAI & JACKSON, 1987; PRATER, 1971). Except on very high mountains, elephants live mainly from the lowlands up to 2,000 m a.s.l. They prefer tall forest on undulating terrain (PRATER, 1971). The distribution pattern of elephants is subject to seasonal change. In the dry season, elephants tend to be more widely distributed than in the wet season (SANTIAPILLAI & JACKSON, 1987). On the other hand, although in the dry season elephants may scatter widely, they may gather at high density in a particular area, for instance near a stream where food and water are abundant (SUKUMAR, 1989; PRATER, 1971).

In Thailand, the various types of forests which are habitat for elephants are patchy. The elephant population in Thailand is distributed accordingly to those forest patches. They occur in small populations in relatively large protected areas, including national parks and wildlife sanctuaries (SUKUMAR, 1989; DOBIAS, 1987). In Phu Luang Wildlife Sanctuary, there are an estimated 125–250 individual elephants (STORER, 1981; DOBIAS, 1987; SRIKRAJANG, 1992).

As far as management is concerned, there is little information on how elephants are distributed in various types of forest. Therefore, this study aimed, firstly, to determine the distribution of elephants in different types of forest and in different seasons and, secondly, to determine herd size and structure.

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METHODOLOGY

Study Area

The study was carried out in 500 km² in the eastern section of Phu Luang Wildlife Sanctuary (848 km²), Loei Province, northeastern Thailand, during January–December 1995. The study area was selected based on previous reports (STORER, 1981; DOBIAS, 1987). There were no reports on the existence of elephants in the western section of the sanctuary. The sanctuary is situated between 17° 3'–17° 24'N and 101° 16'–101° 21'E. The study area covers three major watershed areas, namely, Nam Top (200 km²), Nam San (180 km²) and Nam Loei (100 km²) (Fig. 1).

The Nam Top area is the watershed of six streams called Nam Top, Huai Nam Dam, Huai Gung, Huai Baeng, Nam Khor and Nam Khai, all of which are perennial. The main vegetation type is hill evergreen forest (400 km²) and the ground cover is dominated by vine bamboo *Melocanna humilis*. Other vegetation types are dry evergreen, mixed deciduous and dry dipterocarp forests, all of which are found in small areas along the Nam Khor and Nam Khai. Altitudes range from 350–1,500 m a.s.l. The Nam San area is covered with dry evergreen and hill evergreen forests which range from 700–1,500 m a.s.l., in the watershed of the Nam San Noi. The Nam Loei area is covered with mixed deciduous, dry evergreen and hill evergreen forests, and ranges from 300–1,500 m a.s.l. It is the watershed of the Nam Loei stream (RFD, 1995).

Monthly rainfall varies from 5–200 mm. Minimum and maximum daily temperatures range from 15–24°C and 28–35°C, respectively.

Data Collection

Ground surveys were made by hiking into the study area along existing natural trails (Fig 1). The surveys were done by 3 teams of 12 persons every other month. Fifteen days were spent on each survey, working daily from 0800–1700 hours.

Fresh tracks and trails used by elephants were recorded, measured and mapped on a map (scale 1 : 250,000). Dung and food plants found in and around feeding ground were recorded. Food plants were identified and the parts of the plant consumed were recorded.

Elephant ageing was determined by height, which was obtained from the circumference of a front footprint x 2 (SUKUMAR, 1989). To determine age-classes of elephants from heights, we followed SUKUMAR (1989) and RAMAKRISHNAN ET AL. (1991), and classified them as, adult: over 13 years, sub-adult: 3–13 years and calf, 1–3 years (Appendix 1).

Once a herd or an individual was encountered, number, sex and age were recorded and the animals photographs were taken (whenever possible). Herd recognition was confirmed by the number of the calves and the size of their footprints.

Climate information from 1984–1993, collected at Loei Station, was obtained from the Meteorological Department and is shown in Appendix 2.

Other large animals and birds such as gaur and hornbills sighted in the study area were also recorded.

