# Chapter 3
# Habitat Requirements of the Elephant



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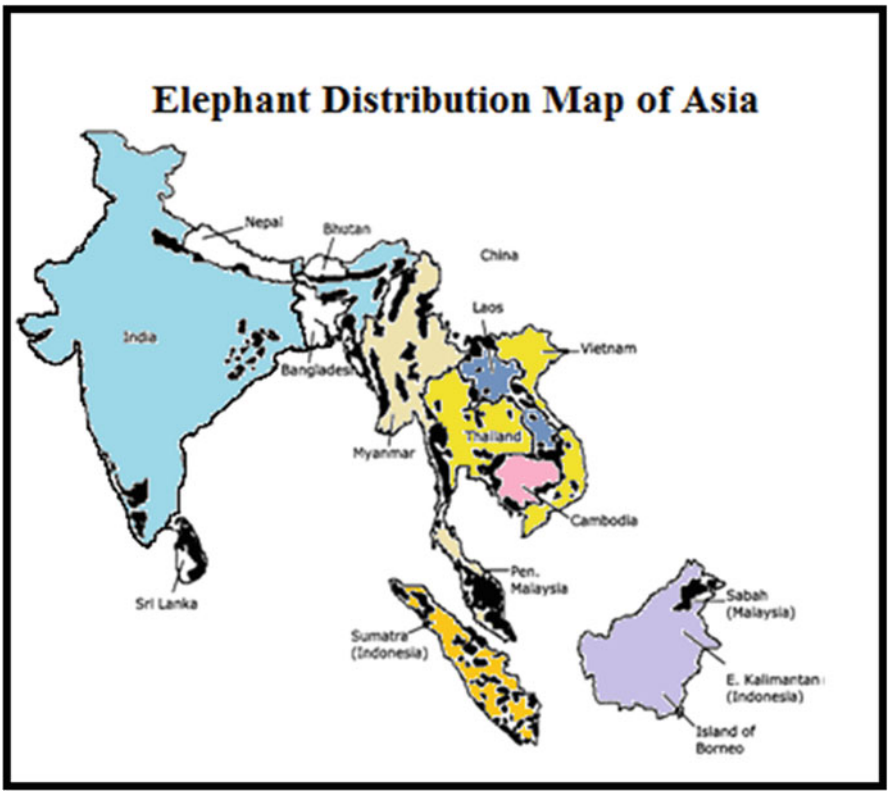
**Abstract** This chapter is based on the behavioural analysis of the elephant. Elephants are biologically not a seasonal migratory species. But in this case the movement of the elephants is found to be seasonal and repetitive. Each year they used to move from their original habitat (Dalma) to the destination habitat (Panchet Forest Division). They stayed a certain period in the destination area and after that returned back to their original habitat. One of the main objectives of this research work is to trace the reasons for such atypical behaviour. To do so, it is necessary to identify the home range of elephants. A detailed review work was done to characterise the home range of elephants over varied landscapes in the Indian subcontinent and in the study area. Not only have forest statistics been used to reveal the facts of migration, but field enquiry has also been required to identify the exact cause. The nature of food habits, nutritional requirements and changing food habits in the newly invented habitat are elucidated through empirical survey. The character of shelter is delineated by examining the forest cover, vegetation succession, ground coverage, distance from water source, road, noise and so on. These factors are responsible for both the fragmentation of the natural forest habitat and the movement of elephants within the forest patches.

**Keywords** Home range character • Food habit • Changing food habit • Ecological sampling

## 3.1 Introduction

Elephants can adjust themselves within a broad array of habitats. Throughout India their habitat extends from mountains to plains through plateau areas. They are found to reside in the natural forest cover areas as well as in fragmented patchy or plantation areas. Their home range area varies from 105–155 to 650 $km^2$ based on the availability of fodder, water and shelter and the number of elephants present in the herd. A herd of 100 elephants would require a minimum area of about 650 $km^2$.




**Map 3.1** Elephant distribution map of South East Asia

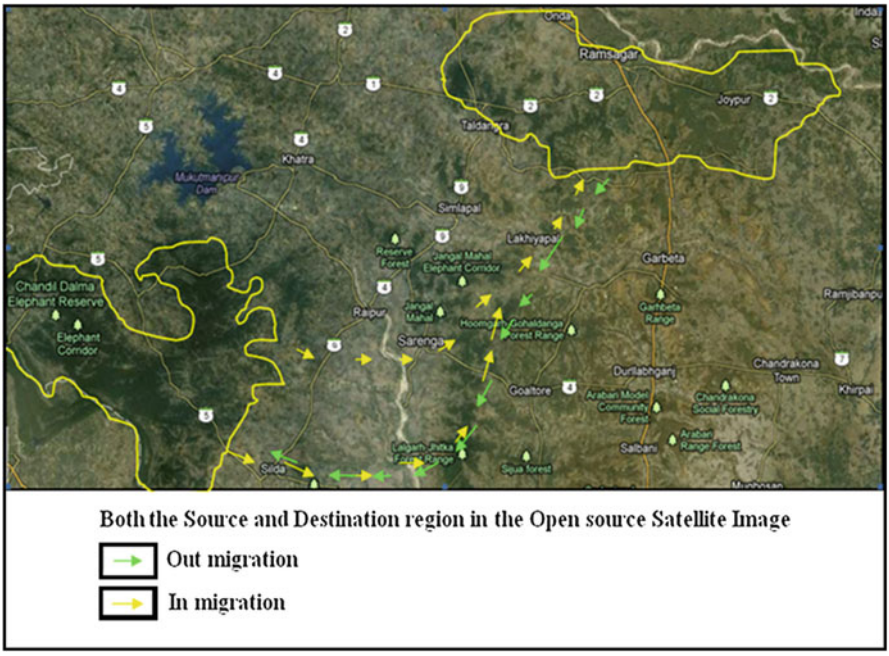
## 3.2 Home Range of Elephants

Elephants naturally prefer more virgin habitats, but they can also be found in a series of small, isolated populations within a highly fragmented landscape. The migrated elephants in the study area exhibit the same behaviour as did a subpopulation of about 50 elephants that had been largely confined to the Dalma sanctuary and its environs and began to make deep forays eastward into southern West Bengal in 1987. Hemant Datye and A. M. Bhagwat followed the course of some of these elephants and found that these elephants cover a home range of nearly 3400–3850 $km^2$ each year. The entire region between Dalma to southern West Bengal is

