The Asian Elephants in Orissa, India

Population status, Conservation and Management of Asian elephants *(Elephas maximus)* in Elephant Reserves of Orissa, India

An Occasional Report of the Asian Nature Conservation Foundation (ANCF)

Produced with the support of the Orissa State Forest Department

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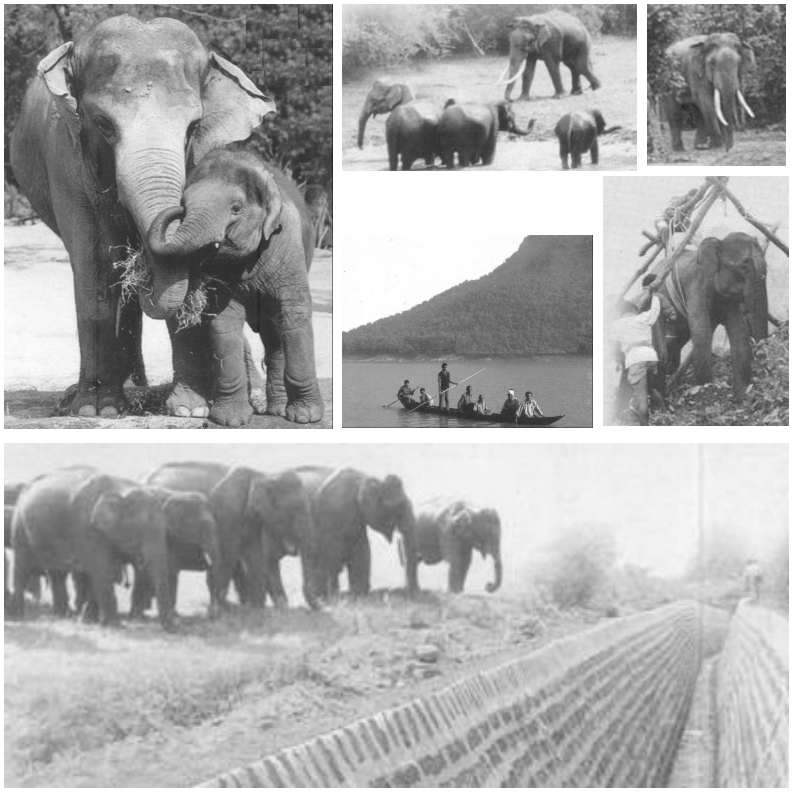

C K Sar, S Varma and R Sukumar

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Asian Nature Conservation Foundation (ANCF) is a non-profit public charitable trust set up to meet the need for an informed decision-making framework to stem the rapidly declining natural landscape and biological diversity of India and other countries of tropical Asia. The foundation undertakes activities independently as well as in partnership with government agencies, research institutions, conservation NGOs and individuals from India and abroad, in all matters relating to conservation of natural resources and biodiversity, endangered flora and fauna, wildlife habitats and environment including forests and wetlands. It participates and disseminates the procured information, knowledge and inferences in professional, academic and public forums.

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Thomas Mathew
Executive Director
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Introduction to the report

Elephants in Orissa constitute 74% of the total elephant numbers of the eastern region of India. This population is distributed within 30% of the state's geographical area. The elephant population in Orissa today faces serious conservation challenges which could be broadly classified into elephant related issues and habitat related issues. Reduction in elephant numbers, elephants under transit in certain regions (giving rise to haphazard movement across human dominated landscapes), human-elephant conflict, and elephant deaths due to poaching and retaliatory killing are some of the crucial elephant related conservation problems. As far as habitats are concerned, encroachment of habitat, impacts from mining activities, illicit felling, irrigation projects, roads and railway lines, industrial development, forest fire, growing cattle numbers (and their grazing in prime elephant habitats) are some of the crucial and visible habitat threats.

Project Elephant, launched by the Government of India in 1992 aims to conserve elephant populations, their habitat and biota contained within. It recognizes and tries to resolve some of these conservation problems. Through this scheme there is hope of minimizing these critical issues, which may ultimately help in maintenance of healthy and viable elephant populations in the wild. For this reason, the creation and maintenance of Elephant Reserves in Orissa is crucial. The Government of Orissa has declared three areas (Mahanadi, Sambalpur and Mayurbhanj) in the state as Elephant Reserves, and has proposed to extend the total area of two of these reserves further. It had also proposed to establish two new Elephant Reserves such as south Orissa and Baitarani. Survey of the viability of a South Orissa Elephant Reserve has to be determined and the possibility of linking Baitarani ER with Mayurbhanj has to be investigated.

Methodology and period of survey

The current survey was commissioned by the Orissa State Forest Department in 2004 and was executed by Asian Nature Conservation Foundation (ANCF), Bangalore, through its Asian Elephant Research and Conservation Centre. Forest divisions falling under each of the elephant reserves were surveyed and the reserves of Mahanadi, Sambalpur, South Orissa, and Baitarni were the focal reserves for the survey. Using a detailed survey sheet, interviews with forest officials, villagers, some of the stakeholders and members of NGOs were conducted. Ground surveys were carried out for specific investigations on the status of corridors, habitat and human-elephant conflict. The ground surveys, discussions with forest officials, field staff, villagers and the other stakeholders, in addition to records obtained from the Forest departments, Directorate of Census Operation, Directorate of Economics and Statistics, Govt. of Orissa, and other literature on elephants and their habitat provided useful insights for the survey. Information collected for compilation of this report covered the period 1999-2000 to 2003-04.

The major objective of the survey was to develop a comprehensive status report and perspective plan for each of the elephant reserves based on the guidelines provided by the Orissa State Forest Department. Insights from the perspective plans were the guiding forces for this specific report under the title of 'Population status, conservation and management of Asian elephants in Elephant Reserves of Orissa, India'. The report has five chapters: the first chapter gives a broad outline of the overall status of elephants in four out of five elephant reserves of Orissa. Chapters 2 to 5 provide detailed information

of the status of elephants in Mahanadi, South Orissa, Sambalpur, and Baitarni Elephant reserves.

The chapters on each reserve focus on introduction, location, history and the significance of the reserve for conservation. Geographical features such as terrain, geology, climate, land use pattern, river systems and other water sources are discussed. Under habitat status, the distribution of forests, vegetation types, density of forest cover, legal and management status, and the ownership of lands are presented. Elephant population, their numbers and trend, elephant distribution over forest ranges and season wise patterns, and status of elephant corridors are presented under overall elephant status section.

Basic details on conservation problems and issues such as encroachments, illicit felling, mining activity, irrigation projects, roads and railways, industrial establishments, tea and coffee cultivation, monoculture plantations, human population, cattle population and grazing, NTFP collection, forest fire and collection of bamboo are also dealt with. Reserve wise details of elephant deaths (natural, poaching, retaliatory killings, poisoning and electrocution) and human – elephant conflicts are also highlighted. Based on this background information, conservation priorities / recommendations that provide management targets for the next 10 years have been made for each reserve with specific conclusions. Literature referred to or available for each of the reserves is given under the reference section.

The report is the first of its kind, providing insights for the overall status of the very crucial elephant reserves of Orissa. However, the limited time available to undertake this investigation was a constraint. Consequently, it restricted the survey to only baseline information on the overall elephant distribution and individual elephant reserves in the state. It is expected that this effort will pave the way for detailed investigations on the status of elephants and their habitats in Orissa.

Chapter 1 Elephant Reserves of Orissa, India**:** Population status, conservation and management of Asian elephants (*Elephas maximus*)

INTRODUCTION

The wild elephant population in the eastern region (previously known as Central India – Sahi and Choudhury, 1985) was estimated to be 2,480 animals in 2001 and this constituted 9% of the total elephant population of India (Bist 2002). Elephants in Orissa constitute 74% of the eastern region elephant population. Elephant habitat in this region faces severe biotic pressure. If the conservation of elephants is to find broad support from local people living close to elephants and sharing their habitats, it is clear that the negative impact of elephants on humans has to be minimized. Considering the status and viability of elephant numbers, and impact of human population and settlements on elephant habitat there is a pressing need for developing effective conservation strategies for the species. Project Elephant (PE) launched by the Government of India recognizes and fulfills some of the conservation strategies. Through PE, there is a chance to minimize the negative impact of elephants on human lives (Chief Conservator of Forests, 1991). A consequent expectation would be a reduction in the risk of injuries or death to elephants, contributing to the maintenance of healthy, viable populations in the wild. For this reason the creation of Elephant Reserves (ER) in Orissa is crucial. The Government of Orissa has declared three Elephant Reserves and has proposed to extend two of these reserves further. It has also proposed to establish two new Elephant Reserves in the State.

LOCATION

Orissa is situated in the south-eastern region of India within 17º 47' to 22º 34' N latitude and 81º 22' to 87º 29' E longitude (*Census of India*, 1991). Situated in peninsular India at its northeast corner, it is bound by the Bay of Bengal in the east, Andhra Pradesh in the south and south-east, Chattisgarh in the west, Jharkhand in the north and West Bengal in the north-east. The four Elephant Reserves assigned for perspective plans are situated in the civil districts shown in Table 1.1

Table 1.1 Elephant Reserves in their civil districts

Elephant Reserve	District
1. South Orissa E R (proposed)	1. Kalahandi, 2. Phulbani, 3. Gajapati, 4. Rayagada
2. Baitarani E R (proposed)	1. Sundargarh, 2. Keonjhar, 3. Angul, 4. Dhenkanal
3. Sambalpur Elephant Reserve	1. Sundargarh, 2. Jharsuguda, 3. Sambalpur, 4. Deogarh
4. Mahanadi Elephant Reserve	1. Boudh, 2. Nayagarh, 3. Cuttack, 4. Angul, 5. Dhenkanal

AREA

Orissa State has a geographic area of 1,55,707 km^2, with a recorded forest cover of 57,184 km^2 (Principal Chief Conservator of Forests, 1981-1990), which constitutes 34 % of the total geographical area. The total land is divided into rural (98%) and urban (1.63% - 1991 census). The geographic area of this State constitutes 4.7% of the country's geographic area. Orissa is divided into 30 civil districts. Within these are situated 39 Territorial Forest Divisions (T), 11 Wildlife Divisions (WL) and one National Park called Similipal Tiger Reserve (STR). Total protected area comprises 10.12% of total forest area in the state (or 4% of the state's geographical area). There are 18 Wildlife Sanctuaries in the State, of which 10 have Asian elephants. The four Elephant Reserves cover 34,655.92 km^2 area of the State (Figure 1.1). Along with declared and proposed elephant reserves (total ER's) the total area

of the State coming under the Elephant Reserves would be 41,699.66 km^2 or approximately 25% of the state's geographical area.

GEOGRAPHY

Geo-morphologically Orissa is divided into five distinct regions: coastal plains; middle mountainous region; rolling uplands; river valleys; and subdued plateaus. Other classifications have brought the State under four physical regions: Northern Plateau (old districts of Mayurbhanj, Keonjhar and Sundargarh), Central Table Land (old districts of Bolangir, Dhenkanal and Sambalpur), Eastern Ghats (old districts of Koraput, Kalahandi and Phulbani) and the Coastal Plains (old districts of Cuttack, Puri, Ganjam and Balasore). Elephants are well established in the Northern Plateau, Central Table Land and parts of the Eastern Ghats (Bist 2002).

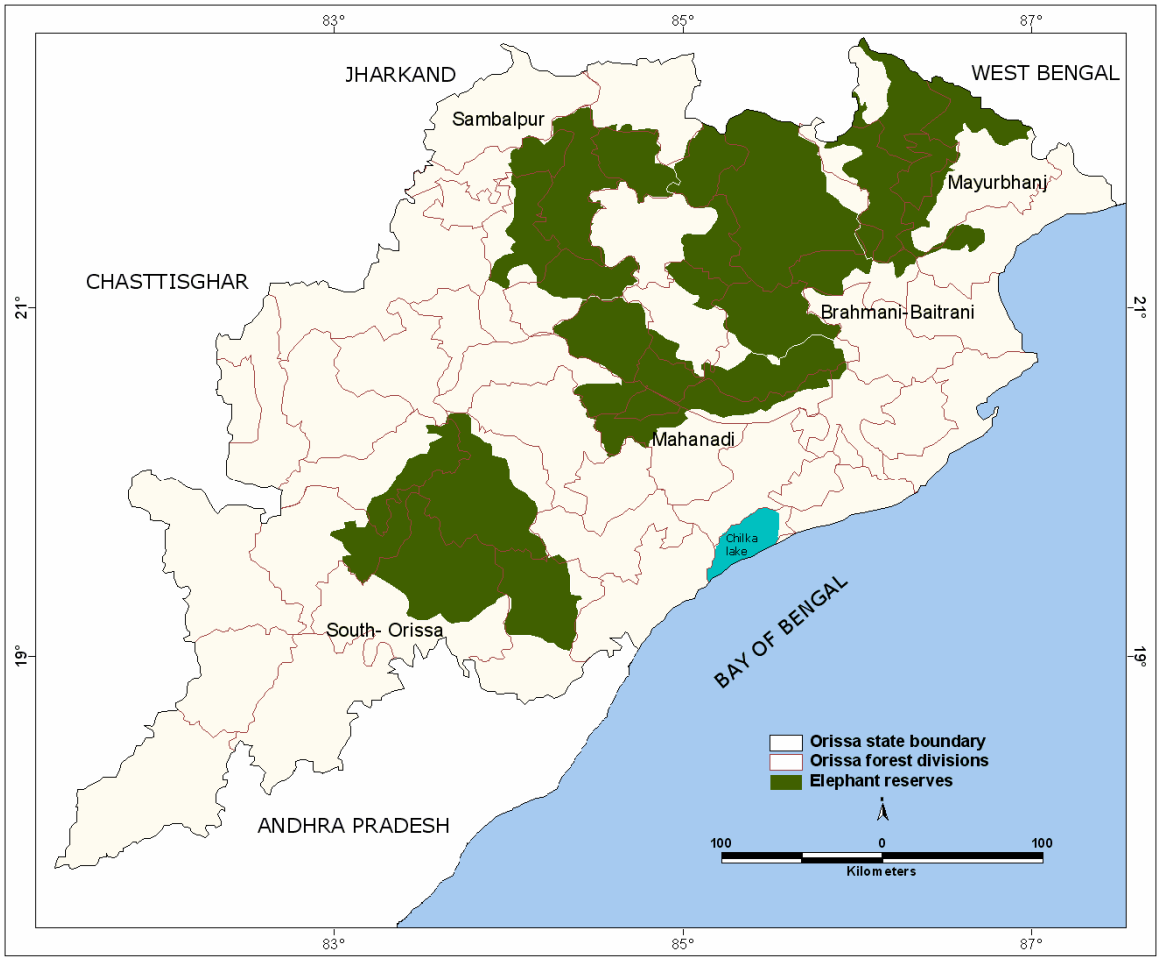

Figure 1.1: Map showing declared and proposed Elephant Reserves in Orissa

HUMAN POPULATION

The population of Orissa is 36.71 million, constituting 3.57% of the country's population (2001); 85% of this population is rural and 15% urban. The mean population density is 236 persons/km^2 (Directorate of Census Operation-undated). Scheduled Tribe population comprises 22.2% and Scheduled Caste population makes up 16.2% of the state population. (Directorate of Census Operation, 1997). The State shows a decreasing rate of population

growth. During the previous decade (1981 – 1991), population growth was 20.06%, which was 3.79% less than the national average. During the last decade (1991 – 2001), the growth rate further decreased to 15.94%, which is 5.4% less than the national average.

FOREST AND FOREST TYPES WITHIN THE STATE

According to the Forest Survey of India report (2001) the State has a forest cover of 48,838 km^2 of which dense forest (crown cover 40% or above) is 27,972 km^2, open forest (crown cover 10% to 40%) is 20,866 km^2, with mangrove forest being included within the above categories. According to the recorded forest area, the State has 16,938.25 km^2 Sal forests (29%), 2030.64 km^2 Teak forests (3%), 21,024.34 km^2 Miscellaneous forests (36%), 1,374.77 km^2 Pure Bamboo forests (2%), 17,749.61 km^2 Overlapping Bamboo forests (30%), and 3.99 km^2 Conifer Plantations (Forest Department 1997). Except for Sal forest, predominantly Miscellaneous, Overlapping Bamboo and Pure Bamboo forests can be considered as suitable habitat for elephants. According to the classification of Champion and Seth, the main types of forests found in Orissa are: I) Northern Tropical Moist Deciduous (Figures 1.2a & b); II) Tropical Dry Deciduous; III) Northern Tropical Semi-Evergreen; IV) Tidal Swampy forests.

Figure 1.2a: Moist deciduous forests in Satkosia WLS

Figure 1.2b: Moist deciduous forests in Satkosia WLS

ELEPHANT POPULATION

The present elephant population (Figure 1.3) is about 1,841 (Bist 2002), which is distributed within 30% of the state's geographical area (Sar, personal observation). The population is presently stable, but human – elephant conflict poses the biggest threat to their future. Details of the elephant population are given in Tables 1.2 and 1.3.