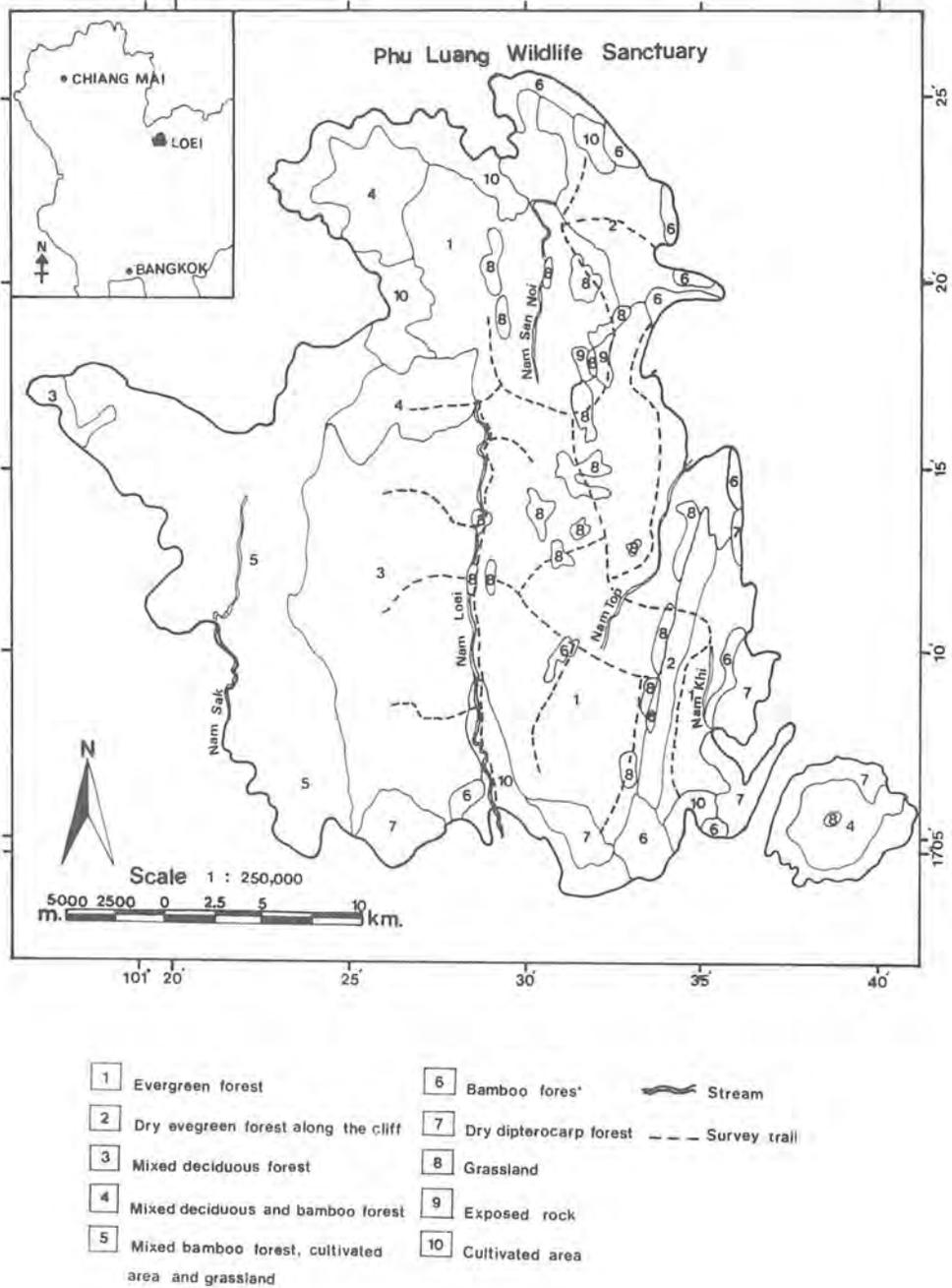


Figure 1. Study area showing vegetation types and survey trails in 1995 at Phu Luang Wildlife Sanctuary.

