RANGING BEHAVIOUR AND HABITAT USE OF ELEPHANTS IN SRI LANKA

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Abstract

We have studied the ranging behaviour of 18 elephants in Northwest and Southeast Sri Lanka (six males and 12 females) over a period of eight years, using VHF radio telemetry. Locations of collared animals were identified using triangulation and homing methods. Elephant home ranges showed a similar pattern in both regions with home range extents of males ranging from 53.6 – 346 km^2 and females from 29.6 – 160.7 km^2. Elephants showed high fidelity to home ranges. No distinct seasonal ranges with long distance migration between them were observed for any of the tracked animals. The musth range of males was much greater than the non-musth range. The relationship of home ranges to protected areas varied from being situated entirely within the protected area, entirely outside or partly in and outside protected areas. A trend of increasing home range size with increasing fragmentation was observed in elephants that ranged in landscapes with high level of human activity. The ranging pattern of female elephants whose home range included both protected and non-protected areas appeared to be influenced by cultivation patterns. Our findings also indicate that in Sri Lanka, elephants prefer disturbed habitats and areas with slash and burn cultivation are important dry season foraging areas. This was confirmed by studies on elephant use of buffer zone areas in Yala. Home range extents of elephants in Sri Lanka were much smaller than in South India and they did not undertake long distance migrations. Genetic studies have confirmed that this pattern of ranging was not created by 'recent' developments.

Background and Objectives

Elephant population in Sri Lanka has undergone a marked reduction starting from the mid nineteenth century. About 12,000 elephants are thought to have inhabited the island in the mid nineteenth century. Although the exact size of the present day elephant population is unknown, most estimates place it between 3000-5000 elephants.

Hunting, capturing, loss of habitat and human elephant conflict can be considered as the major factors that have contributed to the decline in elephant population. During the pre-independence era, a large number of elephants have been hunted or captured for export resulting in a rapid decline in the elephant population (Jayawardene, 1994). As a result, elephants were almost completely obliterated from the wet zone except for few isolated pockets, which remains to date (Handapan ella herd and Peak Wilderness herd). During the post-independent period, development of large scale agriculture projects such as the Mahaweli

Development Project made it possible for people to farm in the dry zone. Under this project a large number of settlements were established in the dry zone. This has led to a reduction in the available habitat as well as fragmentation of habitat, resulting in alteration in the access to food and water and disruption of elephant home ranges and movement patterns. Reduction in the available habitat and establishment of human settlements and large-scale agriculture projects within or closer to areas inhabited by elephants has led to a conflict of interest between humans and elephants. Much conflicts occur in the areas that were developed under the Mahaweli developmental programme (Jayawardene, 1993). These conflicts have contributed to increased elephant mortality. According to the statistics released by Department of Wildlife Conservation, during the last decade alone 1369 elephants have been killed (www.dwlc.lk).

Although, several action plans have being proposed by various individuals with an aim to mitigate human-elephant conflict, a lasting solution is yet to be accomplished. Absence of a sound elephant conservation-management plan for Sri Lanka can be attributed to lack of basic knowledge about the ecology and behaviour of elephants plus as lack of understanding of the perceptions of villagers and their attitudes towards wild elephants.

Therefore, the main objective of this study was to collect baseline data on ranging behaviour of elephants in order to determine the ranging patterns, migratory pathways, habitat preferences and critical habitat pockets of elephants.

Experimental approach

Study Area: Two main areas were selected for the study. They are the Southeastern and the Northwestern regions of Sri Lanka. The Southeastern region contains a number of protected areas and the density of humans low. On the other hand the Northwestern region has very few protected areas and a rapidly growing human population. Therefore, this provided an opportunity to study the ranging behaviour of elephants that occupy habitats inside protected areas and elephants that occupy habitats outside protected areas where there is high and low human use.