predominantly covered by agricultural lands. These elephants are still expanding their range to the Paschim Medinipur, Bankura and Purulia districts. In the Bankura district, where the study area is situated, an increasingly large number of areas have been explored by these migrated elephants.

## 3.3 Habitat Analysis

From the West Bengal Forest Department Report and information collected from the Dalma Wildlife Sanctuary, it is evident that elephant migration has become a regular event in Panchet Forest Division (PFD). Each year elephants extend their forage area in PFD. The landscape ecology of the new habitat (PFD) is more fragmented in nature than their original habitat in Dalma. Thus, it is necessary to assess the habitat character of PFD.




**Map 3.2** Elephant migration route from Dalma Wildlife Sanctuary to Panchet Forest Division on open source image

### *3.3.1 Food, Nutrition and Changing Food Habits*

Elephants spend about 70 % of their time foraging although the amount of time varies seasonally. Their food choices range from grass, bamboo, tree, bark, paddy, fruits and any kind of palatable vegetation. They usually consume 150 kg of wet food per day. Elephants are known to spend between 17–19 h/day feeding on more than 100 species of plants. They eat most of the food crops usually grown adjacent to their forage ground, consuming, for example, paddy, millet, binger millet, sugarcane, wheat, palms and bamboo. Feeding occurs at different levels.

#### 3.3.1.1 Branches of Trees, Shrubs and Grasses

The range of fodder, however, varies with the locality and the season. They eat many kinds of grasses, including *Saccharum spontaneum, Ischaemum pilosum,* species of *panicum, sorghum* and *Themeda, Apluda mutica, arundinnella halocoides, eragrostis gangetica, hackeloch granulavis* and *paspalum scrobiculatum* (Daniel 1998).

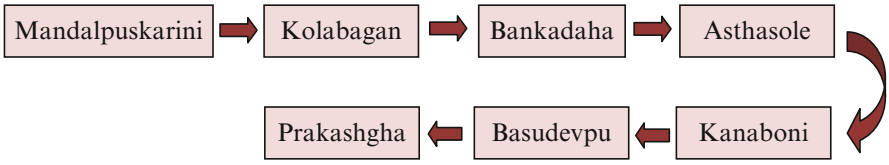
They are entirely vegetarian and have been found to eat hard stems and twigs, but the bulk of their food consists of foliage and soft plant parts or succulent herbs. Bamboo (*Bambusa and Dendrocalamus*), ochlandra, sugarcane and standing crops in the fields are among other types of grasses preferred by elephants. Succulents like pandanus spp. and *Ardisia solanacea* are preferred as these provide a source of water (Daniel et al. 2008). The bark of certain trees, such as *Kydia calycina, Grewia tiliaefolia* and teak trees, is stripped and eaten. They prefer sapling bark rather than dry bark. Many shrubs and small trees are eaten, foliage and twigs together. Species such as *Helicteres isora, Grewia aspera*, *Hibiscus lampas*, *Acacia concinna*, *A. intsia*, *A. ferruginea*, *A. catechu*, *Cordia myxa*, *Zizyphus xylopyrun* and *Phoenix humilis* are the preferred species of elephants. Other species whose foliage elephants regularly eat include *Terminalia tomentosa*, *Premna tomentosa*, *Buchanania latifolia* and *Bauhinia racemosa*. Even the aerial roots of the banyan are broken off at the level of the elephant's reach.

A variety of forest fruits are eaten, for example, *Aegle marmelos*, *Artrocarpus integrafolia*, figs of various types, *Acacia hirsuta*, *Careya arborea*, *Cordial myxa* and *Feronia elephantum*. In addition, typical natural crop raiding is found all over the elephant habitats in India. It may be caused by the conversion of natural forest to monoculture plantation, a switch that usually lowers forage availability and compels elephants to raid crops in the forest margin agricultural lands. Another habit of elephants in the tropical moist forest region is their marked preference for secondary growth habitats over a primary forest habitat (Sukumar 2003). A secondarily grown habitat of bamboo, grass and weedy plants attracts elephants. In the study area, much barren soil has been turned green through social forestry programmes. Coppice sal (*Shorea robusta*), akashmoni (*Acacia auriculiformis*) and eucalyptus