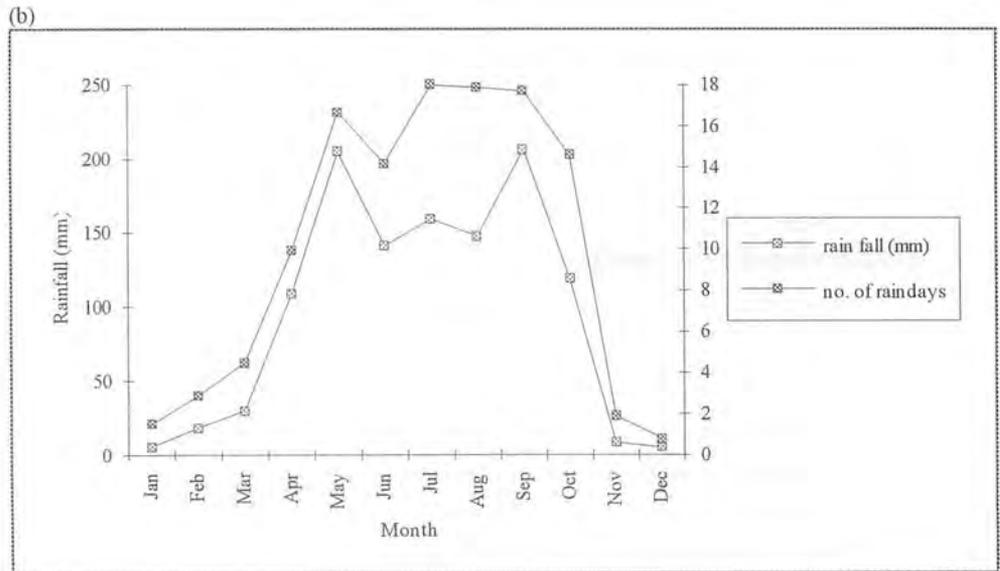
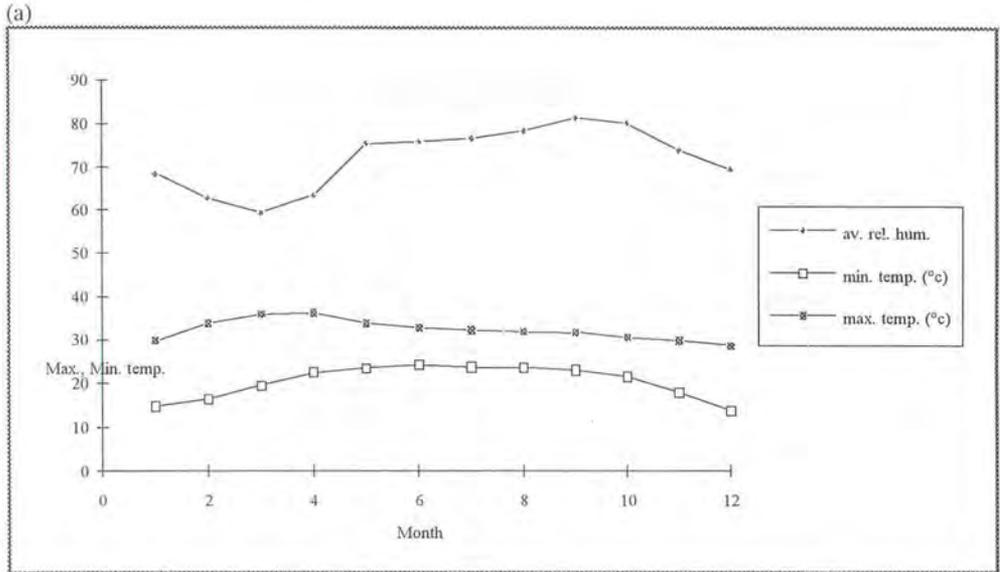


Figure 2. Monthly average (a) temperatures and relative humidity and (b) rainfall as measured at Loei Station between 1984–1993.

RESULTS

Distribution Range

Elephants were obviously found distributed around and near streams (Figs. 1 and 3). There were three main herds recorded in the study area (Fig. 3).

Herd No. 1: This was the largest herd and consisted of approximately 25 individuals. This herd was found in the hill evergreen forest between the Nam Top and Phu Yong Phu areas. They were found at salt licks which were scattered in dry evergreen and dry dipterocarp forests at least twice per month. Hence, they visited these forests for minerals.

Herd No. 2: This herd comprised of approximately 15 individuals and was found in both hill evergreen and dry evergreen forests, the main vegetation types in the area (Figs. 1 and 3).

Herd No. 3: This herd comprised of approximately 10–12 individuals, and was found distributed in hill evergreen and dry evergreen forests, the main vegetation types in this area (Figs. 1 and 3).

An overlap in range was observed between Herds 1 and 3, where there was continuous hill evergreen forest. Herd 2 did not overlap with Herds 1 or 3 (Fig. 3).