Figure 1.3: An elephant herd in Chandaka WLS

Table 1.2: Elephant density and distribution

Elephant Reserve	Number of FD (WLS)	Area km^2	Elephant habitat area km^2	Elephant density / km^2 of habitat area	Total elephant numbers
Mahanadi	9 (2)	8,036.20	3,139.16	0.14	433
Baitarani	5 (0)	10,520.60	2,866.98	0.05	145
Sambalpur	5 (2)	8,385.61	3,034.69	0.14	491
South Orissa	5 (3)	7,713.39	4,216.45	0.03	139

Table 1.3: Elephant sex classification

Elephant Reserve	Male		Female	Young	Calf / sex unknown	Total
	Tusker	Makna				
Mahanadi	71	4	231	43	84	433
Baitarani	43	2	72	28		145
Sambalpur	92	1	270	128		491
South Orissa	36	0	79	24		139

CONSERVATION PROBLEMS

Elephant population status and management

South Orissa elephant reserve and its population stands isolated from other elephant reserves of Orissa. The region contains 140 elephants and has the lowest elephant density amongst elephant reserves in Orissa. According to census estimates, from 1979 to 2002, there has been a reduction of about 60 % in population during this period. Elephants move through all regions of the reserve, and are not permanent residents in any of these locations. Although reasons for a 60% reduction in elephant population in South Orissa ER is not acknowledged, shifting cultivation, growth of areas under monoculture and reduction in overall rainfall may be possible grounds for this. The contribution of disease outbreak, poaching, and natural calamities to the decline of the population is not clear.

Elephant population in Baitarani ER is mostly in transit and 145 elephants have been reported in this area. Elephants use more than the actual elephant area and move from Keonjhar to Similipal, from Keonjhar to Bonai to Badarma WLS and also to Jharkhand.

In recent years, elephant poaching has been a severe problem in South Orissa ER, Baitarani ER and Mahanadi ER. In South Orissa ER, five tuskers were poached in one year (2002). Every year, two elephants die in Baitarani ER and Mahanadi ER due to this problem.

Human – elephant conflict

Human – elephant conflict is one of the biggest threats to elephants (Figure 1.4) in Orissa (Swain, 2001; Swain & Patnaik, 2002), as it shows an increasing trend year after year. More than 100 people have lost their lives in the last five years, and five elephants die every year due to reported retaliatory killing alone (Sar, Personal observation). The total amount spent on compensation for human death and other conflict issues is about Rs. 75 lakhs/year. The status of the Human – elephant conflict situation in the state is shown in Table 1.4.

Figure 1.4: Conflict mitigation - captured problem elephant under training

Human – elephant conflict is very high in Baitarani ER. During 1999-2000 to 2003-04, 68 people died and 26 were injured. The estimated area of crop damage by

Table 1.4: Status of Human – elephant conflict

Elephant Reserve	Villages within the sanctuary	Crop damage / y (acres)	House damage / y	Human death or injury / y	Elephant death / y	Poaching / y
Mahanadi	119	1,372.0	4.8	8.3	2.4	1.83
Baitarani	Nil	1,633.0	245.0	15.67	7.8	2.2
Sambalpur	24	1,264.0	9.2	7.8	1.25	0.16
South Orissa	103	24.4	3.6	0.83	1.56	0.17

elephants is 1,600 acres/year. The ER has the highest incidence of household damage and 250 cases have been reported every year. In Sambalpur ER, crop damage by elephants has been about 6,000 acres during 1999-2000 to 2003-04. About 4,000 people received compassionate relief, with 42 cases of human deaths and 6 cases of injuries reported during this period. Double cropping of paddy is more popular in this reserve area, resulting in crop damage problem round the year; peak crop damage months are December and January. In Mahanadi ER, a total of 37 human beings were killed and 13 injured reported during these five years.

Mining and other activities

Mining is the single largest threat to elephants and their habitat within the State (Swain & Patnaik, 2002), with around 0.1 million hectares of land under this activity (Directorate of Economics & Statistics, 2002). In Baitarani ER mining activities are at their peak and about 48,500 hectares land has been allotted for mining. Major and influential companies operate from this region. Irrigation projects and their canal systems are also major threats as they fragment and degrade prime elephant habitats. The pattern of land use, particularly *Podu* cultivation has further caused damage to elephant habitats. Shifting cultivation practice is a major problem in South Orissa ER as it does not allow even secondary growth (Sahu 1984). In Baitarani ER, shifting cultivation with the reduced cycle reported in dry deciduous forest region is an important conservation issue. Initially, the forest areas were taken over for this practice and later left mostly for illegal mining. The growth of human population on the periphery and within the forest area (Sar and Lahiri-Choudhury, 1999a, 1999b, 2000, 2001, 2002a, 2002b, 2002c, 2002d, 2003a, 2003b) has very damaging effect on the habitat. Baitarani ER has the highest density of human population; the increase was due to migration of people from other regions for mining related activities. In comparison to the other reserves, human population density along the forest areas is very high in this reserve. Mining and other developmental activities have their own ripple effects such as increasing human (labour) settlements within and along the habitat, constant vehicular movements related to mining activities within and along the forest disturbing or restricting wildlife (including elephant) movement across the habitats.

Encroachment

Encroachment is a major problem in many of the forest divisions falling under Elephant Reserves. After 1980, from a minimum of 814 cases to a maximum of 3,223 cases of encroachment have been reported in different Elephant Reserves in Orissa. A minimum of 720 hectares to a maximum of 2,500 hectares forest lands have been encroached in forest divisions falling under different Elephant Reserves in Orissa (Figure 1.5). Encroachment cases and area reported before 1980 were regularized. The effect of encroachment activities is to reduce the habitat size and quality for elephants and increase human activities within the ERs.

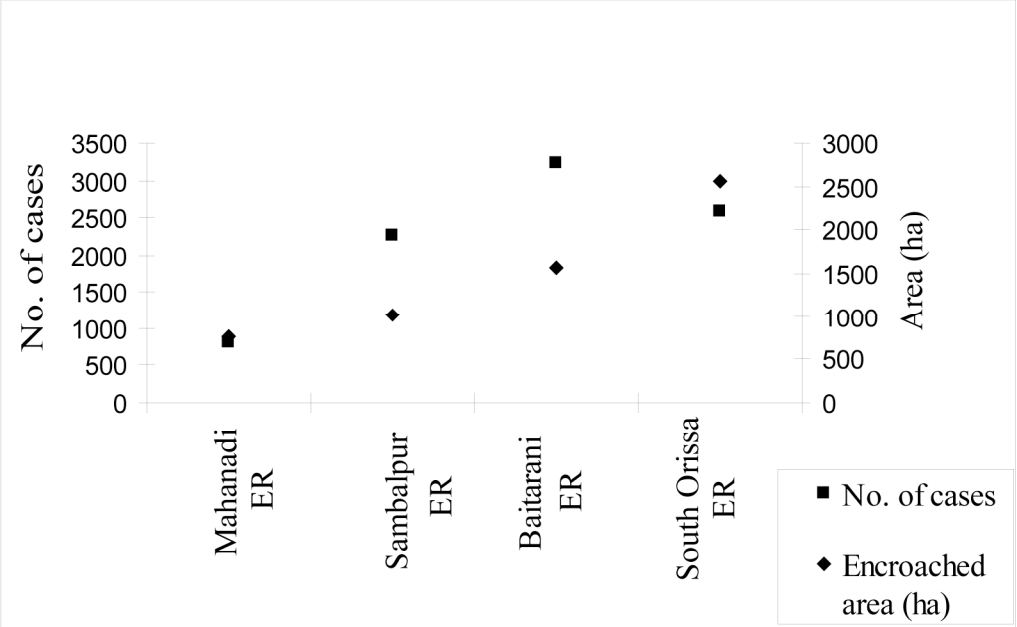

Figure 1.5 Status of encroachments in ERs: No of cases and encroached area (in hectares) are plotted against different Elephant Reserves in Orissa

Illicit felling

Figure 1.6: Illegal felling of timber from forests in Mahanadi ER

This problem is severe (Figure 1.6) in some of the forest divisions. For example, in Mahanadi about 12,000 forest offence cases were reported in one year alone (Figure 1.7). Uncontrolled timber poaching is a major threat to habitat in Mahanadi ER. Timber poaching cases lead to severe damage to the habitat and also result in constant movement of people in the reserve.

Irrigation projects

Almost all the Elephant Reserves have irrigation projects, either within or located outside resulting in a negative impact on habitat quality. In many places irrigation canals associated with the irrigation projects prevent normal elephant movements: for example, the left bank main canal system of Samal Barrage in Dhenkanal forest division of Baitarani ER prevents regular movement of elephants. Minor irrigation projects (MIP) are known to attract elephants to water sources and crop fields, increasing Human-elephant conflict. Badjhore MIP and Suna nall MIP in Bonai forest division of Sambalpur Elephant Reserve are some of examples of this problem.

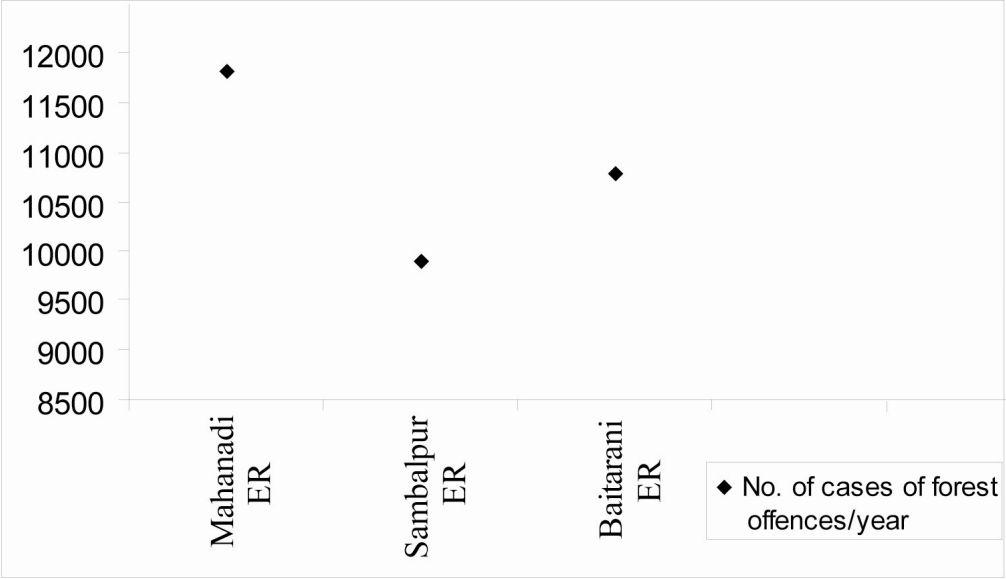

Figure 1.7: Number of cases of forest offences per year plotted against 3 different Elephant Reserves of Orissa

In Mahanadi ER, only 1,000 km^2 is contiguous and the remaining 2,000 km^2 is either fragmented or disturbed, and most of this land is not recoverable due to canals both existing and under construction.

Roads and railway lines

A number of roads and railway lines run through most of the elephant reserves, fragmenting habitat and preventing elephant movement along some transport routes. The railway line between Jharsuguda and Rourkela particularly, is an accident prone area for the elephants. On National Highway (NH) 215, which passes through Baitarani ER, the movement of trucks is restricted during the day but becomes very heavy during the night. This severely affects the movement of wildlife, as thousands of trucks ply on this road every night.

Industrial establishments

Food processing and small scale industries are located within the limits of the South Orissa Elephant Reserve, two sugar factories are located in Mahanadi Elephant Reserve. One steel plant (SAIL) along with many ore crushing plants are found in both Baitarani Elephant Reserve and Sambalpur Elephant Reserve. Coal mine related activities, one thermal power station and seventeen sponge-iron factories are located or are under construction in various forest divisions of Baitarani Elephant Reserve. The effect of these industrial establishments on elephant reserves is not very clear. However one possible consequence could be that the presence of sugar factories may motivate farmers to cultivate sugar cane in more areas, thus leading to increased human-elephant conflict.

Cattle population and grazing

All villages situated within and around the forests release cattle into the government forests. The cattle population of Balliguda FD of South Orissa ER was 1,64,646 (1991 census) and about 58,000 cattle depend on the forests of Mahanadi Elephant Reserve; Dhenkanal,

Athmallik and Satkosia Forest Divisions (FD) have relatively more cattle number. However, data on number of cattle using different ER's are not available with the Forest Department. In most Forest Divisions, there is a provision for collection of grazing fees from the concerned persons and this could help monitor the number of cattle that are grazed in each FD. The other issue associated with this problem is that, except in sanctuary areas, no regular inoculation program was undertaken for cattle on the fringe areas of elephant habitat

Forest fire

For collection of forest products, particularly *tendu* leaves and mohua flower, as well as for hunting of small animals, villagers set fire to the undergrowth. Many people are also engaged in charcoal production by burning wood-logs inside the forest of South Orissa Elephant Reserve, used by hotels and house owners. There is an estimate that around 2% to 40%, 5% to 60%, 7% to 60% and 7% to 40% of the ground forest growth is being affected by fire annually in the different Elephant Reserves of Mahanadi, Batararani, Sambhalpur and South Orissa. This could be a conservative estimate and the data on actual area burned and its effect on the habitat is not available for any of the reserves.

CONSERVATION PRIORITIES / RECOMMENDATIONS

Habitat management

The elephant habitats need to be mapped and assessed. Important measures to be taken are shown below.

i) Quantification of habitat suitability for elephants.
ii) Identification of habitat zones according to levels of quality and viability
iii) Management of plantations in evacuated village areas.

Habitat mapping is necessary, particularly of Angul, Athmallik, and Athgarh Forest Divisions, because they contain more elephants in comparison to other areas of the Mahanadi ER.

Population monitoring

Systematic and consistent population monitoring has to be undertaken taking into consideration the following aspects.

i) Schedule of census, methods and techniques to be followed, interval between each census etc.
ii) Monitoring sex ratio, tusker / makhna ratio, and other population demography related parameters.
iii) Monitoring movement of herds, family structure and presence of solitary animals.

Through Baitarani ER, a relatively large number of elephants traverse and hence the regular estimation of elephant numbers is very crucial. This exercise has to be carried out throughout the year, focusing more on transit and permanent populations that use this ER.

Management of elephants outside the legally protected forest areas

Management of elephants outside the legally protected forest area is based on the availability of basic information such as,

i) Movement of herds.
ii) Scaring of herds / crop raiders by organizing scaring parties among the villagers / JFM groups / NGOs; scaring instruments should be from Forest Departments.
iii) Payment of compensation amount as early as possible.
iv) Setting up a crop damage assessment team or group, consisting of experts from outside the Forest Division / ER area.

Management of mining regions

Management of mining areas could be a very challenging task. The following aspects and region have to be given consideration:

i) Mining is restricted mostly to Keonjhar and Bonai Territorial Divisions. In these two divisions, attention should be given for proper implementation of mining rules and regulations.
ii) In the mining areas, the land with non-working mines should be dealt with separately, or be taken back for forestry activity.

In Baitarani ER, monitoring all developmental activities, especially mining activities should be one of the major conservation priorities for the ER. Legal and illegal mining areas, labour settlements, vehicular transports, constant movement of traffic that restrict the movements of even smaller animals across habitats, need to be monitored. For example, from Rourkella to Paradeep Port, traffic restricts the movement of animals in many forests.

Management of encroachment and other activities

Encroachment issues have to be handled specifically, and the following aspects need to be given priority:

i) Encroachment of Government forest lands was maximum in South Orissa ER, hence priority should be given for recovery of such lands.
ii) Maximum number of villages situated within the Wildlife Sanctuary area was in Mahanadi ER (119) followed by South Orissa ER (103). Priority should be given for the relocation of these villages.
iii) With minimum effort, 24 villages in Sambalpur ER could be shifted.
iv) Bamboo collection should be prevented. Its collection should be limited for only vegetable purpose in Athmallik and Rairakhol FDs.
v) Recovery of forest land from non-productive mining areas or from illegally mined areas needs to be considered.
vi) Impact assessments of new industrial establishments coming up in all the four ERs should be taken up on a priority.

Management of Human – elephant conflict

Mitigation measures can be primarily based on understanding some basic issues: the following aspects play an important role.

i) The Government as well as NGOs should take up promotion of alternative cash-crop cultivation within and on the periphery of the elephant reserve.

ii) Crop protection measures should be undertaken on a priority in Baitarani, Mahanadi and Sambalpur ERs.
iii) Protection to human life should be given priority in Baitarani ER.
iv) A *Kunki* squad of 3 to 4 *kunkies* needs to be raised from the captive elephants.
v) Anti-depredation squads should be raised from VSS / FPC

In Baitarani ER, human – elephant conflict areas such as Keonjhar and Joda-Barbil Police Station (PS) need to be brought under effective elephant barrier mechanism. Electrocution of elephants is severe in this location and about seven elephants have so far been electrocuted in this region during 1999-2000 to 2003-04.

Anti-poaching measures

Poaching of elephants is a severe problem in most of the reserves. The following aspects could be of prime importance to deal with this issue:

i) Establishment of anti-poaching camps, training forest staff in various aspects related to controlling poaching incidents.
ii) A system of attractive cash rewards should be formulated for information leading to recovery of tusk (and other wildlife products) and the arrest of culprits.
iii) Specific anti-poaching measures should be undertaken in Baitarani and Mahanadi ERs.

Co-ordination of priorities between other ERs

Currently no protocol has been established to coordinate priorities between the other Elephant Reserves of the state. However, this aspect can be dealt with by understanding the following factors.

i) Sharing of information.
ii) Development of intelligence network.
iii) Joint maintenance of common elephant corridors.

Working / management / regional plans for ERs

None of the Forest Division Working Plans have specific management plans for elephants. They focus on the overall management of wildlife. Wildlife focused management plans have little value for elephants.

i) A separate elephant management plan for each of the ERs is essential.
ii) Major facets of these ER Plans should be reflected in the Forest Division Working Plans or Sanctuary Management Plans.