species plantations have changed the existing floral diversity. There are no grasslands or major food and fodder sources to meet the high food demands of migrated elephants. Hence, elephants have to search for fodder for their own caloric demands. As a result, they encroach outside the forest in the settled areas and agricultural fields, raiding crops. It has become a routine event in the Panchet Forest areas. Paddy is a favourite target. Dalma elephants started to migrate towards southern West Bengal when the paddy started to mature in the Panchet region. The movement pattern and raiding during the crop season thus reflect their foraging needs. Usually, elephants raid cultivated crops almost exclusively at night. During daytime they confine themselves in the natural forest habitat and start raiding at night. So they have good knowledge of the location of crop fields. It has also been observed that as a landscape becomes more fragmented and its ratio of the perimeter of the forest cultivation boundary to forest area increases, the frequency of raiding by elephants also increases (Sukumar 2003). The patch analysis reflects the fragmented nature of forest here in the Panchet area, which increases the probability of crop raiding. A variety of vegetables including potato, tomato, carrot, spinach and pumpkin and fruits like mango, banana, and jackfruit are consumed. It is very interesting to note that elephants in the study area changed their food habit from agricultural crops (paddy and wheat) into juicy and palatable horticultural crops like cucurbits, cabbage and cauliflower, potato, brinjal, colocasia (Ketsu) and tender jackfruit (Kulandeival 2010). As a result of these changing food habits, farmers in the affected area greatly suffer because most of the crops and vegetables are commercial crops and are very vital to the local villagers' economy.

### *3.3.2 Shelter*

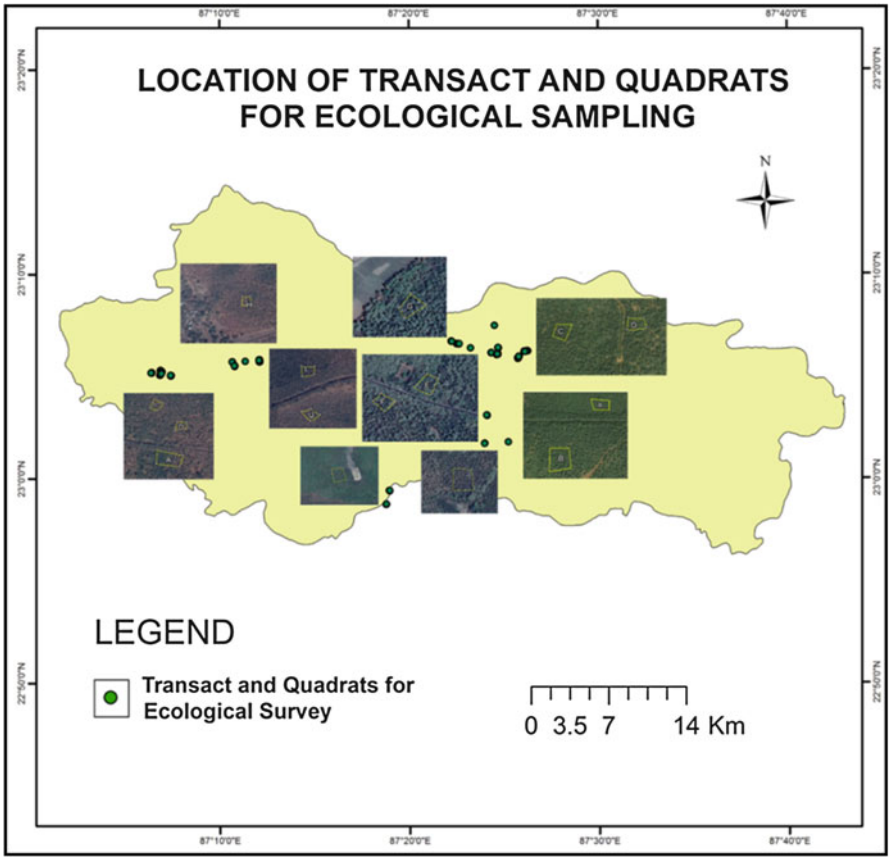
Migratory elephants start roaming within the fragmented forest patches after entering into Panchet from Dalma and they stay throughout the harvesting season. Movement statistics taken from different beat offices show that after entering their destination forest, they usually get separated into small groups and roam from one forest patch to another. They usually stay 7–13 days in a forest patch and then move to other places within the study area. Their movement is generally confined to



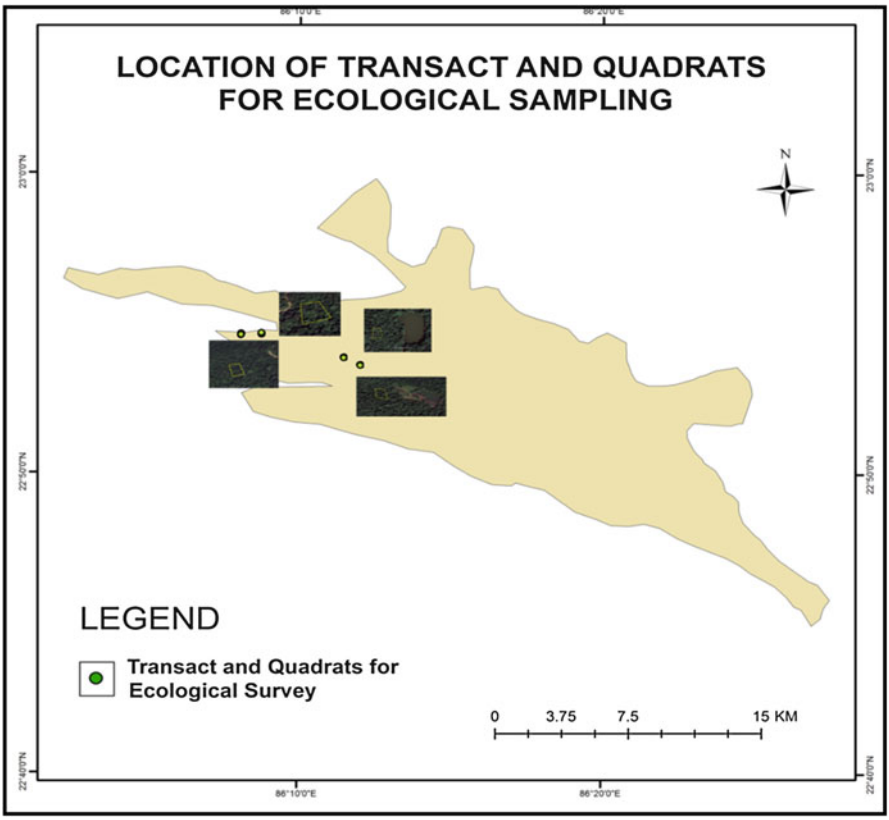

Temporal observation on the movement of these elephants revealed that the elephants are moving very frequently in new areas in search of food. During this movement they take shelter in the forest patches during the day and raid crops and