Distribution of Elephant Trails and Salt Licks

It was observed that, while feeding, the herd split into smaller subgroups of 5 to 6 individuals. These subgroups, however, were still controlled by the female leader of the herd. She would groan very loudly to call strayed or split groups back to the main herd, and then the herd moved on. When going to a salt lick, the separated subgroups would also return to join the main herd.

There were three main regular trail networks, Nos. I, II and III (Fig. 3). Networks No. I and II were joined at one place, in the area where the distribution range overlapped. Trail Networks I, II and III were used exclusively by Herds 1, 2 and 3, respectively.

The distribution of salt licks is shown in Figure 3. It was not even. Distribution ranges of Herds 1, 2 and 3 covered 9, 4 and 2 salt licks, respectively. Most of the salt licks were located near major trails. It is likely that the size of the herd had some correlation with number of salt licks available, which perhaps confirmed the importance of salt licks.

Seasonal Distribution

During winter (January) the recorded minimum temperature was 15°C (Figure 2), but inside the study area at 1,500 m the minimum temperature dropped to 0°C or lower. In January, each herd was found gathered in the valley. This enhanced counts of the number of individual elephants in each herd.

In the rainy season (May–October), when maximum rainfall was 226.7 mm in September (Figure 2), the elephants were widely scattered for foraging. Major food plants recorded were *Melocanna humilis*, *Saccharum* spp. and *Musa* spp. (Table 1). All parts of plants including leaf, shoot, stem, bark and fruit, were consumed. Leaves were the most favoured part (Table 1). The number of elephants in this season was easily confirmed when