Identification of stakeholders in elephant reserve management

Apart from the Forest Department and local communities, various other organizations that are involved directly or indirectly influence the status of the Elephant Reserves.

The major stake-holders in Orissa are: 1) Civil Administration; 2) PWD 3) Railways 4) Highways authority 5) Electricity Board 6) Irrigation Department; 7) Soil Conservation Department; 8) People's representatives (including members from Gram Panchayat,

Panchayat Samithi and Jila Parishad); 9) Local NGOs; 10) JFM Committees; 11) Animal Husbandry Department and 12) Representatives from Mine Owners Association.

Coordination with these stakeholders should be undertaken through:

i) Implementation of the various ER management programmes through the appropriate Departments by allotting necessary funds to them.
ii) Monitoring the implementation of the work given to various stakeholders by the ER managers to improve the awareness and responsibilities of the stakeholders.
iii) ER managers should also have good relations with the stakeholders, and take into confidence the Judiciary, Police and the Media.

Formation of advisory committee and its functions

This concept could play a critical role in the function of ER, and the following aspects have to be given importance.

i) The Advisory Committee should identify the stakeholders, and distribute to them the eco-development work and priorities of the ER management program. One Forest officer, not less than the rank of Conservator of Forests, should head the Advisory Committee.
ii) The committee should also have members from wildlife NGOs, one Research Officer from the State Forest Department, one elephant specialist from a reputed organization or University, one member each from the local stakeholders, and all the DFOs of the involved Forest Divisions / Wildlife Divisions
iii) It is important that only representatives and not all stakeholders are included in the Advisory Committee, and at the Divisional level, the DFO should co-ordinate the proceedings.

CONCLUSIONS

Although the Elephant Reserves have suitable elephant habitat area ranging from 3,000 to 4,000 Km^2, they contain a maximum number of 150 to 500 elephants. The distribution of elephants is patchy in South Orissa Elephant Reserve and they are mostly transitional in Baitarani Elephant Reserve. Only Mahanadi Elephant Reserve and Sambalpur Elephant Reserve have a relatively large number (400 to 500) of elephants, distributed in contiguous forests. Interestingly both are adjoining each other. It appears that South Orissa Elephant Reserve distribution of elephants is patchy because of the inability to link it to other Elephant Reserves. Elephant numbers here may not have long term viability.

The elephants of Mahanadi and Sambalpur Elephant Reserves are linked to other relatively large number of elephant herds of the Similipal Elephant Reserve through Baitarani Elephant Reserve. Because of this aspect Baitarani Elephant Reserve has its own importance.

In Baitarani ER, the area close to Similipal ER (Atai RF and Rebana RF) needs to be declared as a Wildlife Sanctuary. This will act as a protected area linked to Similipal. This particular region has relatively minimum disturbance (example; minimum mining activities) and hence elephants stay here for a relatively longer period of time.

Consolidating Mahanadi, Sambalpur, Baitarani and Similipal Elephant Reserves would provide approximately 15,000 km^2 of elephant habitat for 1,500 elephants. This may lead to a viable population for long-term conservation of the Asian Elephant in Orissa.

Although there is little scope for linking South Orissa ER with the other reserves, exploring the possibilities of linking this ER with Mahanadhi ER has to be considered. About 100 km^2 habitats has to be consolidated for this purpose, and it may be possible, as the fragmented forest patches located between these two ERs are not very far apart. If this concept of linking these two ER is not possible, demographically the elephant population in South Orissa ER has no viability.

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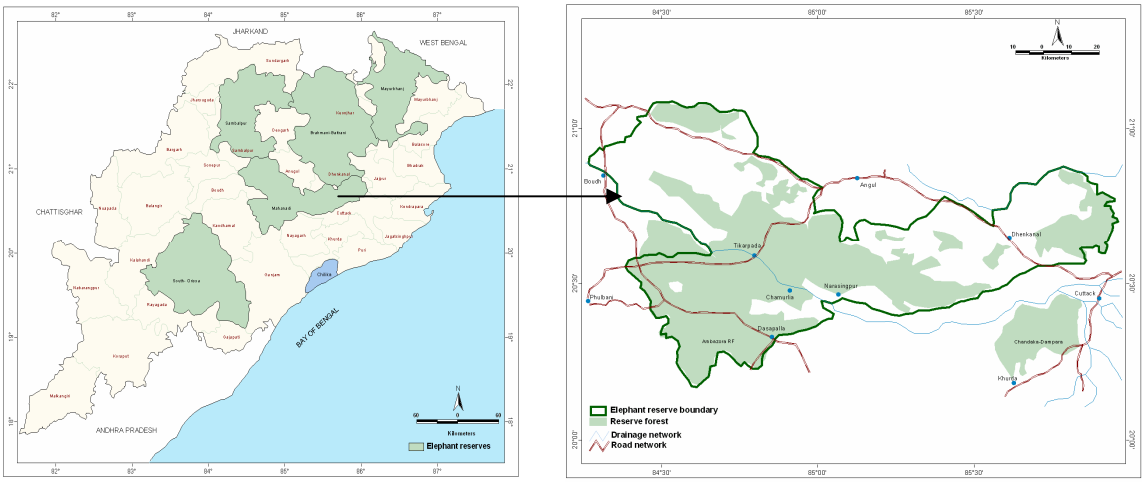
Chapter 2 Mahanadi Elephant Reserve - Extension (MER) Orissa, India: Population status, conservation and management of Asian elephants (*Elephas maximus*)

Profile

Name of the reserve: Mahanadi Elephant Reserve



Latitudes: 20º 10' to 21º 05' N
Longitude: 84º 16' to 85º 58' E

Total area: 8,036 km^2
Legally protected available forest: 3,139 km^2

Geography: Situated on the banks of the Mahanadi river; has vast tract of high hills and deep valleys

Altitude: Ranges from 47 to 932 m MSL

Rainfall: 1,261 to 1,597 mm / y
Water sources: River Mahanadi and its tributaries

Major vegetation types: North Indian Moist Deciduous Forest

Elephant density: 0.14/km^2
Adult male to female sex ratio: 1:3

Significance / conservation issues

i) Mahanadi ER has a relatively large area and is less fragmented when compared to South Orissa and Baitarani Elephant Reserves.

ii) It has two protected areas covering an area of 1,000 km^2.

iii) The habitat is fragmented but forest patches are close to each other. However, in some cases regular movement of elephants is not possible.
iv) This region holds 450 elephants, distributed mostly in a contiguous forest patch. The elephant density is similar to Sambalpur ER

v) Elephant poaching is a greater problem in Mahanadi ER than in the reserves of South Orissa and Baitarani. Deaths due to poaching are more in number when compared to natural deaths.

vi) About 1,400 acres of crop is damaged / year and a total of 37 human beings were killed and 13 injured between the years 1999-2000 to 2003-04.

vii) Density of human population is relatively less.

viii) Mining is not a major conservation issue here.

ix) Only 1,000 km^2 is contiguous forest and remaining 2,000 km^2 of reserve area is either fragmented or disturbed. Most of this is not recoverable due to canals (both existing and under construction).

x) Uncontrolled timber poaching is one of the major threats to the habitat. About 10,000 cases of forest offences, most of it pertaining to timber poaching and smuggling has been reported per year.

xi) Timber poaching has resulted in severe damage to the habitat and is also a cause for constant movement of people in the reserve.

Conservation priorities

i) Irrigation canals fragment habitat. Impact assessment of irrigation projects particularly of canals under construction (Dhenkanal and Athgarh regions) has to be carried out.

ii) Linking and protection of the habitats through Mahanadi River and with Athmallik Forest Divisions, principally of elephant crossing points.

iii) Habitat mapping needs to be done, particularly of Angul, Athmallik, and Athgarh forest Divisions; they contain more elephants when compared to other areas of the Elephant Reserve.

iv) Data on elephant distribution, density and demography has to be collected, primarily employing specific scientific methods.

INTRODUCTION

The Mahanadi Elephant Reserve (MER) is situated on the banks of the river Mahanadi in central Orissa. This Elephant Reserve is home to one of the oldest Wildlife Sanctuaries of the state. The forests of this area are mainly tropical moist and dry deciduous type, which are considered to be one of the favoured habitats of elephants (Sukumar 1986). The elephant population in the area has fluctuated from 400 (1979) to 478 (2002). This number constitutes 25% of the total elephant population of the state. Originally, the Reserve was called as "Satkosia Gorge – Baisipalli Elephant Reserve". Later in 2002, with an extension of area, it was renamed as Mahanadi Elephant Reserve. The present perspective plan includes the proposed extension of MER from an area of 1,038.3 km^2 to 8,036.32 km^2.

Location

The Mahanadi Elephant Reserve is situated between 20º 10' to 21º 05' N latitude and 84º 16' to 85º 58' E longitude. It is spread over the civil districts of Boudh, Nayagarh, Cuttack, Dhenkanal, and Angul. Details of the Territorial Forest Divisions (T) and Wildlife Divisions (WL), along with the Forest Ranges having jurisdiction within Mahanadi Elephant Reserve are given in Tables 2.1 and 2.2.

Table 2.1: Forest Divisions and their areas under the Mahanadi Elephant Reserve

Forest Divisions under Elephant Reserve	Presence of Wildlife Sanctuary	Area within MER km^2	RF and PRF within ER km^2	Elephant population in MER during 2002
Boudh (T) - 1948	Nil	445.01	335.01	0
Mahanadi (WL) - 1999	Baisipalli (1981) & Satkosia Gorge	437.29	300.50	25
Satkosia (WL) - 1984	Satkosia Gorge (1976)	654.99	447.79	155
Nayagarh (T) - 1947	Nil	1,007.35	299.00	0
Athgarh (T) - 1948	Nil	1,081.41	400.48	133
Cuttack (T) - 2003	Nil	114.60	52.20	13
Dhenkanal (T) - 1948	Nil	1,846.67	513.51	54
Angul (T) - 1885	Nil	608.00	252.28	16
Athmallik (T) - 1980	Nil	1,841.00	538.39	37
Total		8,036.32	3,139.16	433

(Establishment year in parenthesis)

Table 2.2: Details of Forest Ranges within MER

Forest Division	Forest Range
Boudh (T)	1. Madhapur, 2. Purunakatak.
Mahanadi (WL)	1. Banigochha East, 2. Banigochha West, 3. Chhamundia, 4. Kusanga.
Satkosia (WL)	1. Pampasar, 2. Purunakote, 3. Jillinda, 4. Tikarpada, 5. Raigoda.
Nayagarh (T)	1. Gania, 2. Dasapalla.
Athgarh (T)	1. Narsinghpur East, 2. Narsinghpur West, 3. Badamba, 4. Athgarh, 5. Khuntuni
Cuttack (T)	1. Daliljoda, 2. Cuttack
Dhenkanal (T)	1. Sadangi, 2. Kapilas, 3. Dhenkanal, 4. Hindol
Angul (T)	1. Purunagarh, 2. Durgapur (Jarapada), 3. Raigada (Bantala)
Athmallik (T)	1. Athmallik, 2. Handapa, 3. Dhandatopa, 4. Madhapur, 5. Bamur.

A total of 32 forest ranges have their jurisdiction within the Elephant Reserve. A complete map at 1: 250,000 scale topo-sheet and boundary description is available for this Elephant Reserve.

Boundary description

In the Boudh FD, the ER area starts from Badajor Nala and Chhamundia-Kusang PWD road near Kusanga and follows Kusanga-Charichhack and Charichhack-Ranipathar roads up to Phulbani Division. Running along Boudh-Phulbani Division boundary, it touches Boudh-Nayagarh District boundary, then runs along the eastern boundary of Podhal, Mundeswar and Hatidhara RFs and follows Nandagadu PRF along the southern boundary till it touches Badajor Nala, the starting point.

In the Nayagarh FD, the boundary starts at the confluence of Brutanga Nala and Mahanadi near Manibhadra and runs up stream till it joins Mahanadi RF boundary near Kadalibari. Following the Mahanadi RF it joins Baisipalli RF and reaches Banigocha. From here it follows the Banigocha-Madhapur PWD road till it touches Nayagarh District boundary. Then, following the inter-district boundaries of Nayagarh-Phulbani and Nayagarh-Ganjam up to Ghogada village, it runs along Ghogada-Dasapalla PWD road up to Dasapalla. Running along Dasapalla-Gania PWD road and Gania-Chhamundia PWD road, it reaches the starting point at Manibhadra.

The entire Mahanadi Wildlife Division, covering Baisipalli and southern part of Satkosia Gorge Sanctuaries, and Satkosia Wildlife Division comes under the ER area.

In the Athgarh FD, the boundary starts at the tri-junction point near Nandinia Pahada and follows along Satkosia Wildlife & Athgarh inter-divisional boundary, Nuagada RF, Balikiari RF, Barabhaya and Bhurkundi village boundary, and Tulka Compartment No.12 boundary till it reaches Suhagi Nala. Following Suhagi Nala it joins Mahanadi river near Odasingha ghat, from where it runs down stream up to Kakudia and follows the PWD road via Narsinghpur, Champeswar, Badamba, Maniabandha, Tigria, Athgarh, and Khuntuni, where it touches NH 42. Then it follows NH 42 up to Naraj Railway line and follows Nirgundi Railway line, passing through Marthapur and Gurudijhatia Railway station up to Athgarh Sub-Division boundary, meeting the Ambilijhari PF boundary. Following Ambilijhari PF boundary, it reaches Dhenkanal-Cuttack inter-district boundary near Chatighar, and runs along the Baniabandha, Badajora, Haladiashrerni, Olaba, Debabhuin and Nuagada RFs till it reaches the starting point.

The ER area in Cuttack FD starts from the common boundary of Baniabandha RF and Dalijora Protected Forest (PF) till it meets the inter district boundary of Cuttack and Dhenkanal Districts in the north; then moving in the north-eastern direction it reaches Chatighar village. From here it moves northward along Satalandi PF boundary till Haridapal village, and then touches Tangi-Chatighar PWD road and moves along the boundary line of Ambilijhari and Dalijoda PFs, till it touches the common boundary of Athgarh civil sub-division and Athagarh Division.

In the Dhenkanal FD, the ER boundary starts from the tri-junction of Cuttack, Angul and Dhenkanal districts near Nandinia Pahada and follows the Dhenkanal district boundary up to Khankira RF, following Lahada and Balipasi RFs, till the Sadangi-Mandar PWD road. Running along this road it touches the Brahmani river and runs upstream up to Gengutia. It then follows Gengutia–Korian road till NH 42, and reaches Gudiakateni Chhack and runs up to Satamile along the PWD road. Then it follows the Hindol-Mahidharpur road up to Mahidharpur, and runs along Mahidharpur-Bantala road up to Hindol-Angul inter sub-divisional boundary, reaching the starting point.

In the Angul FD, the ER boundary starts from the tri-junction point of Angul, Dhenkanal and Cuttack Districts near Nandinia Pahada and Nuakheta RF near village Kanja. Then following the Nuakheta RF boundary line it reaches Nuakheta-Bantala Panchayat road and runs up to Bantala. Following the Bantala-Karatapata and Karatapata-Badakera State Highway (SH) 23 roads, it joins NH 42 near Badakera. Running along the National Highway it reaches Athmallik sub-division boundary near Kadalimunda village. Subsequently following the Athmallik-Angul inter sub-division boundary, it joins the Satkosia and Angul inter- division boundary near Laxamanpur Chhack and Antulia RF. After that it runs along Trainsi–Jagannathpur Panchayat road and reaches Jagannathpur. Following Jagannathpur-Pampasar and Pampasar-Raigoda roads it reaches Rasanda, and follows Raigoda-Nuakheta RF till it reaches the starting point.

The ER boundary in Athmallik FD starts from the junction of river Mahanadi and Kusumkuhuri Nala (Athmallik P.S.). Following the Nala it meets the Athmallik-Daruha road and runs up to the Chanagodi Nala, running upstream it touches the Athmallik sub-division boundary. Thereafter, running in a northerly direction, it reaches NH 42, and runs further to join the confluence of Karandijor & Mahanadi rivers. Then following the Mahanadi river along Angul-Boudh District boundary downstream, it reaches the starting point.

Major towns located within the MER

The major towns on the right bank of the river Mahanadi are Dasapalla, Charichhack and Gonia. On its left bank lie Athamallik, Narsinghpur and Hindol. Dhenkanal town is on the right bank of the river Brahmani. There are in total 12 towns located within the ER.

Approaches to the ER

On the north-east side, Hindol town is approachable from Dhenkanal by road (60 km). On the north, Pampasar is approachable from Angul by road (30 km). Athmallik is approachable by road from Boudh as well as Rairakhol on the west side (approx 30 and 55 km respectively). On the south-west, Charichhack is approachable by road from Boudh (40 km). On the south side, Dasapalla is approachable from Nayagarh by road (40 km). On the south-east, Gania is approachable by road from Nayagarh (60 km). On the east boundary, Kapilas is approachable from Dhenkanal by road (30 km), and Tangi is approachable by road from both Cuttack (35 km) and from Bhubaneswar (50 km). From Bhubaneswar, Dhenkanal and Boinda are connected by rail. There is no State or international boundary involved with this ER.

History

The Government of Orissa notified the "Mahanadi Elephant Reserve" in the year 2002. At the time of its notification the name was "Satkosia Gorge – Baisipalli Elephant Reserve" covering an area of 1,038.30 km^2. The present perspective plan includes its extension to an area of 8,036.32 km^2. Inside the notified ER, two Wildlife Sanctuaries are situated within Satkosia and Mahanadi Wildlife Divisions. The year of establishment of these Wildlife Sanctuaries and those of the Forest Divisions is given above in Table 2.1.