agricultural lands at night. To assess the nature of shelter preferred by elephants, we evaluated the habitat quality of different forest patches. For this purpose several transects and quadrats were randomly selected (a total of 44 transects and quadrats) in each of the forest beats.

Information was collected on the composition of species, density of the patch, average height, diversity of species, abundance of species, microclimatic condition, ground and canopy cover and so on. Additionally, we conducted prescheduled questionnaire-based surveys in randomly selected households in affected villages. Through this questionnaire survey, we tried to identify the causes underlying elephants' shelter preference. The availability of water, that of food and the peacefulness of the area are three main criteria primarily considered by elephants in choosing shelter.




**Map 3.3** Sample sites for ecological surveying at Panchet Forest Division




**Map 3.4** Sample sites for ecological surveying at Dalma Wildlife Survey

### 3.3.2.1 Forest Cover, Vegetation Succession and Movement of Elephant

The ecological analysis of habitat showed that patches distributed in Bankadaha, Joypur, Machantala, Basudevpur and Peardoba are highly preferred by elephants. The quadrats and transacts for ecological survey were selected on the basis of species association, density, degree of ground cover, intensity of canopy cover and layering in forests.

We applied the transect and quadrat method to the foothill, mid-hill and upper part of Dalma Hill of Dalma Forest area. Though the result of ecological analysis revealed that , Dalma Wildlife Sanctuary is superior in terms of species richness and diversity than the PFD areas, the disturbances in the former habitat have pushed the elephants to leave their original place. Regular mining and quarrying activities blast dynamite, which hampers the natural environment (Figs. 3.1, 3.2, 3.3, 3.4 and 3.5).