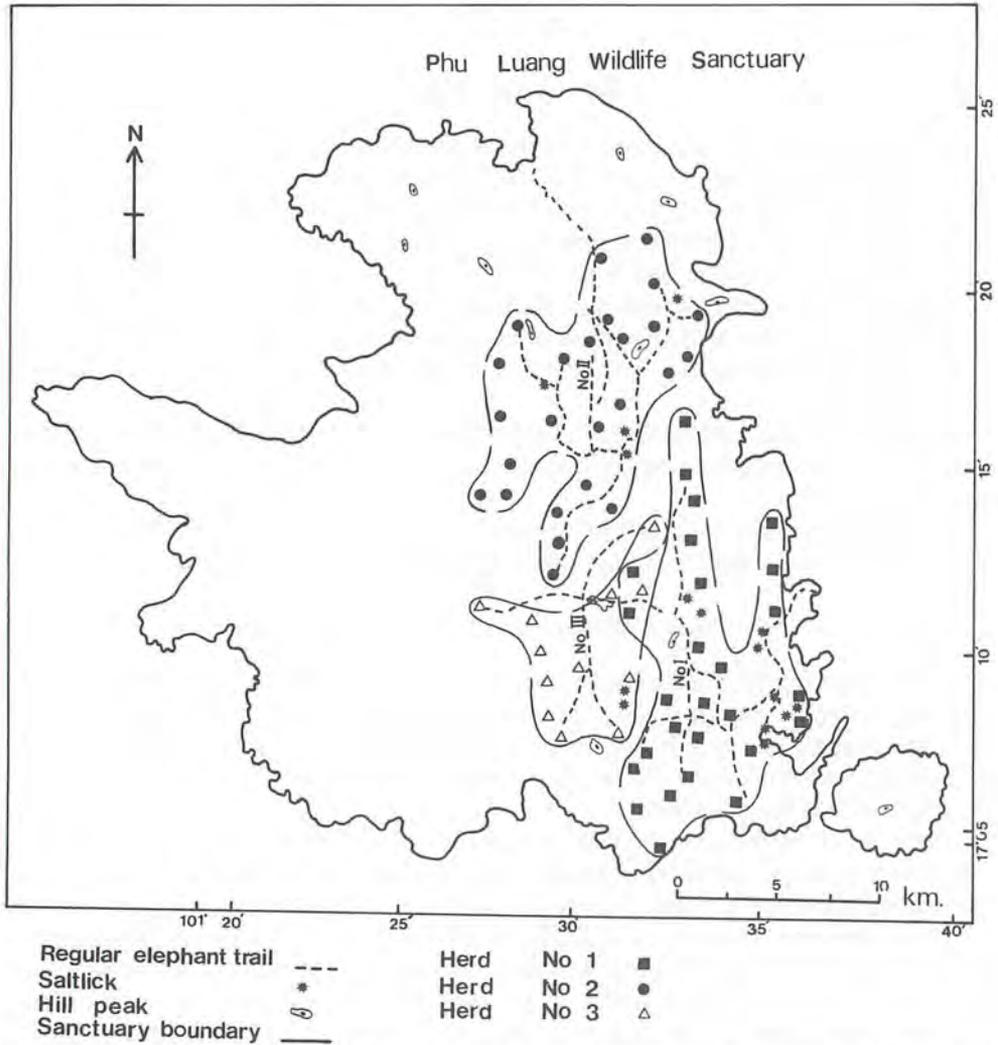


Figure 3. Distribution ranges of three different elephant herds and distribution of regular elephant herds, trails and salt licks in the study area.

they walked into a salt lick. Unfortunately, there was no study on the frequency of visits at each salt lick.

Structure of Herd No. 1

Only Herd 1 was studied for age-class ratio. As shown in Appendix 1, the ratio of adult : subadult : calf was 4 : 3.3 : 1 (12 : 10 : 3 individuals). Sex ratio of males and females was uncertain. Although, most of the large-sized elephants were females, when

Table 1. Observed food plants consumed by wild elephants in Phu Luang between January and December, 1995.

Plant species	Family	Consumed parts
<i>Acacia concinna</i>	Leguminosae	leaves, shoots
<i>Acacia pennata</i>	Leguminosae	leaves, shoots
<i>Aegle marmelos</i>	Rutaceae	fruit
<i>Ailanthus fauveliana</i>	Simarubaceae	leaves, bark
<i>Albizia chinensis</i>	Leguminosae	bark
<i>A. procera</i>	Leguminosae	bark
<i>Artocarpus lakoocha</i>	Moraceae	fruit
<i>Arundo donax</i>	Gramineae	leaves, shoots
<i>Baccaurea sapida</i>	Euphorbiaceae	fruit
<i>Bambusa spp.</i>	Gramineae	leaves, shoots
<i>Bauhinia malabarica</i>	Leguminosae	bark, fruit
<i>Bombax anceps</i>	Bombacaceae	leaves, shoots
<i>Calamus spp.</i>	Palmae	shoots
<i>Canarium subulatum</i>	Burseraceae	leaves, barks
<i>Caryota urens</i>	Palmae	shoots
<i>Celastrus paniculata</i>	Celastraceae	leaves, stem
<i>Cephalostachyum pergracile</i>	Gramineae	leaves, shoots
<i>Cissus repanda</i>	Vitaceae	leaves, stem
<i>Clerodendron infortunatum</i>	Verbenaceae	leaves
<i>Coix lachryma-jobi</i>	Gramineae	leaves, stem, fruit
<i>Costus speciosus</i>	Zingiberaceae	leaves, stem
<i>Choerospondias axillaris</i>	Anacardiaceae	fruit
<i>Dendrocalamus membranaceus</i>	Gramineae	leaves, shoots
<i>Dendrocalamus strictus</i>	Gramineae	leaves, shoots
<i>Dillenia aurea</i>	Dilleniaceae	fruit
<i>D. ovata</i>	Dilleniaceae	fruit
<i>D. pentagyna</i>	Dilleniaceae	fruit
<i>Eleusine indica</i>	Gramineae	leaves, shoots
<i>Entada scandens</i>	Leguminosae	leaves, stem
<i>Eugenia cumini</i>	Myrtaceae	fruit
<i>Ficus spp.</i>	Moraceae	fruit
<i>Imperata cylindrica</i>	Gramineae	shoots
<i>Ipomoea turpethum</i>	Convolvulaceae	stem
<i>Irvingia malayana</i>	Simarubaceae	fruit
<i>Lannea grandis</i>	Anacardiaceae	leaves, bark
<i>Licuala sp.</i>	Palmae	shoots
<i>Mangifera caloneura</i>	Anacardiaceae	shoots
<i>Melocanna humilis</i>	Gramineae	leaves, shoots
<i>Musa spp.</i>	Musaceae	leaves, stem
<i>Oxytenanthera nigrociliata</i>	Gramineae	leaves, shoots
<i>Phoenix acaulis</i>	Palmae	shoots
<i>Phyllanthus emblica</i>	Euphorbiaceae	fruit
<i>Saccharum spp.</i>	Gramineae	leaves, shoots
<i>Sandoricum koetjape</i>	Meliaceae	fruit
<i>Spondias pinnata</i>	Anacardiaceae	fruit

they were subadults or calves it was difficult to identify the sexes. Other herds were too difficult to determine age-classes or sex ratio.