Significance of the reserve for conservation

This has traditionally been an elephant habitat and is the only link for the elephants of South Orissa. There are two PA's having an area of 963.9 km^2 with about 180 elephants. A large portion the forest cover in the reserve is mostly contiguous and suitable for elephants.

TERRAIN

Geography

The ER occupies both banks of the river Mahanadi in the civil districts of Boudh, Nayagarh, Cuttack, Dhenkanal, and Angul (Figure 2.1). The forests in the two ranges of Boudh FD comprise a vast tract of high hills and deep valleys. The precipitous hills descend northward to the bank of Mahanadi. In Mahanadi Wildlife Division the hill ranges are generally contiguous on the right bank, commencing from the confluence of river Kuaria and Kusumi up to the border of Boudh FD, and end on the banks of river Burtang near Kadalibadi and Chhamundia. The landscape of Boudh FD and Mahanadi Wildlife Division represents almost a single unit. The highest peak in this area is Sunakhania Parbat (932 m MSL in Padmatala forest block).

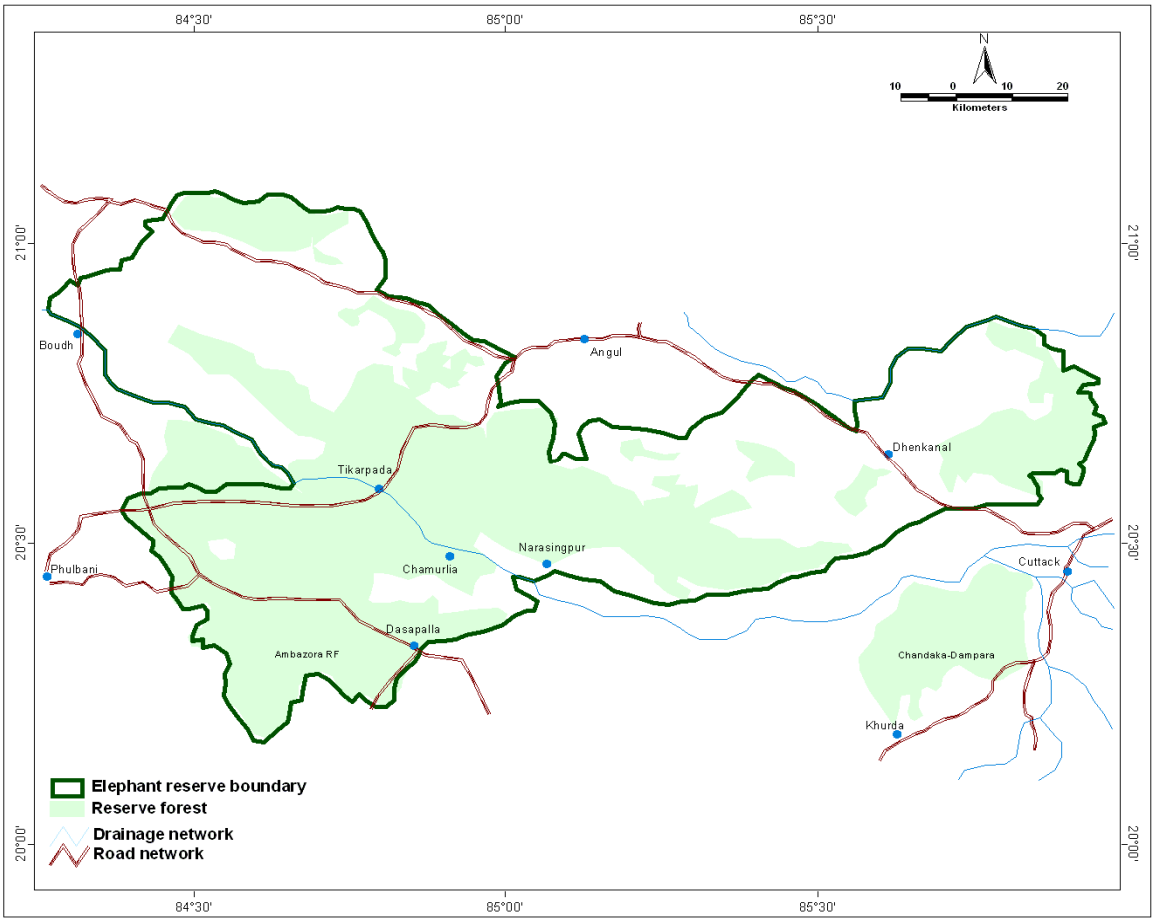


Figure 2.1: Map showing Mahanadi Elephant Reserve

In Nayagarh FD the western portion of the ER is contiguous with the broken mountain system of the adjoining Mahanadi Wildlife Division, interspersed by many streams and rivers, and in the eastern portion numerous plains are intersected by many scattered hills. The

altitude of the area varies from 47 m MSL (Mahanadi river bed) to 855 m MSL (Balimunda peak in Central RF) and forms a continuous hill range connecting Mahanadi WLS to the Ghumsur North FD. On the left bank of the river Mahanadi in Satkosia Wildlife Division the entire tract is high, steep hills and deep valleys. These hill ranges extend from the towns of Athmallik (Athmallik FD) in the west, to Narsinghpur (Athgarh FD) and Hindol (Dhenkanal FD) in the east. The hill ranges run almost parallel to the Mahanadi valley and have a south-east to north-west direction. In Athgarh FD, the terrain is hilly and consists of two main hill ranges, running west to east along the northern border of Dhenkanal FD. The eastern part of the Dhenkanal FD is contiguous with Cuttack FD and the Kapilas hill ranges. The highest peak in the FD is Kapilas Parbat (634 m MSL). The Hindol Range of the Dhenkanal FD is hilly and contiguous with the Angul / Satkosia Divisions and drained by rivers Mahanadi in the south and Brahmani in the north. The Angul portion of the ER is hilly. In the Athmallik FD, the flood plain of the river Mahanadi is a flat stretch of alluvial land, about 3 km to 8 km wide, extending from the border of Angul in the east to Kiakata in the west, and is bound by the Panchadhara hill range. To the west, Baruni, Guja and Bijamaliha are broken extensions of this hill range. In the north again, there is a hill range comprising of Northern forest block, which is contiguous with Angul and Rairakhol FDs.

Geology

The area both to the south and to the north of the river Mahanadi belongs to the Eastern Ghat group of Archean rocks. The main rocks include Khondalite, Basic Granulites, Charnokites, and Quartzschist (usually ferruginous). North of this, the Gondwana formation covers the rest of the area. The Archean rocks are separated from the Gondwana group of rocks by a fault that runs east to west, up to the north of the Cuttack – Sambalpur road.

Climate

Three distinct seasons are encountered in this region. Winter season begins in November and lasts until the middle of February. This is followed by summer which continues up to mid-June. The rainy season or monsoon begins in mid-June and continues up to September. October and first half of November may be treated as post–monsoon season as some rains are experienced, including intense cyclonic storms.

The average rainfall of the forest divisions of this ER range between 1,261.49 to 1,597.10 mm / y. Peak rainfall occurs during the months of July and August. Average number of rainy days varies between 82 days (at Hindol of Dhenkanal), 75 days (at Purunakote of Angul), and 77 days (at Nayagarh). The maximum day temperature varies from 40º C to 45.5º C in the month of May and sometimes can go beyond 48º C. The minimum night temperature varies from 10º C to 13º C in December and can reduce to 7º C in the first half of January. The mean annual maximum humidity is about 90% and minimum humidity about 50%. The lowest humidity is during summer at around 30% and the maximum during rainy season is around 93%.

River system and other water sources

River Mahanadi flows through the ER. Boudh FD, Mahanadi Wildlife Division and Nayagarh FD are situated on the right bank of the river, while Athmallik FD, Satkosia Wildlife Division, Angul FD, Athgarh FD and Cuttack FD are on its left bank. The river Brahmani forms the northern boundary of the ER, from north of Dhenkanal town up to the northeast

corner of the ER. The entire area of the ER is mainly the catchments of the river Mahanadi. In Athmallik FD, only Aunlinadi drains into the river Brahmani and all other streams flow into the Mahanadi. In Dhenkanal FD, Nigra and Badajhor nallas from Hindol portion drains into river Brahmani. A major portion of the nallas from Kapilas hills also drains into the river Brahmani. In Nayagarh FD the Chadiapalli, Ragadimada, Balisinsa forest blocks drain into the river Rushikulya. Except for the above-mentioned *nallas* all other streams drain into the river Mahanadi.

Manjhore reservoir in Athmallik FD, Kuanria reservoir in Nayagarh FD, and Sapua – Badajore reservoir in Athgarh FD and Dhenkanal FD are the major water sources available to the wild animals.

Scarcity of water during summer is common in the area. Both people and elephants use the same water sources (village pond or bore well) in 6% of villages in Boudh FD portion, 2% of villages in Nayagarh / Mahanadi WL area, 10% of villages in Angul portion and Satkosia Division, and 6% of villages in the Athmallik FD. In many places, elephants use bore-well water for drinking.

Land use pattern

The total area of Reserved Forest (RF) and Proposed Reserved Forest (PRF) / Demarcated Protected Forest (DPF) is about 44% of the total geographical area of the Mahanadi Elephant Reserve. Land utilization pattern details collected from the District Statistical Handbook for the year 2000-2001 (the latest data available for Boudh, Nayagarh and Angul Districts) are given in Table 2.3. This estimate excludes urban areas, Reserve Forests (RF), Protected Forests (PF / PRF), Project area, Hill blocks, and Villages submerged under reservoirs.

Table 2.3: Percentage of approximate area under different land uses

Land under different uses	Percentage of land (%)
Forest Area	24.30
Miscellaneous crops and Groves not included in net area sown	1.64
Permanent pasture / grazing lands	4.82
Culturable waste	3.94
Land put to non Agricultural use	10.33
Barren / Un-cultivable land	4.02
Current Fallows	8.15
Other Fallows	5.92
Net area sown	36.86

Apart from the Reserve Forests, Protected Forests, Demarcated Protected forests and Sanctuaries, the available land under forests is 24.30%, and this could play an important role in habitat improvement.

DISTRIBUTION AND LEGAL STATUS OF FORESTS

Of the total forest area (as reserved forest and proposed reserved forest) Athimallik forest division has the largest (538.3 km^2) area, followed by Dhenkanal forest division (513.5 km^2) while Cuttack forest division has only 52 km^2 of forests. Area distribution of the Elephant Reserve between the Forest Divisions (FD) and the available legally protected forest areas are given in Table 2.4.

Table 2.4: Area distribution of Elephant Reserve within the Forest Divisions

Forest Division	Geog. area of the FD km^2	Forest area under different categories – km^2			Geog. area within MER km^2	RF+ PRF within MER km^2
		RF	PRF	DPF		
Boudh	3,326.96	924.77	31.59	Nil	445.01	335.01
Mahanadi WL	437.29	300.50	Nil	21.67	437.29	300.50
Satkosia WL	654.99	431.36	16.43	5.57	654.99	447.79
Nayagarh	3,874.00	856.43	108.23	58.69	1,007.35	299.00
Athgarh	1,510.21	493.86	Nil	20.45	1,081.41	400.48
Cuttack	5,251.00	24.74	33.80	292.98	114.60	52.20
Dhenkanal	4,599.01	1,141.02	Nil	13.789	1,846.67	513.51
Angul	2,909.54	511.71	Nil	218.54	608.00	252.28
Athmallik	1,841.00	538.39	Nil	327.81	1,841.00	538.39
Total	24,404.00	5,222.78	190.05	959.499	8,036.32	3,139.16

RF= Reserve Forest, PRF= Proposed Reserve Forest, DPF= Demarcated Protected Forest.

At present there is no forestry operation within the proposed ER, except in the Nayagarh FD. From Nayagarh FD timber extraction for the "car festival" of Jagannath Puri is of legal binding under the present system.

VEGETATION TYPES

The reserve has dry deciduous, moist deciduous, and semi evergreen forests. Dry and moist deciduous forest complex as prime elephant habitats (Figure.2.2). According to Champion and Seth the forests of this elephant habitat belong to the following types:

Figure 2.2: Moist deciduous forests of the ER

Sub-group 3C – North Indian Moist Deciduous Forests

1. Type – 3C/C2 – Moist Sal Bearing Forest
   - 3C/C2e (i) Moist Peninsular High-level Sal
   - 3C/C2e (ii) Moist Peninsular Low-level Sal
   - 3C/C2e (iii) Moist Peninsular Valley Sal
   - 3C/C2S1– North Indian Tropical Moist Peninsular Sal
2. Type – 3C/C3 – Moist Mixed Deciduous Forest
3. Type – 3C/E3 – Moist Bamboo Brakes

Sub-group 5B – Northern tropical dry deciduous forests

1. Type – 5B/C1 – Dry Sal Bearing Forests
   - (i) 5B/C1c Dry Peninsular Sal Forest
2. Type – 5B/C2 – Northern Dry Mixed Deciduous Forests
3. Type – 5B/E9 – Dry Bamboo Brakes
4. Type – 5B/CS1– Dry Deciduous Scrub
5. Type – 5B/S1– Dry Tropical Riverain Forest

Sub-group 2B – Northern tropical semi evergreen forests

1. Type – 2B/C3 – Orissa Tropical Semi Evergreen Forest

Density of forest cover

Density of forest cover estimated by Forest Survey of India (FSI) 2001, shows that the percentages as well as area covered of dense and open forest cover is highest in Angul District followed by Nayagarh. The forest cover in Boudh also has a higher percentage covered under dense forests and lowest under scrub. District wise density of forest cover is given in Table 2.5.

Table 2.5: District-wise densities of forest cover (area and %) showing different density type of forests available to elephants

District	Dense forest		Open forest		Scrub		Total	
	km^2	%	km^2	%	km^2	%	km^2	%
Boudh	770	57.0	510	37.8	71	5.2	1,351	100.00
Nayagarh	1,031	52.4	674	34.3	262	13.3	1,967	100.00
Cuttack	362	43.1	294	35.1	183	21.8	839	100.00
Dhenkanal	660	45.7	606	41.9	179	12.4	1,445	100.00
Angul	1,658	59.1	992	35.3	156	05.6	2,806	100.00
Total	4,481	53.3	3,076	36.6	851	10.1	8,408	100.00

LEGAL AND MANAGEMENT STATUS

Ownership of lands

Out of the total area (8,036.32 km^2) proposed for the "Mahanadi Elephant Reserve", Revenue land constitutes 4,897.16 km^2 (61%) and forest department owned land (under Reserved Forest (RF) and Proposed Reserved Forest PRF) is 3,139.16 km^2 (39%). Revenue land includes agricultural lands, human settlements and all types of other forests, except for RF & PRF.

There are two Wildlife Sanctuaries within the Elephant Reserve while another (Kapilas Sanctuary) has been proposed**.** At present 963.87 km^2 out of the total area of 3,139.16 km^2 is under Wildlife Sanctuaries. There are 119 villages situated within the sanctuary area (Table 2.6)

Table 2.6: Wildlife Sanctuaries and villages within the Elephant Reserve

Wildlife Sanctuary	Area in km^2	Core area km^2	No. of villages within sanctuary
Baisipalli Wildlife sanctuary (Mahanadi WL)	168.35	NA	22
Satkosia Gorge Wildlife sanctuary (Satkosia WL)	795.52	NA	97
Total	963.87		119

Core area available for elephants

As such the concept of "core area" is not associated with an Elephant Reserve; however, there are two sanctuaries here that could be treated as functional core areas for elephants (963.87 km^2). Within the sanctuaries there is no harvesting of timber as per government. orders. Only a few villages need to be rehabilitated from the sanctuary area if the government approves such a policy.

Status of working plans and management plans

Except for one Division, the time period of the working plans has expired for all the other Divisions. For wildlife divisions management plans have been submitted for approval. The status of working plans / management plans for the nine divisions under this reserve are given in Table 2.7.

Table 2.7: Status of working/management plans for different Forest Divisions of MER

Forest Division	Status of plan	Period from	Period to	Extended up to	Remarks
Boudh	Working plan	1975-76	1994-95	30-June 2001	Final plan submitted for approval
Mahanadi WL	Management plan	2001-02	2010-11	–	First plan submitted
Satkosia WL	Management plan	2001-02	2010-11	–	plan submitted
Nayagarh	Working plan	1983-84	2002-03	Not extended	New plan under preparation
Athgarh	Working plan	1984-85	2003-04	Not extended	New plan under preparation
Cuttack	Working plan	–	–	–	First plan under preparation
Dhenkanal	Working plan	1979-80	1998-99	31-March 2002	New plan submitted
Angul	Working plan	1990-91	1999-00	Not extended	New plan under preparation
Athmallik	Working plan	1985-86	1994-95	2004-05	Valid

Prescription for elephant management in working plans / management plans

Forest Working Plans have no specific plans for management of elephants. Presently, only the wildlife (over lapping) working circle is covered in the working plan, which has little value for elephant management. However, in the Comprehensive Wildlife Management Plan for Baisipalli and Satkosia Gorge Wildlife Sanctuaries the following have been discussed:
i) Vegetation distribution, ii) Corridor identification, iii) Habitat utilization and food requirements, iv) Population dynamics, v) Human – elephant interaction, and vi) Outline of the principles of elephant conservation with specific recommendations for elephant management.