The Southeastern region of Sri Lanka contains number of protected areas. The Southern Protected Area Complex is the largest aggregation of protected areas in Sri Lanka, comprising of Ruhuna, Lunugamvehera, Udawalawe and Bunadala National

Parks, and Nimalawa, Katagamuwa, Kataragama and Weerawila sanctuaries. The Southern Protected Area Complex therefore, provides the best opportunity for long term in situ conservation of elephants. At present the land surrounding most of these protected areas are under populated and therefore utilized by both humans and elephants. However, a number of development projects will be implemented in the Southern region during the next few years. This is likely to change this situation thereby bringing pressure on the elephants that are presently found in the human use areas.

The Northwestern region of Sri Lanka, unlike the Southeastern region, posses the least amount of protected areas, excluding Wilpattu National Park (Kahalla Pallekele, Ritigala, Mahakandarava, Mihintale, and Anuradhapura amounts to a total area of 31,000 hectares). However, a fairly substantial elephant population resides in this area. A census carried out by the DWLC revealed that there are 591 elephants inhabiting the Northwestern region (Hendavitharana, 1993). Furthermore, this region has undergone a rapid development in recent years under the Mahaweli developmental programme. These factors together have contributed to an escalating human-elephant conflict in this area.

Methodology: This study was carried out over a period of eight years from 1995 to 2003. A total of 18 elephants were fitted with radio collars. In the north-western region a total of eight elephants (three males and five females) were radio-collared while the remaining 10 elephants (three males and seven females) were radio collared in the southern region (refer map 1). These animals were tracked two to three times per week. Tracking was done by homing in on the signal using a hand held Yagi directional antenna. In instances where the animals cannot be reached when they inhabit difficult terrain the triangulation method was used. Locations were geo referenced using a hand held GPS instrument. The coordinates were plotted on a (1:50000) land use map and the home range size was determined using the minimum convex polygon method with the aid of two software packages, SEAS and CALHOME.

Results
Elephant home ranges showed a similar pattern in Northwestern and Southwestern Sri Lanka with home range extents for males ranging from 53.6 - 346 km² and females from 29.6 - 160.7 km². These home ranges were much larger than the home ranges reported for Asian elephants in Sri Lanka by other investigators (de Silva et al, 1997; Eisenberg, & Lockhart, 1972; Ishwaran, 1981). This can be attributed to the fact that all these home range sizes were derived based on visual observations of elephants. It has been shown that direct observation tend to underestimate the home range, compared to that of home ranges derived by radiotelemetry (Desai 1991; Desai, 1996; Baskaran, 1995). However, the home ranges of both male and female elephants were relatively smaller compared to that of Southern India (Baskaran 1995). Of the six male

elephants that were monitored, one elephant came into full musth during the study period. The non-musth home range of this bull was much smaller (180 km²) compared to the musth home range (346 km²).

With respect to the ranging patterns, three different categories were identified. They are the elephants that range entirely within protected areas, entirely outside protected areas and both inside and outside protected areas. Of the elephants that range entirely outside protected areas, those who inhabit high human use areas have larger home ranges (male - 183.6 km² and female - 157.9 km²) compared to those who inhabit low human use areas (male - 53.6 km² and female - 48.3 km²). The larger home range size of elephants inhabiting high human use areas can be attributed to fragmentation of their habitat due to human activities. An analysis of the actual available habitat within each home range indicated that the actual available habitat is approximately 40 km² irrespective of the size of the home range for both non musth males and females. Similarly, elephants that inhabit high forest areas had a larger home ranges compared to elephants that occupy scrub forest.

Analysis of the habitat usage within a home range indicated that elephants prefer disturbed habitats such as abandoned chenas and scrub forests over natural forests. It was also observed that elephants show a high preference for abandoned chena areas and that these areas are important dry season foraging areas for elephants.

Elephants showed a high fidelity to their home ranges. No distinct seasonal home ranges were observed even though there were seasonal shifts within the home ranges. It was also discovered that elephants do not undertake long range migrations outside their established home ranges.

