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Activity time budget of Asian elephants in Northwest India: A case study from Rajaji National Park, India

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ABSTRACT

The study was undertaken to understand the activity time budget of Asian elephants in Rajaji National Park, Northwest India. A total of three elephants were selected from an identified group (one adult female, one subadult female and one juvenile). Besides, a solitary adult male elephant was also identified separately for observing the activities. Activities were classified into three broader heads i.e. feeding, movement and associated other behavioural activities. Literature reveals that the budgeting of different activities within a specified period of time provides an opportunity to analyse their strategies of behavioural patterns which can also help in the management of the species. This type of field study is of paramount importance and it's outcomes being significant can be incorporated into management plans.

Key words: Activity time budget, Asian elephants, behavior, Rajaji National Park

INTRODUCTION

Large-range movements in wild animals help them adjust to immediate changes in the environments and develop the ability to maintain population continuity for gene flow. It also influences plant community dynamics through seed dispersal and thus shape the biodiversity. Animal movement is a core component of an ecosystem and maintaining movement patterns may be vital for sustaining ecosystem processes like trophic and species interactions (Lundberg and Moberg, 2003; Massol et al., 2011). The Asian elephants (*Elephas maximus*) in India were once known to migrate from the river Yamuna (in the north) to the Brahmaputra (in the east), travelling a distance of approximately 1,300 kilometers across the foothills of the Himalayas (Singh and Sharma, 2001). Though, movement of species across new grounds results in competition for space and resources and sometimes human-animal conflict also, it provides scope of addressing the edge effects and habitat fragmentation. The field of movement ecology has grown rapidly in the last decade and is now providing the knowledge needed to incorporate movements of species into management planning (Allen and Singh, 2016).

Information on activity time budget of animals helps in the analysis of their foraging and survival strategies, which vary according to the habitat, temperature and rainfall (Vinod and Cheeran, 1997). Elephant activity budget can be defined as "different activities an elephant is involved in or exposed to in a given unit of time" (McKay, 1973; Ahamed, 2015; Booth and Doble, 2022). Rees (2009) reported that activity budgets in eight Asian elephants exhibited variation in activity depending on their age, sex, the time of day and the time of year. This study was done to understand the activity time budget of Asian elephants in Rajaji National Park, Northwest India. The Rajaji National Park is located in Northwest India at 29°51'-30°15'N,

77°52'-78°22' E (elevation 302-1000 m). It falls within the Gangetic plains biogeographic zone (Rodgers et al., 2002) and is dominated by northern tropical moist and drydeciduous forest. Although sal forest occupies a major portion of the park, northern tropical moist deciduous forest, sub-tropical pine forest, tropical dry-deciduous forest, riverine forest and low alluvial Savannah woodland also enrich park's floral diversity.

The dominant vegetation of the study area consists of *Shorea robusta* Gaertner f. (Sal), *Mallotus philippensis* (Lam.) Mull. Arg. (Kamala), *Acacia catechu* (L.f.) Willd. (Cutch), *Haldina cordifolia* (Roxb.) Ridsdale (Kadam), *Terminalia bellirica* (Gaertn.) Roxb. (Bahera), *Ficus benghalensis* L. (Indian Banyan) and *Dalbergia sissoo* Roxb. ex DC (Indian Rosewood). Besides, the elephant as the flagship species, the dominant mammalian fauna of the park consists of *P. tigris* (tiger), *P. pardus* (leopard), *Ursus thibetanus* (Himalayan black bear), *Melursus ursinus* (sloth bear), *Hyaena hyaena* (hyaena), *Muntiacus muntjak* (barking deer), *Naemorhedus goral* (goral), *Axis axis* (spotted deer), *Rusa unicolor* (sambar) and *Sus scrofa* (wild boar).

MATERIALS AND METHODS

Different activities of the elephants were observed over a period of one year, considering nine hours of the day (between 06.00 hr and 18.00 hr) in three seasons, summer (March to June), monsoon (July to September) and winter (October to February). Activities were classified into three broader heads i.e. feeding, movement and associated other behavioural activities (Fig. 1-6). Each day was divided into four time blocks: early morning (06.00-09.00 hrs), midday/afternoon (12.00-15.00 hrs) and evening (15.00-18.00 hrs).

A total of three elephants were selected from an identified group (one adult female, one subadult female and one juvenile). Besides, a solitary adult male elephant was also identified separately for observing the activities. A total of 2,160 hours (12×15 days/month × 12) were spent in observing the animal and analyzing the activity budget (with 7200 scan samples; 40 per day). An ethogram was developed identifying different behaviours (Whilde and Marples, 2011; Ahamed, 2015; Booth and Doble, 2022) based on the study (Table 1).