EXSITING CONSERVATION INITIATIVES

The two sanctuaries located within the reserve could be considered as existing conservation initiatives. The State Govt. has already notified 1,038.30 km^2 under the Elephant Reserve, which includes both the sanctuaries. Apart from these two existing Wildlife Sanctuaries, another is in proposal stage (Kapilas WLS). Besides these, there was one Crocodile breeding centre at Tikarpara in the Satkosia Gorge Sanctuary.

ELEPHANT POPULATION

Elephant numbers with a comparison of trends

The reserve has an elephant population of 430 (Forest department census 2002) Table 2.8 summarizes the results of census operations carried out in these divisions since 1979. The census figures for Angul and Dhenkanal FDs cover both portions under Baitarani ER and Mahanadi ER. For comparisons divisional figures are used from three elephant censuses. There has been an increase in the reported numbers of elephants in 2002, but only by 22% when compared to the first census in 1979.

Table 2.8: Results of census operations carried out in different Divisions of MER.

Forest Division	Forest area of MER (RF+PRF) km^2	Year of census			
		1979	1999	2002	2002 in MER
Boudh	335.0	0	15	0	0
Mahanadi WL	300.5	0	0	25	25
Satkosia WL	447.8	0	0	155	155
Nayagarh	299.0	51	0	0	0
Athgarh	400.5	75	154	143	133
Cuttack	52.2	0	0	13	13
Dhenkanal	513.5	92	94	81	54
Angul	252.3	173	162	24	16
Athmallik	538.4	0	29	37	37
Total	3,139.2	391	454	478	433

Forest range-wise elephant distribution

According to the 2002 Census**,** elephant distribution is restricted to 16 forest ranges (11 ranges + 5 ranges of Athmallik FD) during summer. Density of elephants appeared to be highest in Satkosia Wildlife Sanctuary, followed by Atharh Forest Division. Elephant numbers along with the population structure for each Wildlife Sanctuary and Forest Division is given in Table 2.9.

Table 2.9: Forest Range-wise elephant number for different Divisions of BER

Forest Division	Range	Male		Female	Young	Calf /Sex unknown	Total
		Tusker	Makhna				
Mahanadi WL	Kusanga	4	0	10	7	4	25
Satkosia WL	Pampasar	11	1	19	10	9	50
	Purunakote	10	0	62	13	19	104
	Jillinda	0	1	0	0	0	1
Athgarh	Narsinghpur	12	0	46	10	8	76
	Athgarh	4	0	38	2	13	57
Cuttack	Cuttack	2	0	5	0	6	13
Dhenkanal	Sadangi	8	1	31	0	10	50
	Hindol	1	0	1	1	1	4
Angul	Raigada	8	0	2	0	0	10*
	Durgapur	1	1	3	0	1	6
Athmallik	**	10	0	14	0	13	37
Total		71	4	231	43	84	433

*= Probably all male group with two *Makhnas*

**= Range wise data not available, as field visit was not possible.

Elephant density and age-group distribution

Estimated elephant density in the MER is 0.14 / km.^{2} The total number of elephants for the Mahanadi Reserve is 433. Including RF and PRF, the total area available to elephants is 3,139.16 km^2. The details of age group distribution are available only for two forest divisions (1999 and 2002 census results), adult female to male sex ratio for Athgarh division is 1: 0.2, and for Cuttack it was 1: 0.4. However, number of adult males and females encountered for Cuttack is very low; this division has only 9% of the total numbers estimated for both divisions. The other details related to the age group distribution are given in the Tables 2.10 and 2.11. The details of 1999 census are available only for Athgarh and Athmallik. Athgarh Foresrt Division appeared to have the largest number of elephants.

Table 2.10: Age–group distribution of two Forest Divisions for 2000 census

Forest Division	Range	Up to 4' (Calf)			4' to 5' (Juvenile)			5' to 7' (Sub-adult)			7' & above (Adult)			Extra adult unattached			Total
		M	F	Us	M	F	Us	M	F	Us	M	F	Us	M	Mk	Us	
Athgarh	Narsinghpur	–	–	8	–	–	10	–	5	–	12	41	–	–	–	–	76
	Athgarh	–	–	13	–	2	–	–	–	–	4	38	–	–	–	–	57
Cuttack	Cuttack	–	3	3	–	–	–	–	–	–	2	5	–	–	–	–	13
Total		–	3	24	–	2	10	–	5	–	18	84	–	–	–	–	146

M= Male, F= Female, Us= Sex un-known, Mk = Makhna, **'–' =** Nil.

Table 2.11: Age group distribution of two Forest Divisions for 1999 census

Forest Division	Up to 4' (Calf)			4' to 5' (Juvenile)			5' to 7' (Sub-adult)			7' & above (Adult)			Extra adult unattached			Total
	M	F	Us	M	F	Us	M	F	Us	M	F	Us	M	Mk	Us	
Athgarh	3	1	28	3	13	6	7	31	4	25	32	–	1	–	–	154
Athmallik	–	1	6	–	2	–	–	7	1	8	4	–	–	–	–	29
Total	3	2	34	3	15	6	7	38	5	33	36	–	1	–	–	183

M= Male, F= Female, Us= Sex unknown, Mk = Makhna, **'–' =** Nil

In the 1999 census, adult male to female ratio was 1**:**1.06 and the sub adult male to female ratio was 1**:**5.4 (five elephants were of unknown sex). The male to female sex ratio estimated during 2002 census was 1:4.6.

Seasonal distribution and movement of elephants within ER and from ER to other areas

The seasonal distribution and movement of elephants has not been studied properly; however, during paddy harvesting season, the elephants spread out from the sanctuary area into the crop lands of village areas. They also move to the south into the Ghumsur North FD during harvesting season. There is a regular movement of elephants between Mahanadi and Sambalpur ERs.

Elephant corridors

The list of elephant corridors across Wildlife and Forest Divisions are based on the details provided by the Divisional Forest Offices. The list consists of name of the corridor, location, approximate current land-use pattern and legal status of lands.

Elephant movement is found in:

<u>Boudh Forest Division</u>

1. Mundeswar RF, Hatidhara RF, Karada Koth RF, Arakhapadar RF, and Podhel RF of Boudh division through Govt. Revenue land with Khesra forest in-between.

<u>Mahanadi Wildlife Division</u>

1. Tarsingh RF of Ghumsur North FD – Chadheyapalli RF & Central RF of Nayagarh FD – Baisipalli RF of Mahanadi Wildlife Division.
2. Sonepur of Bolangir East FD – Arakhapadar Mundeswar of Boudh FD – Mahanadi RF / Baisipalli RF of Mahanadi Wildlife Division.

<u>Nayagarh Forest Division</u>

1. Tarsingh- Ghogada-Central- Chadeyapalli RFs.

Satkosia Wildlife Division

1. Satkosia – Hatidhara-Taleipathar of Athmallik FD.
2. Satkosia – Balikiari, Nuagarh, Debabhuin of Athgarh FD.
3. Satkosia – Krushnachakra / Bruti RF of Angul FD.

Athgarh Forest Division

1. Kapilas – Baniabandha – Gobara – Dalijoda (all RF).

Cuttack Forest Division

1. Dalijpda RF – Baniabandha RF of Athgarh FD – Kapilas RF of Dhenkanal FD – Ambilijhri PRF, Satalandi PRF, Karanji PRF & Dalijoda RF of Cuttack FD.

Dhenkanal Forest Division

1. *To link Godabolua with Saptasajya RF.*

Location: - Godabolua to Saptasajya via Regeda Pathanasahi, Padmalavpur and Badarpalli.
Area: - 04 km^2
Land use: - Waste land with cultivated paddy fields.
Legal status of land: - Revenue wasteland and tenant's lands.

2. *To link Saptasajya with Matiamundia RF.*

Location: - Godijhaaran to Saptasajya via Krushnaprasad.
Area: - 03 km^2.
Land use: - Cultivated paddy field and revenue lands.
Legal status of land: - Tenant's lands and revenue forest land.

3. *To link Sadangi with Lahada RF.*

Location: - Sadangi – Mandar PWD road near village Kamalpur, locally called Jharan-Chhaka.
Area: - 0.1 km^2
Land use: - Govt. road with tenant's paddy field.
Legal status of land: - Govt. land and tenant's lands.

4. *To link Kapilas with Romei RF.*

Location: - Foot hills of Rasunia Ghati Dholapathara Nalla (Haripur – Deogoan PWD road via Sorisiapada).
Area: - 0.08 km^2
Land use: - Govt. road with tenant's paddy field.
Legal status of land: - Govt. road and tenant's lands.

5. *To link Kandhara to Nanadinia RF.*

Location: - Crossing Hindol – Narsinghpur PWD road at the border of Hindol and Narsinghpur Range behind Hindol Jail.
Area: - 0.05 km^2
Land use: - Govt. road and forests.
Legal status of land: - Govt. lands.

6. *To link Nanadinia RF to Koi RF.*

Location: - Behind Radhanathpur village crossing Hindol –Maidharpur PWD road.
Area: - 0.25 km^2
Land use: - Paddy field.
Legal status of land: - Tenant's lands.

Angul Forest Division
1. Takarsingha RF of Satkosia Wildlife Division.
2. Krushnachakra RF – Bruti RF – Kalapat RF of Angul FD.
3. Raigoda RF of Satkosia Wildlife Division, Nukheta RF – Bolanga RF of Angul FD.

Athmallik Forest Division
1. Hatidhara – Taleipathar – Ghosar – Udal –Northern RFs.
2. Antulia -Para –Katara –Dantarikhola – Similipathar – Northern – Udal RFs.

Few existing corridors have already been identified by CK Sar & Lahiri Choudhury 2002b that also could be considered for corridor management.

CONSERVATION PROBLEMS AND ISSUES

i) Encroachments

As a whole, encroachment is a problem in Dhenkanal FD. In many places encroachment of village / khasra forest is also rampant. No ground verification of the status of the encroachment is available. Encroachment reduces forest area, increase human activities with its ripple effects. The figures available on encroachment for each Forest Division are given in Table 2.12 below.

Table 2.12: Status of encroachment in MER

Forest Division	Pre-1980 encroachment		Post-1980 encroachment		Total encroached area (ha)	% of forest encroached
	No.	Area (ha)	No.	Area (ha)		
Boudh	40	26.94	256	161.79	188.73	0.15
Mahanadi (WL)						
Nayagarh	-	165.87	-	218.19	384.06	0.21
Athgarh &	113	58.56	111	20.42	78.98	0.08
Cuttack						
Dhenkanal	214	214.11	395	320.21	534.32	0.31
Angul	111	94.79	52	50.33	145.12	0.14
Athmallik	-	-	-	-	-	0.07
Satkosia (WL)	0	0	0	0	0	0

'-'Details not available

ii) Illicit felling

Illicit felling degrades forest quality and increases human activities. All forms or modes of transport are used to move the materials cut or collected from the forest. About 12,000 cases of forest offences are reported annually. Average forest offence cases booked during the previous five years in different Forest Divisions are presented in Table 2.13.

iii) Mining activity

Mining is not a problem in this Elephant Reserve.

Table 2.13: Average forest offence cases booked for five years in different Forest Divisions

Forest Division	Average* number of cases / year
Boudh	1584
Mahanadi (WL)	241
Satkosia (WL)	657
Nayagarh	1534
Athgarh	-
Cuttack	2499
Dhenkanal	2310
Angul	1254
Athmallik	1737

*= from 1999-2000 to 2003-04; '-'Details not available

iv) Irrigation projects

Irrigation projects fragment habitat, increase agricultural activities around the fringes of the forests and are a major cause for Human – elephant conflict. The major irrigation projects within the ER are:

- Manjore Medium Irrigation Project in Athmallik FD
- Suhagi Minor Irrigation Project in Satkosia Wildlife Division
- Kuanria Medium Irrigation Project in Nayagarh FD
- Budhidei Minor Irrigation Project in Athgarh FD
- Damkuch Minor Irrigation Project in Mahanadi Wildlife Division and Boudh FD (Boudh Dist.)
- Sapua – Badajore Medium Irrigation Project in Dhenkanal FD
- Kansa, Baunsapokhari, Ekatali, Gunalipal, Bedapada, Gundiraposi, and Dhanianalli Minor Irrigation Projects in Dhenkanal FD
- Haripur Minor Irrigation Project in Cuttack FD (source:Dalua 1991).

v) Roads and railway lines

Roads and railway lines passing through the reserve, fragment habitat and elephant corridors, thus preventing elephant movement across the forests. Roads such as NH 42, and SH 1, 23 & 25 pass through Mahanadi ER. Division-wise forest road, PWD road and Railway line lengths are given in the Table 2.14.

Table 2.14: Details of division-wise forest road, PWD road and Railway lines

Forest Division	Forest road km)	PWD road km	Railway line km
Boudh	85.20	–	–
Mahanadi (WL)	79.80	172.00	–
Satkosia (WL)	186.00	40.00	–
Nayagarh	46.00	110.00	–
Athgarh	122.00	–	–
Cuttack	6.00	–	–
Dhenkanal	94.08	–	–
Angul	29.04	–	–
Athmallik	137.50	–	40.00
Total	785.62	322.00	40.00

'–' Data not available

In spite of this, there were no reports of accidents to elephant by vehicular traffic or trains in this area.

vi) Industrial establishment

There are two sugar factories in the ER, one at Badamba (Athgarh FD) and the other at Dhenkanal (Dhenkanal FD). A spinning mill also comes within the ER area at Nuapatna (Athgarh FD). In addition, two steel plants have been proposed within the ER (at Ghantikhal and at Khuntuni) in Athgarh FD. The impact of these industrial establishments on the ER is not clear as yet to the ER managers. Sugar factories may motivate the farmers to cultivate more area under sugar cane, and it may result in more Human – elephant conflict conflicts.

vii) Tea and coffee cultivations

There is no tea or coffee cultivation within Mahanadi ER.

viii) Monoculture plantations

A total of 8,638 hectares area of monoculture plantation has been reported for the reserve. Athgarh FD has more percentage area under monoculture plantation followed by Angul FD. Total area of plantation (ha) during last five-year period in each FD is given in the Table 2.15.

Table 2.15: Total area of plantation in each Forest Division for five-years (area in ha)

Forest Division	1999-00	2000-01	2001-02	2002-03	2003-04	Total
Boudh	0	138.00	180.00	194.95	293.00	805.95
Mahanadi (WL)	0	0	0	0	0	0
Satkosia (WL)						200.00
Nayagarh	-	100.00	40.00	50.00	140.00	330.00
Athgarh	-	185.59	1785.00	321.85	1453.00	3745.44
Cuttack	-	-	-	-	-	-
Dhenkanal	28.8	24.25	258.75	354.00	184.50	850.30
Angul	1094.7	60.00	180.00	168.00	1204.00	2706.70
Athmallik	-	-	-	-	-	-
Total	1123.50	507.84	2443.75	1088.80	3274.50	8638.39

'-' Data not available

ix) Human population

A total of 1,790 villages with a total population of 8,35,435 are located within and close to the reserve. The census data of 2001 for the human population and the number of inhabited villages present within the Elephant Reserve area are given in the Table 2.16.

Recent information on the percentage of scheduled tribe (ST) and scheduled caste (SC) within the elephant reserve is available only from 1991 Census. Between 20% and 33% of the population in the various districts of the proposed ER area belong to the ST and SC community and they primarily depend on forests resources. However, detailed demographic distribution of ST and SC population is not available for the area covered by the ER, but was available for the districts. This data is given in Table 2.17.

Table 2.16: Census data (2001) for human population and inhabited villages present in the ER

Forest Division	No. of inhabited villages	Total population
Boudh	26	3,752
Mahanadi (WL)	56	10,863
Satkosia (WL)	88	22,592
Nayagarh	260	70,506
Athgarh	213	1,12,218
Cuttack	13	14,039
Dhenkanal	407	3,40,358
Angul	173	67,184
Athmallik	554	1,93,923
Total	1790	8,35,435

Table 2.17: Detailed demographic distribution of ST and SC population

District	Forest Division	% of ST	% of SC
Boudh	Boudh & Mahanadi WL	12.92	19.64
Nayagarh	Nayagarh & Mahanadi WL	5.96	13.78
Cuttack	Cuttack & Athgarh	3.49	18.19
Dhenkanal	Dhenkanal	12.66	16.03
Angul	Angul & Athmallik	11.65	16.75

x) Cattle population and grazing

About 58,000 cattle depend on the forests of this reserve; Dhenkanal, Athmallik and Satkosia have relatively more numbers of cattle. Details of cattle population found data collected at the Forest Division Offices is given in the Table 2.18.

Table 2.18: Details of cattle population for different Forest Divisions

Forest Division	Cattle population
Boudh	6,788
Mahanadi (WL)	3,377
Satkosia (WL)	26,037
Nayagarh	12,570
Athgarh	55,151
Cuttack	6,626
Dhenkanal	3,08,185
Angul	40,378
Athmallik	1,22,456
Total	5,81,568

No management plan related to improvement of cattle breeds and reduction of its number from the villages situated on the periphery and within forests has been incorporated for long term ER management.

All villages situated within and around the forests release cattle inside the forests. There is a provision for collection of grazing fees from livestock graziers. But there has been no systematic inoculation programme undertaken for cattle on the fringe areas of elephant habitat (RF or PRF), except for the Sanctuary areas.

xi) NTFP Collection

All forest regions have this problem. Most of the NTFP items, except Sal leaves and gum, are currently collected under the jurisdiction of Gram Panchayats.

xii) Forest fire

Between 2 to 40% of the forest ground cover is being affected by fire annually. The main cause of fire is the collection of minor forest produce.

xiii) Elephant deaths

During 1999-2000 to 2003-04, elephant deaths cases reported for the reserve was 53; of these 19 were male, 15 female and 10 calves, with details not being available for the remaining 9 cases. The maximum number of elephant deaths (19) was reported in 2004.