Discussion
Elephants in Sri Lanka have smaller home ranges compared to the home ranges reported for elephants in Southern India. Furthermore, unlike in South India elephants do not show distinct wet season and dry season ranges. Consequently, long range migration between wet and dry season home ranges does not take place in Sri Lanka as was believed earlier. Elephants also showed strong fidelity to their home ranges. Thus establishment of long narrow corridors between large protected areas to enable movement of elephants between protected areas as a means of reducing human-elephant conflict will not be a viable management option. However, elephants with fragmented habitats such as elephants that inhabit high human use areas showed fixed cross over point between habitat patches. These areas can be converted in to short range corridors to ensure that continuity between habitat patches within a given home range is not disrupted.

Elephants ranging in high human use areas tend to have larger home ranges compared to that of elephants in low human use areas. However, the

actual habitat available within the home range of elephants that range in high human use and low human use areas tend to be the same. This indicates that the size of the home range is primarily determined by the habitat availability. Thus the ranging behavior of elephants seems to be influenced primarily by availability of food and water. However, water does not appear to be a limiting factor for the elephants, especially in the North-western region, as there are many man made water bodies that retain water throughout the year. Therefore, availability of food appears to be the main determining factor of the extent of the home range. In addition, humans, who tend to drive elephants from one locality to another, also influence the ranging behavior of elephants in the high human use areas.

The results indicate that elephants prefer disturbed habitats over undisturbed areas as these areas carry their food plants at a higher density. They showed a preference towards scrub and grassland habitats, especially abandoned chena areas which were critical dry season foraging areas especially in the Southeast. Therefore slash and burn cultivation creates habitat for elephants. However, there is a increasing tendency for farmers to move away from traditional slash and burn cultivation to permanent cultivations due to the unavailability of land as well as increased availability of water due to new irrigation schemes. Such a shift will be detrimental to elephants as they will lose critical foraging areas during the dry season and continuous use of these areas by elephants will lead to conflict as is already observed in the Northwestern region.

A management practice currently employed by the Department of Wildlife Conservation is to construct electric fencing along park boundaries to prevent the influence of elephants on communities that inhabit areas adjacent to the park border. This policy will have a detrimental impact on the ranging patterns of elephants whose home range includes areas inside and outside of protected areas. Furthermore, DWLC intends to drive all elephants that occupy habitats outside the protected area into the park before erecting such a fence. This will increase the elephant density inside the park, which will adversely influence those elephants that range entirely inside the park as well as increase competition for resources within the park. Therefore, erection of the electric fence along park boundaries will not be a suitable management strategy. Instead it is recommended that such fences should be erected along ecological boundaries or else an alternate solution should be available for the elephants that lose their home range due to erection of electric fences.

Conclusions
The Asian elephant in Sri Lanka has much smaller home ranges compared to elephants in South India. They show a high fidelity to their home range and do not engage in long range migrations. The ranging behavior seems to be influenced by availability of habitat. The preferred habitat of elephants is found to

be scrub and grassland. Shifting cultivation creates such habitats and therefore abandoned chenas function as critical dry season foraging grounds of elephants. The findings indicate that most of the management practices employed today are not based on sound science and is likely to mitigate the human elephant conflict or ensure long term conservation of Asian elephant in Sri Lanka.

Acknowledgements

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Front cover depicts a stylized version of the '*Sandakadapahana*' or moonstone, an essential element of ancient Sri Lankan architecture. The moonstone is a form of stone sculpture unique to Sri Lanka. It was placed at the foot of steps leading to important royal and religious buildings. The level and intricacy of decoration on this half-moon shaped step depended on the era and the kingdom. The moonstone, archeologists say, symbolizes the endless cycle of birth and death and the path to nirvana.

Back cover carries an image of the elephant stone carving found at the entrance to the Temple of the Tooth in Kandy, Sri Lanka's last capital before the British colonized the entire country in 1815. Sri Lankans believe that a tooth relic of Lord Buddha is enshrined in the 400-year old temple, which has preserved its medieval rituals and carried them on even today. The temple is best known for the colourful pageant it holds during the full moon of August, where hundreds of heavily caparisoned elephants parade in the narrow streets of Kandy. The tooth relic is carried by an especially trained tusker.