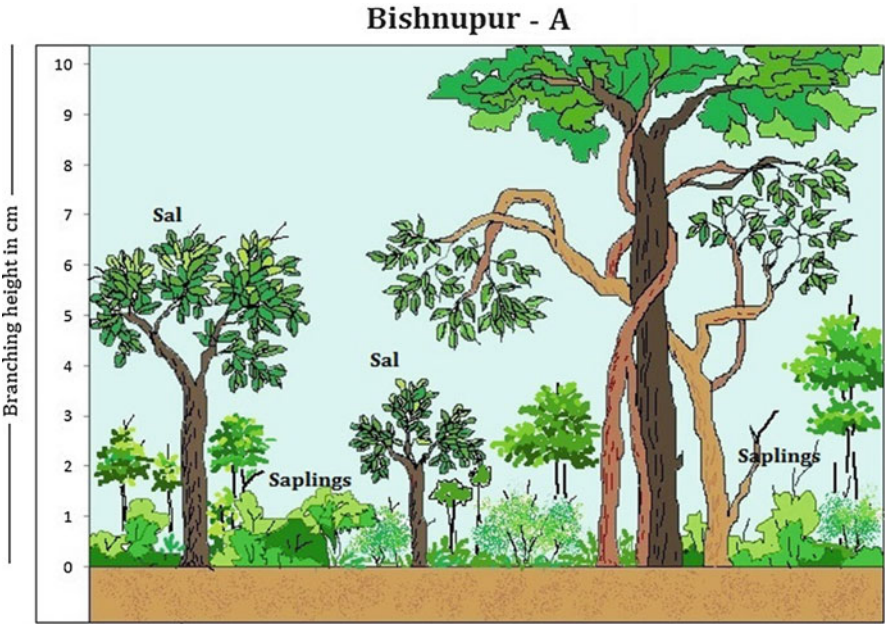



**Fig. 3.1** Ecological survey at Bishnupur—transect A

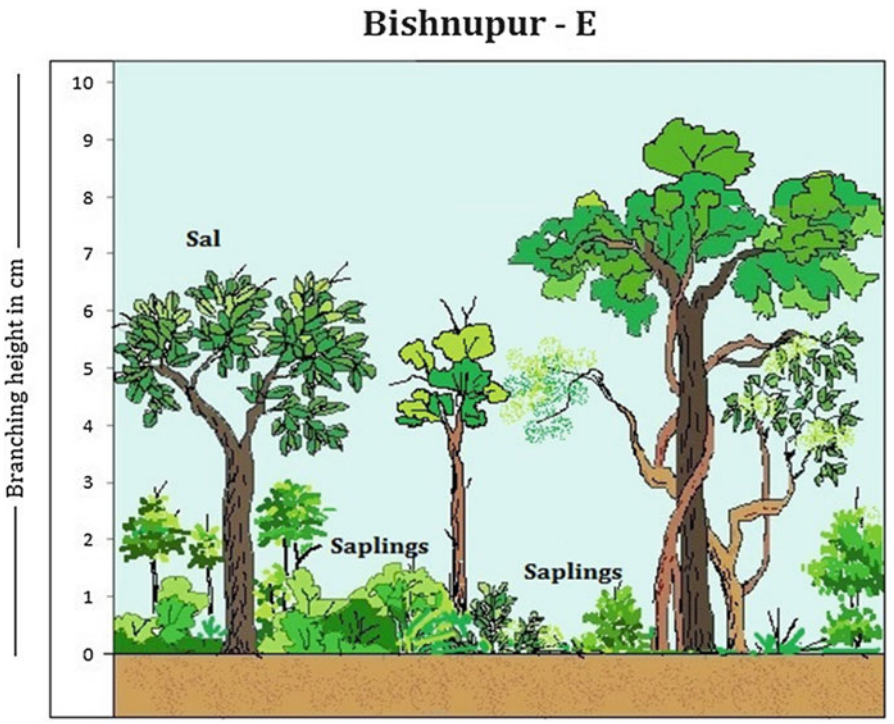



**Fig. 3.2** Ecological survey at Bishnupur—transect E

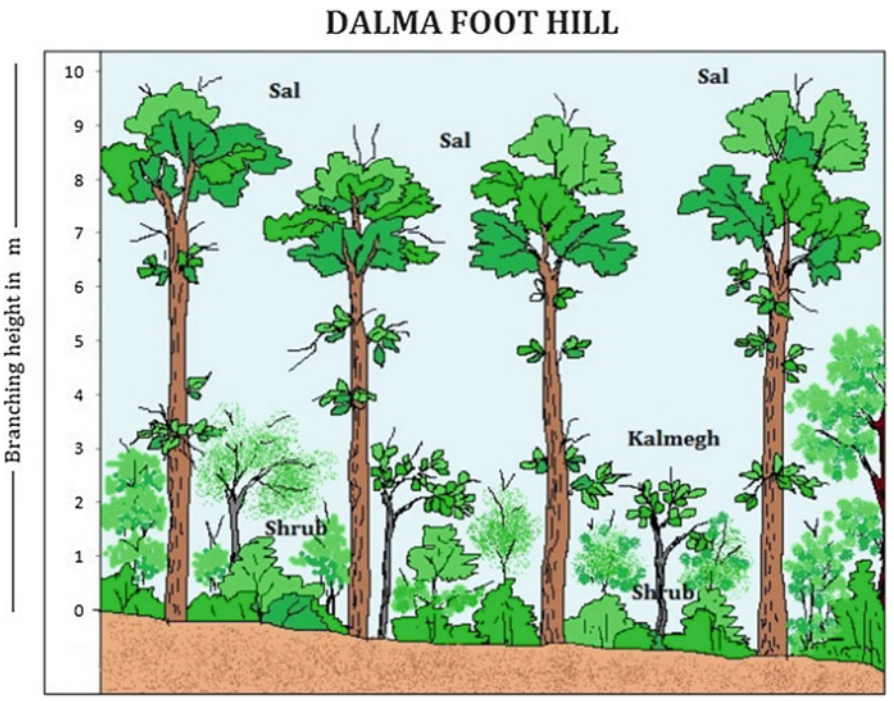



**Fig. 3.3** Ecological survey at Dalma—foothill

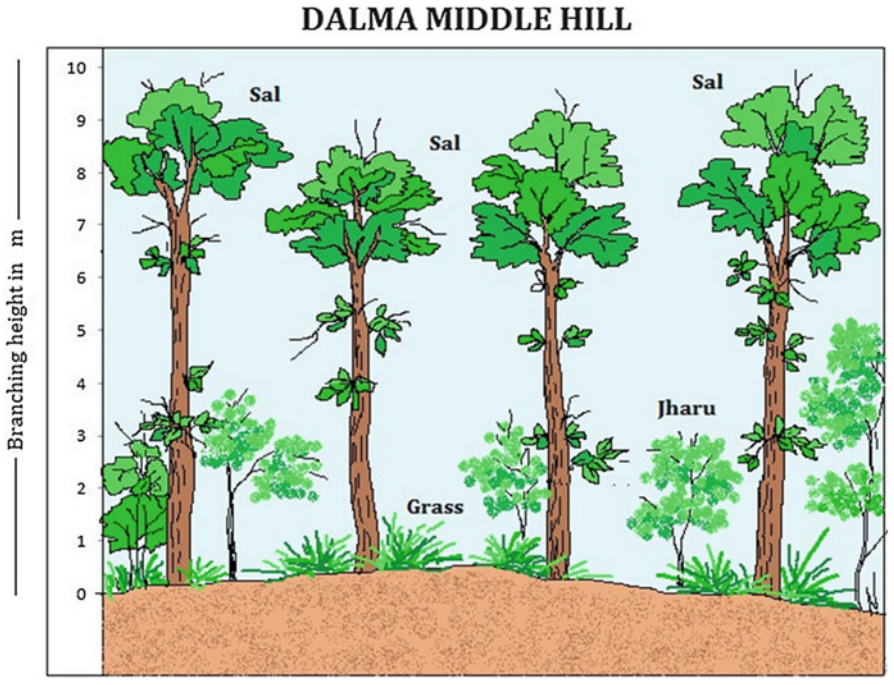



**Fig. 3.4** Ecological survey at Dalma—middle hill

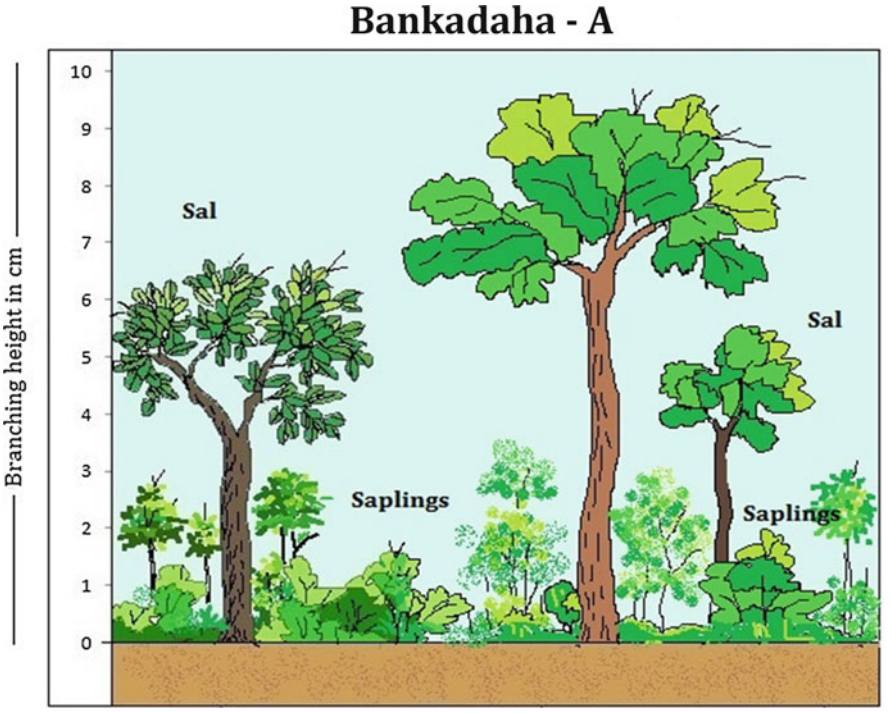



**Fig. 3.5** Ecological survey at Bankadaha—transect A

**Plate 3.1** Ecological surveying at Adkhatha forest range

### 3.3.2.2 Ground Cover

Elephants in the Panchet area prefer the patches with ground cover on more than 80 % of the total patch area. For example, Basudebpur Forest area near Bishnupur is preferred by elephants for this reason. Transect profile and quadrat information shows that the patch is characterised by climbers of different types. This huge association of species make the forest difficult to penetrate for villagers. So it is undisturbed in nature.

### 3.3.2.3 Nearness to Agricultural Land

The entire elephant habitat in PFD is surrounded by agricultural lands. These agricultural lands are either single- or double-cropped. Paddy, wheat, sugarcane, corn, fruit crops and different types of vegetables are grown in these agricultural fields. The regenerated forests in the study area make a corridor for elephant movement, but it cannot satisfy their large demand for food. So the elephants raid crops and vegetables. It has become a regular phenomenon. There is a positive relation between elephant resting ground and distance from agricultural land. The following ergograph shows the relationship between rainfall temperature and crop calendar of the PFD. It depicts that there are three main seasons: summer crop, monsoon crop and winter crop. In some cases it has been observed that they follow the maturity season of specific agricultural crops, especially paddy and vegetables. The interesting fact is that they have a 'mental map' of the location of agricultural fields from which they will get their food. Information on 'duration of stay' in different forest beats was collected from forest beat offices. After plotting the information, we obtained a comprehensive picture of the elephant movement behaviour in the study area. We also observed that they extended their habitat into the new areas in successive years.

Figures 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13 and 3.14.