Causes

a) Natural deaths: There were 24 cases of natural death, of which one was due to a fight between elephants, one due to collapse of a roof; 4 deaths were due to sunstroke and 7 were due to disease.

b) Poaching: Out of 53 deaths, 11 were were a result of poaching; for 12 cases, details were not available, (reported by the Forest Department)

c) Retaliatory killings – poisoning / electrocution: According to Forest Department records, 4 out of 53 deaths were by electrocution; of these 3 were deliberate and one accidental. The case of accidental electrocution death indicates that the standards regarding the height of electric line have not been adequately followed. The most sensitive forest ranges, where elephant deaths occurred are given in Table 2.19.

Table 2.19: Division wise sensitive Forest Ranges, of elephant deaths

Forest Division	Sensitive Forest Range
Boudh	No such sensitive area
Mahanadi (WL)	No such sensitive area
Satkosia (WL)	Raigoda range
Nayagarh	No such sensitive area
Athgarh	Narsinghpur & Badamba ranges, Boniabandha RF
Cuttack	No such sensitive area
Dhenkanal	Kopilash area
Angul	Talcher
Athmallik	Not available

xiv) Trend of elephant deaths in the ER area

As stated above, about 12 % of the elephant population (53 out of 433) died during the period 1999-2000 to 2003-04. Death due to electrocution was 7%; poaching deaths were 21%; and natural death accounted for 45%. This could translate into a crude death rate of 2.4% per year for the ER. The death rate should be regarded as a minimum rate, because some carcasses, especially those of calves and juveniles, would not have been detected.

xv) Status of elephant poaching and its control measures

Persons booked under elephant poaching related cases between 1999-2000 to 2003-04 were as follows: in Angul FD - 9 persons; in Athgarh FD - 9 persons; and in Satkosia - 8 persons. Traditional poachers are active in the area. Although poachers have been arrested, prosecution has been poor and needs more attention. Existing control measures taken by the Forest Department appears to be adequate. Intelligence network and mobility of the Forest

Staff needs to be improved in all the divisions. As per the Forest Department assessment, relationship with the Police was good in controlling wildlife offences.

xvi) Human – elephant conflict

a) Human deaths and injuries by elephants: In Mahanadi ER as a whole, 37 human deaths and 13 cases of human injury caused by elephants were reported during the period 1999-2000 to 2003-04. Of the 37 deaths, 12 deaths occurred in Dhenkanal Forest Division. Seasonal occurrence of these incidents indicates that 20% were in the month of January, when crops were harvested.

b) Crop damage by elephant: During the last five years elephants damaged 4,509.86 acres of paddy crop in these Forest Divisions (for Angul FD 3 years data was available and for Athamllik only one-year data was available). Average yearly damage in these Forest Divisions was 1,372 acres, which needed compassionate amount payment per year. It was also observed that claims for relief lodged with the Forest Department were more often than not, determined by local awareness of the people, gravity of the damage, proximity of the forest office, and relief payment for damage in previous crop seasons.

c) House damage by elephant: During the last five years, elephants damaged 24 houses in these Forest Divisions. According to the Departmental staff, elephants damaged houses as they were attracted to the brewing of country liquor inside the houses.

ELEPHANT CONSERVATION PRIORITIES / RECOMMENDATIONS

1. Mapping and assessment of vegetation types and corridors in the ER is required.
2. Monitoring of population structure, density, and movement pattern has to be undertaken.
3. Demarcation of and legal protection to the identified corridors is to be carried out.
4. Identification of crossing points on National Highways and proper protection to such crossing points. Priority should be given to ground verification and providing legal status to the corridors. Two corridors linking Godabolua and Saptasajya RF and Saptasajya and Matiamundia RF need immediate augmentation and protection. Crossing points on the irrigation canals also need to be identified.
5. Mitigation of Human – elephant conflict, particularly human death and injury, and crop damage cases, should be given priority.
6. Monitoring of irrigation canal system and elephant movement and crop raiding pattern need to be carried out.
7. A separate management plan for Mahanadi ER is very important. Except Athmallik FD, working plans for all the territorial divisions have to be prepared / approved. Management plans for the Sanctuaries have also to be prepared/ approved. In Satkosia Wildlife Division, the practice of monoculture plantations of exotic teak, conforming to previous working plans, should be replaced with natural regeneration.
8. In Athgarh FD, the right bank canal of Samal village from Tigria to Narsinghpur should be considered as the southern boundary of the ER. In Dhenkanal FD, Dhenkanal town should be kept out of the ER area, and the Bumpa RF boundary should be considered as the northern boundary of the ER.
9. Actual fund requirement and allotment for managing the ER is not known, hence budgeting should be carried out under micro-management plan. A compassionate amount of Rs 25 lakhs, needed annually for crop damage and human death by elephants should be made available with the nodal officer of the ER. Special funds also should be made available for the restoration of corridors.

CONCLUSIONS

Mahanadi Elephant Reserve has a relatively large area and is less disturbed, with its 450 elephants being distributed mostly in continuous forest patches. The habitat is linked to three other elephant reserves. Regular population monitoring, mapping and mitigating human elephant conflict by bringing vulnerable areas under Elephant proof trench (EPT), electric fencing or stone wall construction (depending on the need or the efficacies of the methods), and restoration of corridors, could be the management targets for the reserve for next ten years.

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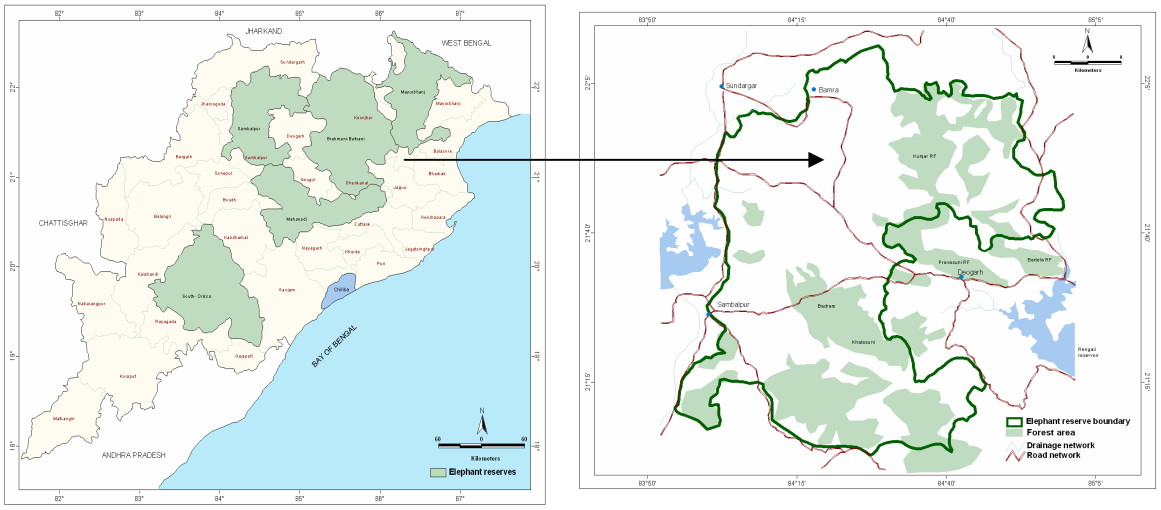
Chapter 3 Sambalpur Elephant Reserve (SPER) in Orissa, India**:** Population status, conservation and management of Asian elephants (*Elephas maximus*)

Profile

Name of the reserve: Sambalpur Elephant Reserve



Latitudes: 21º 03’ to 22º 11’ N
Longitude: 83º 55’ to 84º 59’ E

Total area: 8,385 km^2
Forested area: 3,034 km^2

Geography: Situated between Brahmani and Mahanadi rivers, has flat cultivated land and mountains, mountains are divided into two compact masses of hill blocks by Kharla and Saplata valleys

Altitude: Ranges from 150 to 808 m MSL (except river bed)

Rainfall: 1,323 to 1,655 mm
Water sources: Brahmani and Tikara rivers, tributaries of Bhedan river and Hirakud reservoir

Major vegetation types: North Indian Moist Deciduous and Dry Deciduous forests

Elephant density: 0.14/km^2
Adult male to female sex ratio: 1:2.9

Significance / Conservation issues

i) Sambalpur has relatively large habitat and relatively less fragmented forests.

ii) It has two compact areas under protected area network covering 420 km^2. Although the forests in territorial Forest Divisions (T) are fragmented, the forest patches are close to each other, giving a scope to consolidate the habitat.

iii) The density of human population is relatively low.

iv) The ER holds a population of about 450 elephants and about 3,000 km^2 of forested area is available to them.

v) The forest is dominated by Dry and Moist Deciduous, and it is relatively less disturbed.

vi) Elephant poaching is relatively less and officially only one case has been reported from the years 1999-2000 to 2003-04.

vii) Crop damage by elephants is relatively high, with about 6,000 acres being damaged in five years. About 4,000 people received compassionate relief, 42 cases of human deaths occured and 6 cases of injuries were reported during last five years.

viii) Double cropping of paddy is practised, resulting in crop damage problem round the year. Peak crop damage months are from December to January.

ix) Mining problem is relatively less and only the ER's fringes have reported the problem. If not monitored , it may have a negative impact on the elephant habitat.

Conservation priorities

i) A boundary demarcation of the reserve has to be carried out.

ii) Habitat quality and suitability mapping including different land-use pattern needs to be done.

iii) Regular elephant census programme and equipping forest staff on methodology along with long term monitoring needs to be organised.

INTRODUCTION

The Sambalpur Elephant Reserve (SPER) is in the western part of the State and situated on the left bank of the river Mahanadi. Initially, known as Badrama-Khalasuni ER, its name was later changed to Sambalpur ER with an extension of area (from 427 km^2 to 8,386 km^2). The habitat here is mostly contiguous with relatively good regeneration, and forest type is dominated by Dry Deciduous (with Sal) and Bamboo. According to census estimates, elephant numbers have increased from 262 (1979) to 512 (2002) i.e., the numbers almost doubling by 2002. Currently, about 500 elephants have been reported for the 3,000 km^2 forest area. Considering the viability of the area for elephants, the Government of Orissa notified the Elephant Reserve in the year 2002. Given its ranging behaviour and present rate of population increase, the extension of area from 427 km^2 to 8386 km^2 is a crucial input for long-term conservation of elephants in the region.

Location

The Sambalpur Elephant Reserve (SPER) is situated approximately between 21º 03' to 22º 11' N latitude, and 83º 55' to 84º 59' E longitude. It is spread over the civil districts of Sundargarh, Jharsuguda, Sambalpur and Deogarh (Figure 3.1). The names of the Territorial Forest Divisions (T) and Wildlife Division (WL) along with their Forest Ranges under the Elephant Reserve are given in Tables 3.1 and 3.2. The major towns located within SPER are Sambalpur, Jharsuguda, Rairakhol, Bamra and Bonai.

Table 3.1: Forest and Wildlife Divisions within SPER

Forest / Wildlife Divisions	Presence of WLS	Area within SPER - km^2	RF + PRF within ER - km^2	Average rainfall - mm
Bonai (T) – 1948)	Nil	1,644.36	693.56	1,655.90
Bamra (WL) – 1950 (T), 2003 (WL)	Khalasuni WLS (1982) & Badrama WLS (1987)	2,642.25	1,004.76	1,350.00
Sambalpur (N) – (2003)	Nil	749.00*	63.35	1,323.01
Sambalpur (S) – (2003)	Nil	2,100.00*	495.00*	1,325.54
Rairakhol (1948)	Nil	1,250.00	778.02	1,315.80
Total		8385.61	3,034.69	

* = approximate area needing further ground verification
(Establishment year is shown within parenthesis)

Table 3.2: Forest Divisions and their Ranges

Forest Division	Forest Range
Bonai (T)	1. Bonai, 2. Sole, 3. Tamara, 4. Jarda
Bamra (WL)	1. Bamra, 2. Kuchinda, 3. Jamankira, 4. Badrama, 5. Khalasuni.
Sambalpur North (T)	1. Kolabira, 2. Bagdihi, 3. Jharsuguda.
Sambalpur South (T)	1. Rengali, 2. Padibahal, 3. Sambalpur Sadar, 4. Dhama, 5. Ulunda.
Rairakhol (T)	1. Girishchandrapur, 2. Naktideul, 3. Rampur, 4. Charmal, 5. Mochibahal.

Approaches to the ER

National highway 6 runs through the middle of the ER; NH 42 runs through the southern boundary of the ER, and Sambalpur-Rourkela state highway runs through the western and northern boundary of the ER. Major railheads are Rourkela, Bamra, Jharsuguda, Sambalpur and Rairakhol.

History

The Government of Orissa notified the "Sambalpur Elephant Reserve" in the year 2002. At the time of notification its area was only 427 km^2. The present perspective plan is for its extension to an area of 8,385 km^2. Within the notified ER there are two Wildlife Sanctuaries both situated within Bamra Wildlife Division. The year of establishment of these WLSs and that of the Forest Divisions are given in Table 3.1.

Significance of the reserve for conservation

The area is used by elephants for their movement from Mahanadi ER to Baitarani ER and further to Jharkhand State to the North of Orissa. The forest cover is mostly contiguous. This ER holds 28% of Orissa's elephant population and serves as the main passage between Baitarani and Mahanadi ERs.

TERRAIN

Geography

Sambalpur Elephant Reserve is situated between Brahmani and Mahanadi rivers in the civil districts of Sundargarh, Jharsuguda, Sambalpur and Deogarh (Figure 3.1). In Bonai FD, on the right bank of the river Brahmani there is flat cultivated land with varying width from 5 to 15 km. The remaining area is mountainous, divided into two compact masses of hill blocks by Kharla and Saplata valleys. The hill ranges rise gradually to a height of about 762 m MSL. The principal peak is Baghbindha at 808 m MSL. In Bamra Wildlife Division, the forest areas are hilly, with the hills situated on the southern side having a south-east to north-west direction. The north-west group of hills forms the northern boundary of the Kuchinda plains; these are an extension of the Bonai hill ranges, and have a general direction of north-west to south-east. In Sambalpur FD (both North Sambalpur and South Sambalpur) east of the river Mahanadi, there is plain cultivated land which is an extension of the Bargarh plain. From these flat cultivated lands, isolated and broken chains of steep hills rise abruptly and extend to about 40 km to the north, east and south of the Sambalpur town. The direction of the hill ranges is generally north–west to south-east in the north, and north-east to south–west in the south of the town, forming an approximate semi-circle in the south-east along the common boundary of Rairakhol Forest Division. In Rairakhol FD, the section of ER lying between river Tikra and NH 42 is a continuous stretch of hill ranges with scattered valleys. Most of these areas are undulating and the highest peak lying in Landakot RF is Taljharan at 609 m MSL.

Geology

The area belongs to the Archaean super group, Cuddapah system of Precambrian age and Gondwana super group. In the Precambrian age newer Dolorite, Kolhan series and Unconformity Singhbhum granite Iron Ore series are found.

Climate

Three distinct seasons are experienced: a very hot summer, well-distributed rains during monsoon season, followed by a distinct cold season. Summer begins in early March and continues up to the second week of June. Rainy season ensue thereafter and continues till the

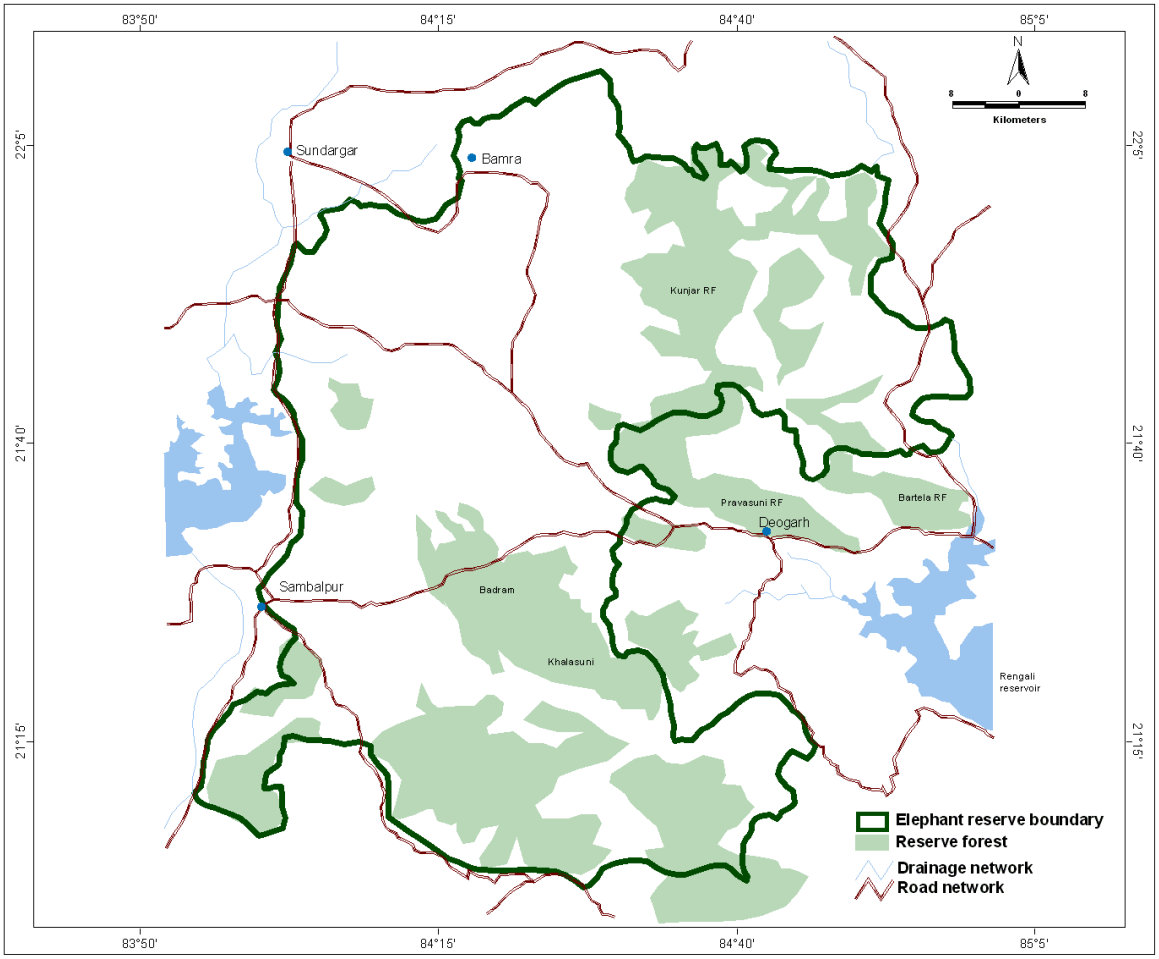


Figure 3.1: Map showing Sambalpur Elephant Reserve

end of September. October and November constitute the post monsoon months. Winter starts from November and lasts till the end of February. The average rainfall in the forest divisions of this ER is given in Table 3.1. Maximum rainfall occurs during the months of July and August. The number of rainy days varies between 73.9 at Sambalpur to 77.7 days at Rairakhol (information was available only for these two places). The average mean monthly temperature at Sambalpur varies between 13.5 ºC minimum in December to 40.2 ºC maximum in May. The mean annual humidity at Sambalpur is 68.8%, with the minimum mean monthly humidity being 49% in April and the maximum being 85% in August.