Other Species in the Study Area

A small herd of 10 gaur (*Bos gaurus*) was encountered along the edge of hill evergreen forest while conducting this study. The only hornbills sighted were Oriental Pied Hornbills *Anthracoceros albirostris*. We made no attempt to count the number of individual hornbills found in the area. However, subjectively, the number of hornbills tended to decline. A known cause that threatened the hornbill population was hunting.

DISCUSSION

It was clear that each elephant herd found in the study area was independent. This is supported by PRATER (1971) who reported that different herds would not mix. The herd is believed to consist of members of one family. However, stray females and young males may migrate from one herd to another (PRATER, 1971). From this study, the herd did not stay intact all the time, but broke up into subgroups for foraging. This phenomenon is normal when food is scattered or scarce. The herd then usually splits into smaller groups and gathers again when conditions are favourable (PRATER, 1971).

The distribution of elephants in this study depended on the size of favourable habitat, such as hill evergreen forest, and abundant sources of water and salt licks. In addition, the abundance of salt licks seemed to keep the largest number of elephants around. Hence, the Nam Top watershed area was the best habitat among those three areas to support a large herd of elephants. The area provided all necessary factors including food plants, particularly *Melocanna humilis*, several streams and abundant salt licks. There was no report of elephants in the western side of the sanctuary. This may be because, in the west, 1) the terrain may have been too steep, 2) ultimate factors (i.e. water, food, salt licks) may be scarce and 3) human disturbance may be intense. Thus, we believe that the number of elephants reported in this study was the total number found in Phu Luang Wildlife Sanctuary.

With regard to seasonal distribution, we found that in the colder season, the herds gathered at a lower altitude. This was slightly different from what PRATER (1971) described. He stated that the elephants in Burma (Myanmar) wander into bamboo forest at 3,050 m a.s.l. in all seasons. Furthermore, he stated also that elephants usually live in steamy humid or in cool elevated forest. In Sikkim, their tracks were seen in the snow at 3,660 m a.s.l. (PRATER, 1971).

Such dispersed behaviours in Burma and Sikkim seem to be affected by the shortage of food. In Phu Luang Wildlife Sanctuary, however, the elephants appeared to avoid higher altitudes in cold weather. In this study, food shortage may not be the cause of dispersal of elephants from higher altitude. It may rather be the shortage of water at high altitude during cold and dry months.

To determine the optimal conditions within a habitat for elephants at Phu Luang Wildlife Sanctuary, long-term data collection is recommended. This should include climate, plant communities, water sources and salt licks, together with utilization of the latter three variables by elephants. Only then can effective management be conducted.

CONCLUSION

In the study area, there were 3 herds of elephants roaming around. Each herd occupied a certain area. Herd 1, the largest herd, occupied the Nam Top area (200 km²) and was composed of about 25 individuals. Herd 2 occupied the Nam San area (180 km²) and was composed of about 15 individuals. Herd 3, the smallest, occupied the Nam Loei area (100 km²) and included 10–12 individuals. Three regular trail networks were found, each one used by a specific herd. Their distribution changed seasonally. In the coldest month (January) the herds moved into the valleys, perhaps due to lack of water. The structure of Herd 1 was studied, and the ratio of adult : subadult : calf was 4 : 3.3 : 1.

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Appendix 1. Different age classes of elephants and their average sizes (from SUKUMAR, 1989; RAMAKRISHNAN ET AL., 1991).

Age class	Age (years)	Average height (m)	
		male	female
Calf	1	1.21	1.19
	2	1.39	1.35
	3	1.55	1.49
Subadult	4	1.69	1.61
	5	1.80	1.70
	6	1.90	1.77
	7	1.98	1.83
	8	2.05	1.88
	9	2.12	1.93
	10	2.17	1.97
	11	2.22	2.00
	12	2.25	2.03
	13	2.28	2.06
Adult	14	2.31	2.09
	15	2.35	2.13
	20	2.50	2.28
	25	2.62	2.34
	30	2.68	2.38
	30	2.68	2.38
	40	2.72	2.40