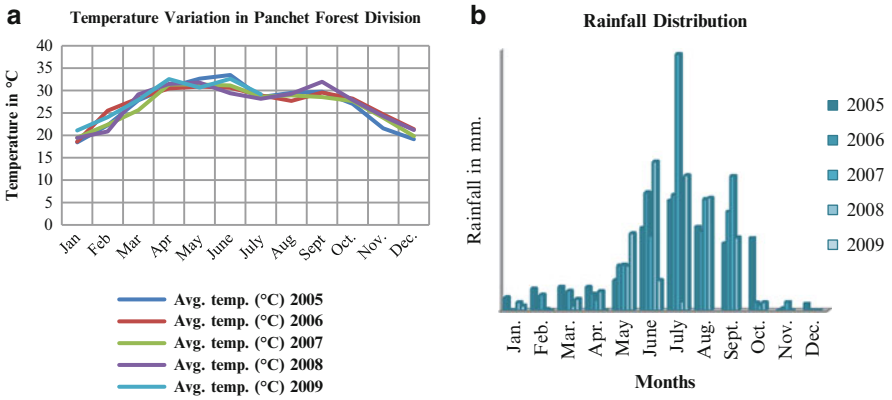



**Fig. 3.6** (**a**) Temperature variation in Panchet Forest Division (PFD). (**b**) Rainfall distribution in PFD

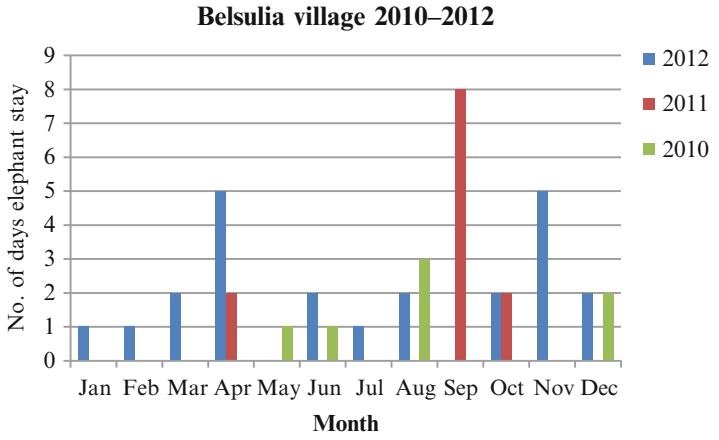



**Fig. 3.7** Duration of elephant stay at different stations in Belsulia village

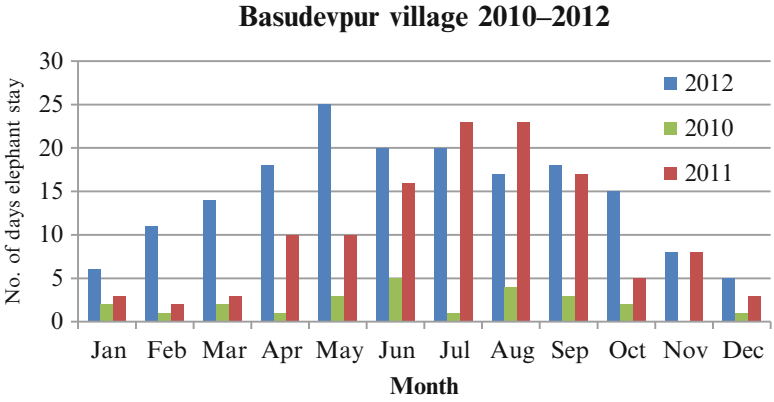



**Fig. 3.8** Duration of elephant stay at different stations in Basudevpur village

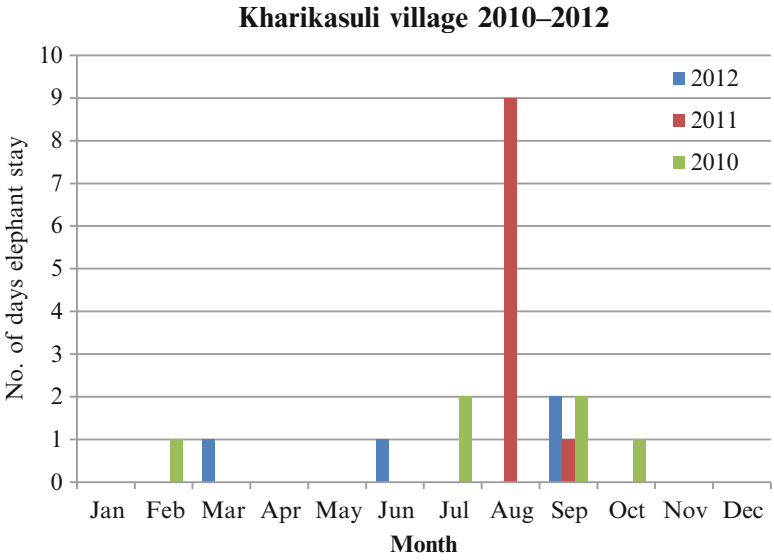



**Fig. 3.9** Duration of elephant stay at different stations in Kharikasuli village

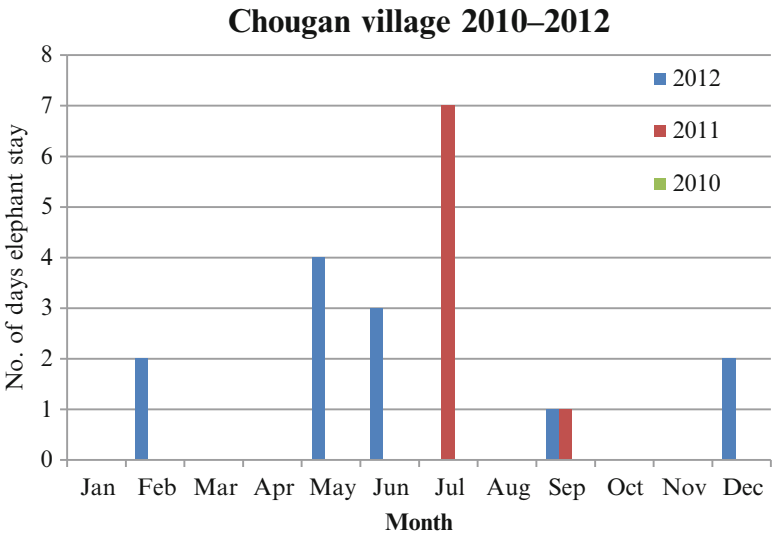



**Fig. 3.10** Duration of elephant stay at different stations in Chougan village

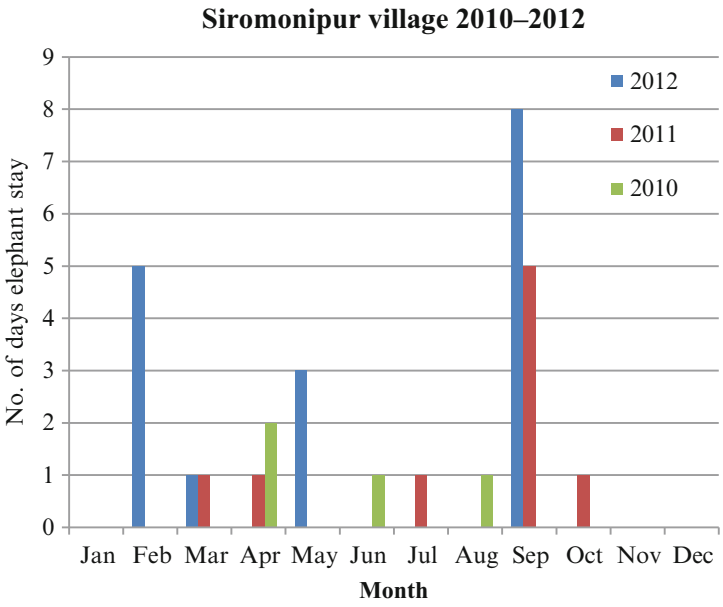



**Fig. 3.11** Duration of elephant stay at different stations in Siromonipur village

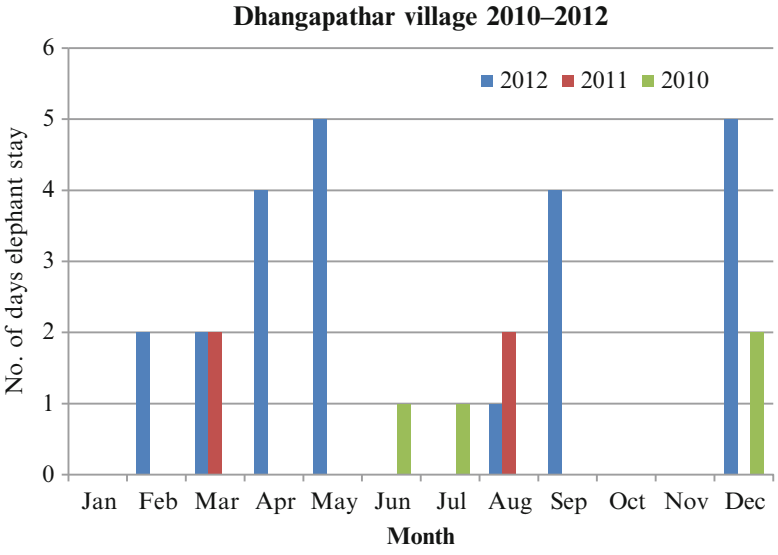



**Fig. 3.12** Duration of elephant stay at different stations in Dhangapathar village

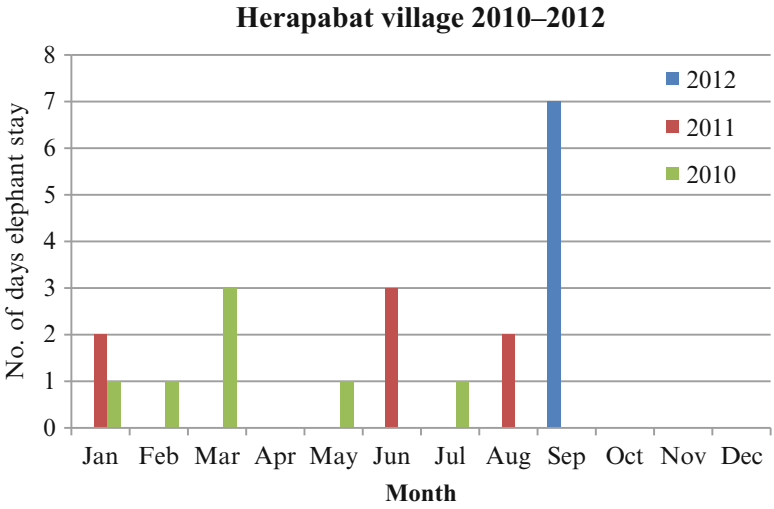



**Fig. 3.13** Duration of elephant stay at different stations in Herapabat village

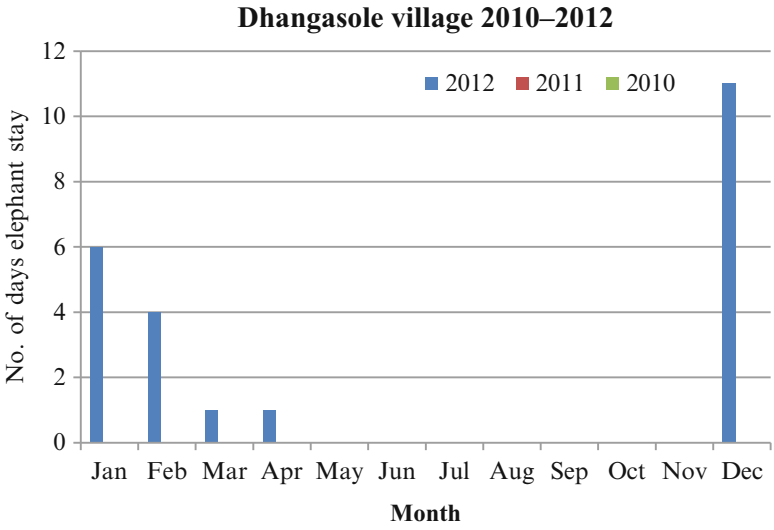



**Fig. 3.14** Duration of elephant stay at different stations in Dhangasole village

**Plate 3.2** Elephant venturing the crop field

**Plate 3.3** Agricultural fields on the vicinity of forest

#### 3.3.2.4 Distance from Road or Noise Source

While analysing the preference for resting ground, we found that elephants prefer a calm and noise-free environment; therefore, their resting grounds are usually located at a distance from a road or noise source. But in the human-modified fragmented forest patches, it is not possible to maintain a distance from settlement. Some of the roads and canals pass through the forest area, which interrupts the free movement of elephants. They face accidents or are injured while crossing the roads within the forest.

**Plate 3.4** Elephant are crossing motorable road

**Plate 3.5** Elephant are across railway track

### *3.3.3 Water Source*

Along with shelter and food, water is one of most important factors that regulate the movement of elephants. The main water sources are the Dwarakeswar River, Kangsabati Canal, Berai (tributary of Dwarakeswar), human-made ponds in the settled areas and potholes dug by the forest department within the forest. The agricultural fields near the Dwarakeswar River are regularly raided by elephants. Kangsabati Canal, which is the main source of irrigation, passes through the forest patches and is an important source of water for elephants. In addition, ponds near the forest fringe areas are also used as a source of water.

**Plate 3.6** Kangsabati canal, as source of water in PFD

**Plate 3.7** Elephant herd near Dwarakeswar River


**Plate 3.8** Metalled road through the forest