Table 1. Ethogram of Asian elephant under the study

Sl.No.	Behaviour	Definition
1	Walking	Movement from one area to another
2	Resting	Animal is stationary, not performing any other behaviour
3	Drinking	Elephant takes water through trunk, passes water into its mouth
4	Bathing	Immersed in water
5	Feeding	Elephant uses trunk to pick up food, puts food in mouth
6	Playing	trunk wrestling, head-to-head sparring, mounting and rolling on one another
7	Excretion	Urination or defecation
8	Dusting	Elephant takes mud/ loose earth in its trunk, sprays it on its body
9	Standing	Elephant standing on its feet, not moving
10	Flapping the ears	To and fro movement of ears
11	Exploring	Elephant investigates any objects using its trunk in its environment
12	Tail swiveling	The tail goes stiff and normally held out to one side

Fig. 1. A tusker bathing at a waterhole at Chillawali forest

Fig. 2. A male elephant spraying mud over its body

Fig. 3. A female elephant breaking a twig of a juvenile tree with its forefoot to feed

Fig. 4. Two female elephants trying to climb up a high hillock, keeping the baby in the middle

Fig. 5. Tactile communication: Two female elephants while communicating with each other

Fig. 6. A bull elephant during charge

RESULTS AND DISCUSSION

For matriarchal group of elephants, feeding activity during the winter accounted highest (7.40 hours), followed by the monsoon (6.45 hours) and summer (6.15 hours). In contrast, movement activity accounted maximum during the summer (1.25 hours), followed by the monsoon (0.50 hours) and winter (0.35 hours). Associated other behavioural activities, which include resting, drinking, bathing, interacting with each other, nursing calves and play, defecation, dusting, standing and flapping the ears, exploring, tail swiveling and greetings accounted highest during monsoon (1.25 hours), followed by summer (1.20 hours) and winter (0.45 hours). It is worth mention that the movement activity depends on the availability of resources in the given area. For adult male elephant, feeding activity accounted highest for winter (6.45 hours), followed by monsoon (6.10 hours) and summer (5.15 hours). Similarly, movement activity with respect to male elephant was recorded highest during summer (1.25 hours), followed by monsoon and winter, respectively (1.15 hours). Associated other behavioural activities were recorded highest during summer (2.20 hours), followed by monsoon (1.35 hours) and winter (1.0 hours), respectively. Activities of matriarchal group of elephants and solitary adult male elephant in different seasons along with duration of activity are depicted in Table 2 and Fig. 7.

Table 2. Activities of matriarchal group of elephants and solitary adult male elephant in different seasons along with duration of activity

Season	Activities					
	Feeding		Movement		Associated behavioural activities	
	Matriarchal group	Male elephant	Matriarchal group	Male elephant	Matriarchal group	Male elephant
Summer	06:15	05:15	01:25	01:25	01:20	02:20
Monsoon	06:45	06:10	00:50	01:15	01:25	01:35
Winter	07:40	06:45	00:35	01:15	00:45	01:00
Total	20:00	18:10	02:50	03:55	03:30	04:55

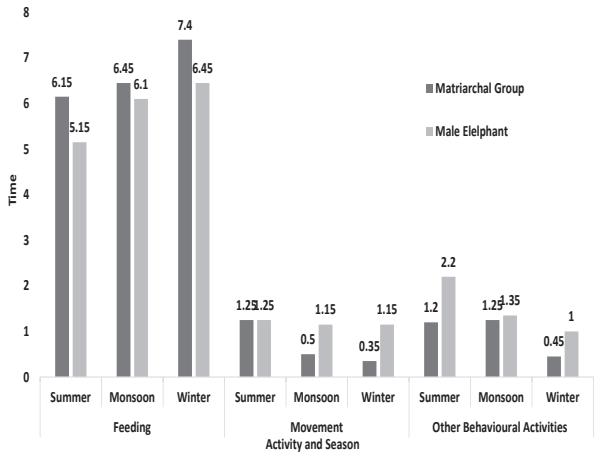

Fig. 7. Duration of the activities in different seasons as observed in the identified individuals of matriarchal group and solitary adult male elephant

Vinod and Cheeran (1997) found that Asian elephants in Idukki WLS spent 65% of their time feeding in dry season, while it accounted for 80% in wet season. The study revealed that elephants spent more time on feeding during wet season. However, grazing was found to be predominant in both dry season 63% and in wet season 71%. The amount of time that an animal or group of animals spends in any particular activity indicates a trend of the time budget, which varies from day to day. Generally, elephants became more active before dawn and start their morning activities in the vicinity of the area where they spent night. During the summer, feeding activity was observed maximum during the morning and evening hours, however, during the mid-day, members of the group and bull elephants prefer to take rest in available cooler areas under

the large trees and begin their activities in the evening, which were quite similar to the morning activities. However, in winter, feeding activity is almost constant throughout the day and elephants consume less time in resting activities. In summer, movement activity was recorded maximum as natural water sources dry during the period and elephants also move along the riparian corridor to feed on succulent forage like bark of teak wood, kut-sagaun and Indian rosewood. During the monsoon, the movement and feeding activities slightly fluctuates, especially among the groups because of availability of rainwater reservoirs in shorter distances. Similarly, as there is less requirement of water during winter,movement activity was observed less. Resting follows the standing of elephants in any cool shaded areas under trees like *Ficus bengalensis, Adina cordifolia and Butea monosperma*. However, during the winter, elephants prefer to stand and feed in open areas. Early morning and evening hours were the times to drink and bathe especially during summer.

Conflict between humans and elephants most often arises in areas adjacent to elephant habitats, particularly where people cultivate crops. Apart from fragmentation, sometimes the lack of water or food inside the forests also forces the elephants to move to the outskirts of the forest. Literature reveals that the budgeting of different activities within a specified period of time provides an opportunity to analyse their strategies of behavioural patterns which can also help in the management of the species. It is imperative that field studies are conducted extensively so that the outcomes are incorporated into the management plans.

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