River system and water sources

In Bonai FD, the river Brahmani divides the Sambalpur and Baitarani Elephant reserve. It flows from north to south through the middle of the Division. From SPER it receives Kantangmurah and Rukhura nallahs, which dry up during summer. In Bamra FD, no major perennial river is present. The northern portion of the Bamra FD is drained by Lohranga nallah and the middle portion by the tributaries of Bhedan River. All these finally drain into the Hirakud reservoir. The southern portion of the Bamra division is drained by the perennial Tikra River. The ER area of Sambalpur North Division is mainly drained by Bhedan River. Another perennial river in the Sambalpur North Division is IB draining into the Hirakud reservoir, which is on the border of the ER. In Sambalpur South FD, the Mahanadi river and the irrigation canal system of the Hirakud Reservoir are the main sources of water. In Rairakhol FD the river Tikra forms the northern boundary of the division, which flows to the

river Brahmani. The southern boundary of the division is the river Mahanadi. Malati, Harihar, Surubali and Karandi jhors, all drain to the river Mahanadi. Water availability is very scanty during the hot summer and is restricted to very small shallow pools in the nallah / riverbeds. The Hariharjore irrigation reservoir on the south of the ER and river Mahanadi and Hirakud reservoir on its west, are within the contiguous range of the elephant habitat. In Sambalpur South FD, irrigation channels from Hirakud reservoir serve as a major source of water for both humans and elephants.

Land use pattern

The total area of RF and PRF / DPF is about 34% of the total geographical area of the Forest Divisions. All irrigated lands are under double cropping. Shifting cultivation is present only in very small areas of Deogarh district portion of the ER. Land utilization pattern information collected from the District Statistical Handbook for 2000-2001 is given in Table 3.3. This estimate excludes urban area, Reserve Forests (RF), Protected Forests (PF / PRF), Project area, Hill blocks, and Villages submerged under the river.

Table 3.3: Percentage of approximate area under different uses

Land under different uses	Percentage of land (%)
Forest area	29.19
Miscellaneous crops and groves not included in net area sown	0.77
Permanent pasture / grazing lands	5.01
Cultivable waste	5.17
Land put to non agricultural use	9.75
Barren / un-cultivable land	1.98
Current fallows	8.33
Other fallows	5.24
Net area sown	34.56

DISTRIBUTION AND LEGAL STATUS OF FORESTS

Distribution of Elephant Reserve areas within the Forest Divisions and the available legally Protected Forest Areas are given in Table 3.4.

Table 3.4: Distribution of ER areas within the Forest Divisions

Forest Division	Geo. area of the FD km^2	Forest area under Different categories – km^2			Geo. area within SPER km^2	RF+ PRF within ER km^2
		RF	PRF	DPF		
Bonai	2,934.21	1,028.95	341.05	58.81	1,644.36	693.56
Bamra	2,642.25	733.81	270.95	Nil	2,642.25	1,004.76
Sambalpur (N)	2,081.00	31.33	96.78	25.51	749.00*	63.35
Sambalpur (S)	2,687.00*	574.84	Nil	Nil	2,100.00*	495.00*
Rairakhol	2,223.00	1,068.87	Nil	103.81	1,250.00	778.02
Total	12,567.46	3,437.80	708.78	188.13	8,385.61	3,034.69

* = area given is approximate, RF= Reserve Forest, PRF= Proposed Reserve Forest, DPF= Demarcated Protected Forest

VEGETATION TYPES

Forest types within the reserve can be classified based on Champion and Seth, and they belong to the following types.

Sub-group 3C – North Indian Moist Deciduous Forests

1. Type – 3C/C2 – Moist Sal Bearing Forest
    i) 3C/C2e Moist Peninsular High Level Sal
    ii) 3C/C2e Moist Peninsular Low Level Sal
    iii) 3C/C2e Moist Peninsular Valley Sal
2. Type – 3C/2S1 – Northern Secondary Moist Mixed Deciduous Forest

Sub-group 5B – Northern Tropical Dry Deciduous Forests

1. Type – 5B/C1 – Dry Sal Bearing Forests
    i) 5B/C1c Dry Peninsular Sal
2. Type – 5B/C2 – Northern Dry mixed Deciduous forests
3. Type – 5B/E9 – Dry Bamboo Brakes

Density of forest cover

District wise density of forest cover as a whole (km^2) is given in Table 3.5 and shows percentage density of different types of forests available to the elephants (FSI, 2001)

Table 3.5: District wise density of forest cover (area and %) showing different density type of forests available to elephants

District	Dense Forest		Open Forest		Scrub		Total	
	km^2	%	km^2	%	km^2	%	km^2	%
Sundargarh	2,625	60.0	1,471	33.4	275	6.3	4,371	100
Jharsuguda	107	34.6	169	54.7	33	10.7	309	100
Sambalpur	2,291	68.2	998	29.8	64	2.0	3,353	100
Deogarh	781	57.0	577	42.0	12	1.0	1,370	100
Total	5,804	61.7	3215	34.2	384	4.1	9,403	100

LEGAL AND MANAGEMENT STATUS

Ownership of lands

Out of the total 8,385.61 km^2 area proposed for the Sambalpur Elephant Reserve, revenue land (agricultural lands, human habitation and other types of forests) accounts for 5,350.92 km^2 or 64%. It includes all other types of forests, except RF & PRF. Forest department owned land (RF + PRF) constitutes 3034.69 km^2 or 36% of the area out of which 420.03 km^2 is under Sanctuaries. Table 3.6 gives a summary of the WLS area for each land type.

Table 3.6: Details of WLS area and villages within SPER

Wildlife Sanctuary	Area km^2	Core area km^2	No. of villages within the sanctuary
Khalasuni WLS (Bamra WL)	116.00	34.00	3
Badrama WLS (Bamra WL)	304.03	80.53	21
Total	420.03	114.53	24

There are 24 villages situated within the sanctuary areas. In Khalasuni WLS, out of three revenue villages, two villages have voluntarily shifted out. In Badrama WLS, around 4,198 people live in 21 villages.

Core area available for elephants

There are two sanctuaries located within the reserve. Depending on their status and location, it could be treated as a core area for elephants. Presently, as per a government order, there is no occurrence of timber harvesting. There are only 22 villages situated within the sanctuary area now.

Status of working and management plans

The status of working / management plans for the 5 divisions under this reserve is given in Table 3.7. Except for one division, the time period of the working plans has expired for all the Divisions. For Sanctuaries, management plans are being prepared for the first time. Like other ERs, the working and management plans have no specific management goals for elephants. In the present system, only wildlife (over lapping) working circle is present.

Table 3.7: Status of working and management plans

Forest Division	Status of plan	Period from	Period to	Extended up to	Remarks
Bonai	Working Plan	1997-98	2016-17	–	Valid
Bamra	Management Plan	–	–	–	New plan under preparation
Sambalpur (N)	Working Plan	1990-91	1999-2000	Not extended	New plan under preparation
Sambalpur (S)	Working Plan	1990-91	1999-2000	Not extended	New plan under preparation
Rairakhol	Working Plan	1982-83	2001-2002	Not extended	New plan under preparation

EXISTING CONSERVATION INITIATIVES

The State Government has already notified 427 km^2 under Elephant Reserve, which includes both the Wildlife Sanctuaries. Bamra Territorial Forest Division was re-organised into Bamra Wildlife Division in 2003.

ELEPHANT POPULATION

Elephant population and trend

A total of 491 elephants were estimated for the reserve during the 2002 elephant census (Forest Department, 2004). The waterhole count technique was adopted and the censuses were carried out in the pinch period, when elephants concentrated around water resources and cover (shade), which is found in plenty within the sanctuary area of the ER. The census figures for Bonai FD cover both the portions under SPER and BER. After the 1979 census, Athmallik FD was carved out from Rairakhol FD. In 2003, Khalasuni was taken out from Rairakhol Division and added with Bamra Division. Going by the elephant numbers, there has been an increase in reported elephants. Table 3.8 summarises the results of census operations carried out in these divisions since 1979.

Forest range-wise elephant distribution

Elephants are distributed in 12 ranges of the reserve, and numbers reported in these ranges are presented in Table 3.9.

Table 3.8: Details of elephant number for various years in SPER

Forest Division	Forest area (RF+PRF) of ER km^2	Year of census				Details of 2002			
		1979	1999	2002	2002 in SPER	M	F	Young	Calf / Sex unknown
Bonai	693.6	25	53	82	67	15	40	–	27
Bamra	1,004.8	179	183	201	303	45	123	–	33
Sambalpur (N)	63.3	7	54	64	58	20	22	–	22
Sambalpur (S)	495.0								
Rairakhol	778.0	51	170	165	63	25	93	–	47
Total	3,034.7	262	460	512	491	105	278	0	129

M= Male, F= Female.

Table 3.9: Forest Range-wise elephant number for SPER

Forest Division	Range	Male		Female	Calf / Young / Sex unknown	Total
		Tusker	Makhna			
Bonai	Sole and Jarda	7	1	22	10	40
	Tamra	3	Nil	9	15	27
Bamra	Bamra	3	Nil	5	1	9
	Badrama	25	Nil	116	32	173
	Kuchinda	8	Nil	10	1	19
	Khalasuni	21	Nil	63	18	102
Sambalpur South	Sambalpur Sadar	8	Nil	7	14	29
	Dhama	8	Nil	10	5	23
	Rengali	3	Nil	1	2	6
Rairakhol	Charmal	3	Nil	21	21	45
	Rampur	3	Nil	9	6	18
Total		92	1	270	128	491

Elephant density and age-group distribution

Estimated elephant density in the 'SPER' is 0.14/km^2 of forests [Bonai 67 + Bamra (WL) 303 + Sambalpur (S) 58 = 428, these elephants were within the forest area counted (RF + PRF 3034.69km^2)]. Table 3.10 summarises the range wise numbers.

Table 3.10: Details of Forest Range wise elephant numbers

Forest Division	Range	Up to 4' (Calf)			4' to 5' (Juvenile)			5' to 7' (Sub-adult)			7' & above (Adult)			Extra adult unattached			Total
		M	F	Us	M	F	Us	M	F	Us	M	F	Us	M	Mk	Us	
Bonai	Sole & Jarda	–	–	5	–	3	2	–	7	3	7	12	–	–	1	–	40
	Tamra	–	–	–	–	–	3	–	–	–	3	9	12	–	–	–	27
Bamra	Bamra	–	–	1	–	–	–	–	–	–	3	5	–	–	–	–	9
	Badrama	–	–	22	1	8	–	6	34	–	17	74	–	1	–	10	173
	Kuchinda	1	–	–	–	–	–	2	7	–	5	3	–	1	–	–	19
Total		1	–	28	1	11	5	8	48	3	35	103	12	2	1	10	268

Age-group distribution of only two Divisions was available for 2002 census (Table 3.11). In the 1999 census, adult male female ratio was 1**:**2.58 and the same ratio for sub-adults was 1**:**3.46 (in the sub adult class, 26 were of unknown sex). The ratios for the 2002 census was

1:2.71 for adult (22 unknown sex) and 1:6 for sub-adult (3 unknown sex). In the sub adult group, "unknown sex" animals play a vital role in determining the sex ratio.

Table 3.11: Age-group distribution for 1999 census for SPER

Forest Division	Up to 4' (Calf)			4' to 5' (Juvenile)			5' to 7' (Sub-adult)			7' and above (Adult)			Extra adult unattached			Total
	M	F	Us	M	F	Us	M	F	Us	M	F	Us	M	Mk	Us	
Bonai	–	–	12	–	–	1	1	4	3	8	21	–	3		–	53
Bamra	–	–	16	–	–	18	10	32	14	19	74	–	–		–	183
Sambalpur(N) and (S)	–	–	5	–	–	5	2	7	9	7	16	–	3		–	54
Rairakhol	2	8	16	6	9	14	11	40	–	17	44	–	3		–	170
Total	2	8	49	6	9	38	24	83	26	51	155	–	9	–	–	460

M= Male, F= Female, Us= Sex un-known, Mk = Makhna, '–'= Nil.

Seasonal distribution and movement of elephants within and outside ER

No detailed information on seasonal movement of elephants is available, although during the paddy-harvesting season, they spread out from the ER area to other Forest Divisions like Sundargarh, Rourkela and Deogarh. There is a regular movement of elephants between this ER and Jharkhand State as also between Baitarani and Mahanadi ERs. From the south bank of the river Mahanadi, a herd of 96 elephants migrated into this ER area during 1996 (Sar & Lahiri Choudhury, 2002c).

Elephant corridors

The list of elephant corridor reported here is based on the information given by the Divisional Forest Offices.

Forest Department identified six corridors in the ER area, which are as follows:

i) Badrama – Binjipali – Mendhabahal – Kolabira.
ii) Badrama – Pravasuni – Khajuria – Betjharan – Bandhabar – Bamra.
iii) Badrama – Meghapal – Jujumara – Dhama.
iv) Khalasuni – Naktideul – Kansar.
v) Bandhabar – Mahuldiha – Majurdima.
vi) Khajuria – Majurdima – Kunjar.

CONSERVATION PROBLEMS AND ISSUES

i) Encroachments

Compared to South Orissa ER, encroachment of forestlands is not a major problem here. However, in many places encroachment of village forest / khasra is rampant. Encroachment figures available for each Forest Division are given in Table 3.12.

ii) Illicit felling

Illicit felling cases in different FDs of the reserve vary from 1500 to 3150 cases per year. North and South Sambalpur divisions appear to have more problems regarding this issue.

Average forest offence cases booked in different Forest Divisions during 1999-2000 to 2003-04 are given in Table 3.13. There are about 10,000 cases reported every year for SPER.

Table 3.12: Details of encroachments in SPER

Forest Division	Pre-1980 encroachment		Post-1980 encroachment		Total encroached area (ha)	% of forest encroached
	No.	Area (ha)	No.	Area (ha)		
Bonai	132	80.89	1968	857.97	938.86	*
Bamra	1	0	42	17.20	17.20	0.01
Sambalpur (N)	0	6.98	0	0	6.98	0.02
Sambalpur (S)	0	0	0	0	0	0
Rairakhol	7	13.35	251	138.51	151.86	0.09

* Only revenue forest encroached.

Table 3.13: Reported cases of illicit felling

Forest Division	Average* no. of cases / year
Bonai	3,139
Bamra	2,079.4
Sambalpur (N) and (S)	3,150.4
Rairakhol	1,526.2

*= from 1999-2000 to 2003-04

iii) Mining activity

Mining activity is mainly restricted to the Bonai FD, and majority of the mines are in Baitarani Elephant Reserve. However, mining related activities like ore crushing plants, transport of ore, settlement of labour force, etc., affect both the ERs. At present there are seventeen sponge iron factories under construction in Bonai FD, and some are in the SPER area. Details of mines in different FDs are given in Table 3.14.

