

Preface

Elephants are known as a ‘keystone species’ in an ecosystem. A keystone species is a species that has a very large effect on the community through both direct and indirect pathways (Pain 1966; Power et al. 1996). Being a mega herbivore, an elephant has a tremendous impact on the habitat through its feeding and other activities (Sukumar 2003). Habitat selection of the elephant depends on its behavioural characteristics and the ecological carrying capacity of the habitat it inhabits. The unprecedented growth of the human population is responsible for the degradation and decline of the forest cover. It has been decimated from 40% (a century ago) to 19% in 1997 (MoEF). Anthropogenic perturbation in the form of agricultural and settlement expansion results in depletion or loss of natural habitat, loss of biodiversity, fragmentation of habitat and loss of corridors. The disproportionate sharing of forest resources and shrinkage of the sojourn area creates a food scarcity for the elephant, which ultimately forces animals to change their original habitat and migrate to a new one. During this migration, human–elephant conflict is a common issue in the corridors and edges in between habitats.

Human–elephant conflict is recognized as one of the main threats for survival of Asian elephants (Choudhury et al. 2008). Habitat destruction, human encroachment in the elephant habitat, fragmentation of natural habitat due to a rise in population pressure, settlement expansion and developmental activities within or near the forest areas ultimately squeeze the animals into narrower areas of remaining habitats. In most cases, these remnants of habitats are surrounded by crops or agricultural fields that elephants like to feed upon. As a result, elephants frequently raid and destroy crop fields (Living Planet Report 2006).

Human–elephant conflict has become a serious socioeconomic and political issue today. There were 900 human deaths from elephant attack in India from 1998 to 2001. Every year 250–300 people lose their life due to elephant attacks. This number increased to over 400 in 2010 (Baskaran et al. 2011). In 2011, 67 people were killed by wild elephants in West Bengal alone (State Forest Report 2011–2012). Elephants annually damage 0.8–1 million hectares of land in India (Bist 2002a) and affect at least 500,000 families (Gajah 2010). The marginal small landholders and individual cultivators suffer tremendously. Our religious beliefs, taboos,

and cultures in many cases prevent us from either protecting or harming them, but continuous suffering eventually changes the attitudes of local people, and the conflict increases in many villages on forest fringes.

Man–elephant conflicts do have ecological consequences too. Farmers are forced to change both their cultivation patterns and their selection of species for cultivation. Resistance efforts employed to prohibit elephants lead to unusually aggressive behaviour, which actually multiplies problems.

The selected study area, Panchet Forest Division (PFD) of Bankura district, West Bengal, has experienced human–elephant conflict since 1987. Herds of elephants from the Dalma Wildlife Sanctuary (DWS) of Jharkhand generally migrate eastward into the adjoining districts of Bankura, Purulia, and Midnapore in the state of West Bengal after the rainy season. The study area is largely covered by agricultural land along with moist and dry deciduous forests. Elephants utilise small patches of regenerated sal (*Shorea robusta*), a species selected for community development and conservation programmes (Gajah 2010), for shelter. This monoculture of sal is not a food source so the elephants raid crops found in the forest fringe agricultural lands as well as those along their migration route. As a result, man–elephant conflict has developed and has led to a huge loss to agricultural production, damage to property, human injury and even death.

A literature search revealed that man–elephant conflict not only led to socio-economic loss, but also had detrimental impacts on elephants. In order to understand this problem better, an in-depth description of the land use, land cover characteristics and landscape ecology is provided. One of the primary objectives of the research presented in this book is to assess the ecological deterioration in both the source region (DWS, Jharkhand) from which the elephants are forced to migrate and the destination region (PFD) that lures the elephants to immigrate. This study assesses habitat quality by evaluating the forest density, structural pattern, plant species composition and association. Emphasis has also been given to identifying the characteristics of the man–elephant conflict zone in terms of land use, cropping patterns, elephant migration trends, patterns of migration, suffering of local population due to elephant attacks, livelihood patterns of villagers and probable causes of elephant migration. Moreover, we also focus on community attitudes towards elephants, level of awareness of the locals and methods they have adopted to resist elephant crop-raiding. Particular importance is also given to the crop selection behaviour of elephants.

The content of this book is divided into eight chapters.

Chapter 1 provides detailed information regarding the distribution of elephants throughout Asia and the Indian subcontinent. It clearly depicts elephant habitat characteristics in different parts of India including the vegetation and climatic characteristics. The objectives and methodology of our study are described in this chapter.

Chapter 2 deals with the ecological biogeography of PFD and DWS. This chapter is important because it gives the background matrix of the study. The theory of ecological biogeography entails the relationship between animal species and their environment over space and time (de Candolle). For instance, eco-

logical biogeography analyses the type of environment where a specific plant is found. In this context 'environment' refers to the latitudinal factor or gradients, competition between species, geology of that area, climate, soil and so on (de Candolle 1820). The associations of plants depending on these factors are known as 'biomes', 'life zones' or 'ecoregions' (Wagner and Sydow 1888, cited in Cox and Moore, 1931). Similarly, the associations of both plants and animals within a specific environment are studied in ecophysiology. Both of these branches of study—ecological biogeography and ecophysiology—express the importance of environmental factors for the distribution of plants and animals. In this chapter we give a detailed ecological biogeography of both the source and destination regions of elephant migration.

Chapter 3 provides information on habitat requirements of elephants. Throughout India, elephant habitats represent diversified characteristics. In this chapter, we attempt to establish their habitat preference in terms of shelter, source of water or food, disturbed or undisturbed environments, seasonality of crop production and so forth.

Chapter 4 describes the migration and movement behaviour of elephants with the help of different models. We apply various statistical models, including regression, correlation, multivariate analysis, habitat suitability index and gap analysis models to understand the habitat–wildlife relationship.

In Chapter 6 we discuss various aspects of the local human population. Demographic characteristics such as density, composition, education level, economic status and occupation characteristics are considered because they are related to the man–elephant conflict issue.

Chapter 7 focuses on the behavioural study of migratory elephants and the changing behaviour of people in the affected area. We applied a perception survey technique that was supported by a pre-structured questionnaire to gauge people's attitudes towards elephants.

Chapter 8, the concluding chapter, is segregated into two parts: mitigation measures and various ways of managing human–elephant conflict. Mitigation measures adopted by the local people as well as by the forest department and those on the national level are examined. Finally, we propose some rational management measures that could be applied to address the issue of human–elephant conflict based on the major findings of this research work.

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