Table 3.14: Details of mines in different Forest Divisions of ER

Forest Division	No. of mines	Area (ha)
Bonai	58 working	9,933.68
	70 not working	13,572.22
Bamra	0	0
Sambalpur (N)	0	0
Sambalpur (S)	1	59.16
Rairakhol	0	0

iv) Irrigation projects

From Hirakud reservoir a network of irrigation canals spreads over the Sambalpur South FD. Rukura Minor Irrigation Project (MIP), Badjhore MIP and Suna nalla MIP of the Bonai FD are situated in the ER. The Hatia MIP is in Sambalpur North FD. The presence of minor irrigation projects have attracted elephants to the water and irrigated crop fields.

v) Roads and railways

National highway 6 runs through the centre of the SPER, and NH 42 almost forms the southern boundary of SPER. Apart from these two NHs, the major State highways are Bamra–Deogarh road, Sambalpur–Dhama road and Sambalpur–Jharsuguda road. The

Sambalpur–Jharsuguda railway line constitutes the western boundary of the ER in most areas. The Sambalpur–Talcher railway line, parallel to NH 42, runs through the ER on the south. The Jharsuguda–Rourkela railway line on the north runs through the ER part of Sambalpur North Forest Division and Bamra WL Division. As reported by the Divisional Forest Office, from 1999-2000 to 2003-04, there was no accidental death of elephants on these railway lines. However, earlier reports indicate that the railway line between Jharsuguda and Rourkela is accident prone to elephants.

vi) Industrial establishments

In Bonai Forest Division, apart from SAIL factory's establishment there are many ore crushing plants. As mentioned earlier, seventeen sponge-iron factories are presently under construction. In Sambalpur North Forest Division, L&T factory stands on the border of the ER. Bhusan Steel Factory is coming up in Sambalpur South FD. The effect of these industrial establishments on the Elephant Reserve is yet to be assessed.

vii) Tea and coffee cultivations

There was no tea or coffee cultivation within the SPER.

viii) Monoculture plantations

Out of the total area planted 2.42% was under Teak monoculture. The total area of plantation (in ha.) during the years 1999 – 2004 for each FD is given in Table 3.15.

Table 3.15: Details of plantations in different Forest Divisions of SPER (area in Ha)

Forest Division	1999-00	2000-01	2001-02	2002-03	2003-04	Total	Teak mono.
Bonai	26.72	–	550.00	405.12	–	981.84	NA
Bamra	40.00	–	280.00	50.00	50.00	420.00	NA
Sambalpur North	–	–	–	32.40	165.00	197.40	130.00
Sambalpur South	–	1,150.00	630.00	864.49	591.86	3,236.35	NA
Rairakhol	–	550.00	460.00	150.00	200.00	1,360.00	50.00
Total	66.72	1,700.00	1,920.00	1,502.01	1,006.86	6,195.59	180.00

ix) Human population

The census data of 2001 for human population and number of inhabited villages present inside the Elephant Reserve has not been incorporated in the management plan. However, district level percentage of Scheduled Tribe (ST) and Scheduled Caste (SC) are given in Table 3.16.

Table 3.16: District level percentage of Scheduled Tribe (ST) and Scheduled Caste (SC)

District	Forest Division	% of ST	%of SC
Sundargarh	Bonai	50.74	8.78
Jharsuguda	Sambalpur North	31.88	17.15
Sambalpur	Bamra	35.08	17.07
	Sambalpur South		
	Rairakhol		

x) Cattle population and grazing

All villages situated within and around the forests release cattle into the government forests. However, the details on the number of cattle using forest lands are not available with the Forest Department. There is a provision for collection of grazing fees from the concerned persons which could help in monitoring the number. Another issue associated with cattle using forest lands is that, except in sanctuary areas, no regular inoculation program has been undertaken for cattle on the fringe areas of elephant habitat.

xi) NTFP collection

NTFP collection could be one of the major conservation issues, however no details of the list and quantity collected from these forests is available. Except Sal leaves, most of the NTFP items are now collected under the jurisdiction of Gram Panchayats.

xii) Forest fire

Around 7% to 60% of the ground forest growth is being affected by fire annually. villagers set fire to the undergrowth for collection of *kendu* leaves and mohua flower, as well as for hunting of small animals.

xiii) Collection of bamboo

Apart from the Forest Department's regular bamboo working circle, villagers also collect bamboo shoots as vegetable. Bamboo collection not only affects the local economy but also harms the bamboo clumps and their regeneration. The selling of bamboo shoots in dried and chopped condition has to be banned particularly in Rairakhol FD.

xiv) Elephant deaths

Officially a total of 32 cases of elephant deaths have been reported for the period 1999-2000 to 2003-04 for the ER. Out of the 32 cases, 12 were male, 11 female, 6 were calves and details were not available for 3 cases. The number of cases increased from 4 in 1999-2000 to 11 in 2003-04, mainly due to electrocution.

Causes
a) Natural deaths: There were 13 cases of natural deaths, of which two were by sunstroke and two due to disease.
b) Poaching: As per the reports available with the forest departments, there was only one case of poaching.
c) Retaliatory killings – poisoning / electrocution: According to the Forest Department report, 18 deaths were due to electrocution. Of these, 14 cases involved villagers in retaliatory killing and only 4 were by accidental electrocution.

xv) Sensitive areas and mortality trend

During 1999-2000 to 2003-04, 32 out of a total of 512 elephants i.e., 6 % elephant population in the ER died. Electrocution was the major cause of mortality (3.5% of the 512 elephants). Annual mortality rate recorded for this ER is 1.25%. Most sensitive Ranges in terms of elephant mortality are given in Table 3.17.

Table 3.17: Details of sensitive areas for elephant deaths

Forest Division	Sensitive Forest Range
Bonai	Tamra
Bamra	No such sensitive area
Sambalpur (N)	Kolabira
Sambalpur (S)	Sadar, Dhama, Rengali
Rairakhol	Mochibahal

xvi) Status of elephant poaching and its control measures

In Sambalpur South FD, thirteen people have been booked under elephant poaching related cases. No traditional poachers are operating in these areas presently, but they could be operating in the Athmalik and Athgarh areas of the Mahanadi ER. Existing control measures of the Forest Department appear to be adequate, particularly by the Sambalpur North DFO. Improving the intelligence network and mobility of the Forest Staff always has had its impact. As per the Forest Department assessment in all the Divisions, the relationship with Police was very good in controlling wildlife offences. It should be noted that no ivory market existed in the area.

xvii) Human – elephant conflict

a) Human death and injury by elephants: Forty-two cases of human deaths and 5 cases of human injury by elephants were reported during the period 1999-2000 to 2003-04. Of these, 30 deaths occurred in Sambalpur Forest Division. All human injury cases were from Bonai Forest Division.

b) Crop damage by elephants: From 1999-2000 to 2003-04 elephants damaged 6,322.79 acres of paddy in these Forest Divisions. Major crop damage occurred in Sambalpur FD (62% of the total area) mostly in 14 villages (Figure 3.2). A total of 4,261 persons received the compassionate amount in these Forest Divisions. Double cropping in Sambalpur South Division is one of the main causes for maximum damage.

Figure 3.2: Banana plantation damaged by elephants

c) Property damage by elephants: During the period 1999-2000 to 2003-04 elephants damaged only 46 houses, mostly in Bamra FD (29 nos., 63%). According to the FD staff, house damage was due to brewing of country liquor inside the houses, which attracted the elephants.

CONSERVATION PRIORITIES / RECOMMENDATIONS

1. Boundary description needs to be incorporated for elephant management. The area distribution of ER within its forest divisions is approximate and further ground verification is needed.

2. Apart from the Reserve Forests, Protected Forests, Demarcated Protected forests and Sanctuaries, the available land under forests is 29.19%. This land could be taken up for habitat improvement.
3. A detailed vegetation map for the SPER should be prepared.
4. Scientific monitoring of population trend, sex ratio, population structure, density and movement pattern of elephants is a priority for this ER.
5. Conflict management should get first priority by way of developing effective mitigation measures in double cropping areas of Sambalpur South FD. For this purpose, identifying core conflict areas, viability of existing mitigation measures, and management of existing mitigation measures should be done in collaboration with the villagers.
6. Cases of accidental electrocution deaths indicate that the standards regarding the height of electric lines have been inadequately followed.
7. Status of poaching is not well documented. No metal detectors are in use during the post-mortem of elephants. Experienced doctors are not available particularly for post-mortem of elephants. Pathological and forensic test facilities are absent in the ER area. All these factors need to be considered on a priority basis.
8. Elephants regularly move between SPER and Jharkhand State, and between Baitarani and Mahanadi ERs. From the south bank of the river Mahanadi, 96 elephants immigrated into this ER in 1996. Identification, mapping and demarcation of these routes and reported corridors, and their legal protection should be a priority.
9. Identification of crossing points on Talcher–Sambalpur railway line and establishing some alternatives is a priority. Near Rairakhol, a bridge is currently used by elephant herds and should be protected. Crossing points on NH 42 between Rairakhol–Chamal and Jujomura–Sambalpur also requires protection.
10. Placing speed limits on NHs where elephant crossing points are located is a priority.
11. Sunstroke of elephants was reported in the Badrama WLS area in summer season; this issue has to be taken up seriously for a detailed investigation and for preventive measures.
12. Encroachment of village khasra / forest is rampant and needs ground verification from the Revenue Department.
13. Latest information on cattle population should be included in the management plan. The improvement of cattle breeds and reduction of their numbers in the peripheral villages has to be incorporated in Sambalpur's ER management.
14. Around 49% to 59 % of the human population in the proposed ER area is primarily dependent on the forest resources. Alternative arrangement of resources for their livelihood will be the major challenge for ER managers.
15. Shifting of villages from Badrama Wildlife Sanctuary area needs attention
16. Monitoring of current and future industrial development and its impact is priority.
17. Budgeting for this ER should be under micro Management Plan. Human – Elephant conflict appears to be a growing problem. Cash should be made available with the CF in-charge of SPER for immediate compassionate payment for crop damages and human deaths,. In the budget, non-planned and planned expenditure should match. A vehicle for Bamra Wildlife Division is immediately required.

CONCLUSIONS

Sambalpur elephant reserve has a population of about 450 elephants and approximately 3000 km^2 of legally protected forested area available to elephants. Incidents of crop damage by elephants is high in this reserve due to double cropping and other reasons associated with

regular population monitoring. Developing effective conflict mitigation measures for the worst affected villages of the reserve could be the management targets for the reserve for the next 10 years.

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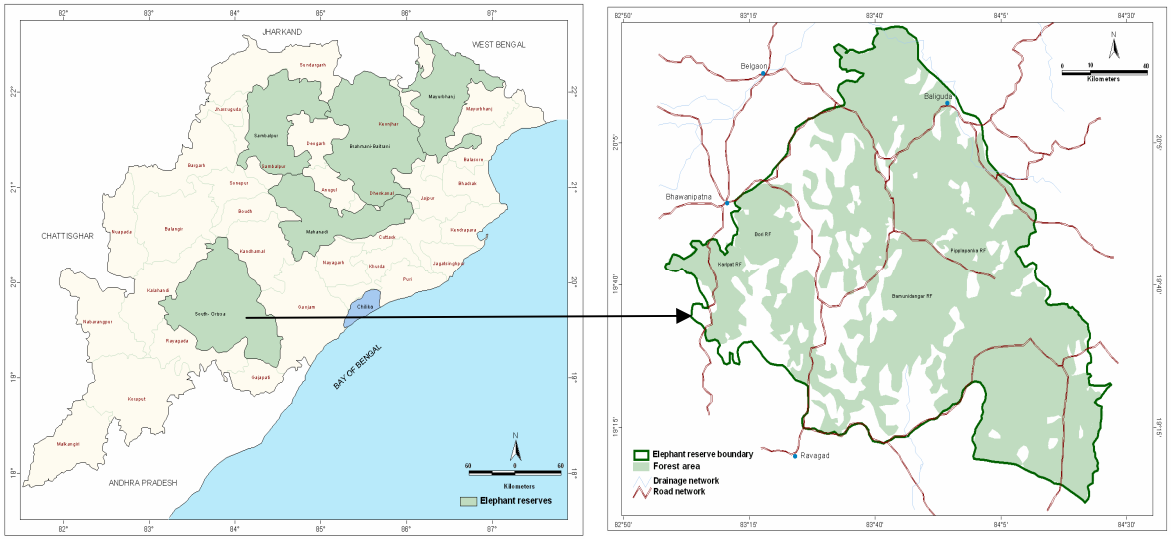
Chapter 4 South Orissa Elephant Reserve (SOER) of Orissa, India (Proposed): Population status, conservation and management of Asian elephants (*Elephas maximus*)

Profile

Name of the reserve: South Orissa Elephant Reserve



Latitudes: 19º 03’ to 20º 27’ N
Longitude: 82º 58’ to 84º 28’ E

Total area: 7,713 km^2
Forested area: 4,216 km^2

Geography: Situated on the Eastern Ghat tracts. The terrain falling within the ER is hilly (locally called Dongerla area)

Altitude: Ranges from 75 to 1,650 m MSL

Rainfall: 1,365 to 1,597 mm
Water sources: Khadaga, Budhanai, Raul and Rushikulya Rivers

Major vegetation types: North Indian Moist Deciduous Forest and Northern Tropical Dry Deciduous Forest

Elephant density: 0.03 km^2
Adult male to female sex ratio: 1:2.19

Significance / Conservation issues

i) The total area available for elephants is relatively larger, but highly fragmented.

ii) There are three protected areas within the Elephant Reserve, but they are located far away from each other.

iii) The largest protected area is 400 km^2 and the smallest is 175 km^2. They are connected only by patches of forests harboring human or development activities in and around.

iv) South Orissa ER and its elephant population are isolated from other Elephant Reserves of Orissa.

v) The region containing 140 elephants is the lowest elephant density region of Orissa.

vi) According to various census estimates, a reduction of elephant numbers of about 60% took place from 1979 to 2002. Elephants move through all regions of the reserve, and are not permanent in any of these locations.

vii) The major forest type in this reserve is Dry Deciduous; shifting cultivation practice is a major problem in these forests not allowing even secondary growth.

viii) Elephant poaching has been a severe problem in recent years. Five tuskers have been poached in 2002 alone.

ix) Human – elephant conflict is relatively less; only 120 acres of crops have damaged by elephants during 2001-02 to 2003-2004 (only 40 acre / year). Unlike other reserves, only single cropping pattern is practiced.

x) Human density is less and mining is not an issue; only 2.5 ha area is under this activity.

Conservation priorities

i) The reasons for 60% reduction in elephant population in this region is not known and needs to be investigated. Shifting cultivation, mono-cultural activities and reduction in overall rainfall could be possible reasons for this. Additionally, disease outbreak, poaching, and natural calamities need to be examined in this investigation.

ii) Exploring the possibility of linking South Orissa ER with Mahanadi ER. For this purpose about 100 km^2 habitat has to be consolidated, and this may be possible seeing that the fragmented forests located between these reserves are not very far from each other.

iii) If a proposal to link these two reserves is not feasible, the elephant population in South Orissa has no viability, demographically.

INTRODUCTION

South Orissa Elephant Reserve (SOER) is a newly proposed ER in the southern part of the river Mahanadi in Orissa State. A major part of the habitat, about 55%, is under legally protected areas and the forest type present in this region appears to be ideal for elephants. However, shifting cultivation (traditionally called *podu*) has been the most important biotic factor that has devastated the forests in the whole region. The cycle time of *podu* has come down drastically (not allowing even the secondary growth) and may have forced the elephants to shift to other places. Or the threat through this practice could have been severe and the elephant population may have declined very sharply during the last 23 years. In the entire south bank of the river Mahanadi the population declined from 675 in 1979 to 243 in 2002, about 64%. There are reports of elephant poaching in this region; however, the current adult male to female ratio suggests that poaching may not have contributed to the decline in elephant numbers. Given this, it is important to note that, although 55% area in this reserve is legally protected, only 10% of the habitat comes under Protected Area network. The prime conservation strategy for the reserve would be to increase the area under Protected Area network, which may improve and increase the quality of habitat available for the elephants.

Location

South Orissa Elephant Reserve is situated approximately between 19º 03' and 20º 27' N latitude and 82º 58' and 84º 28' E longitude. It is spread over the civil districts of Kalahandi, Phulbani, Gajapati and Rayagada (Figure 4.1). Details of the Forest Divisions (FD) along with their area and the status of Protected Area network are presented in Table 4.1. Table 4.2 summarizes the forest ranges within these divisions. The major towns located within SOER are Baliguda and Moniguda. Bhawanipatna and Raigada towns are situated on the border of the Elephant Reserve.

Table 4.1: Forest divisions and the protected area network

Forest Divisions under ER	Presence of WLS within the division	Area within SOER km^2	Legally protected forests available within SOER km^2
Kalahandi (N) (1948)	Nil	519.00	270.45
Kalahandi (S) (2003)	Karlapat (1992)	510.00	350.00
Rayagada (1958)	Nil	400.00	250.00
Balliguda (1938)	Kotagarh (1981)	4,260.00	1,916.00
Parlakhemundi (1965)	Lakheri Valley (1985)	2,024.00	1,430.00
Total		7,713.00	4,216.45

(Establishment year in parenthesis)

Table 4.2: Forest divisions and their ranges

Forest Division	Forest Range
Kalahandi (N) (FD)	1. Madanpur-Rampur, 2. Narla.
Kalahandi (S) (FD)	1. Biswanathpur, 2. Karlapat, 3. Thuamul-Rampur North.
Rayagada (FD)	1. Guduri, 2. Muniguda, 3. Kalyan-Singpur.
Balliguda (FD)	1. Baliguda, 2. Kanjamundi Nuagoan, 3. Simanbadi, 4. Bamunigaon, 5. Kotagarh Sanctuary 6. Tumudibandha, 7. Belghar.
Parlakhemundi (FD)	1. Chandragiri, 2.Ramgiri, 3. Debagiri (R.Udayagiri), 4. Mohana

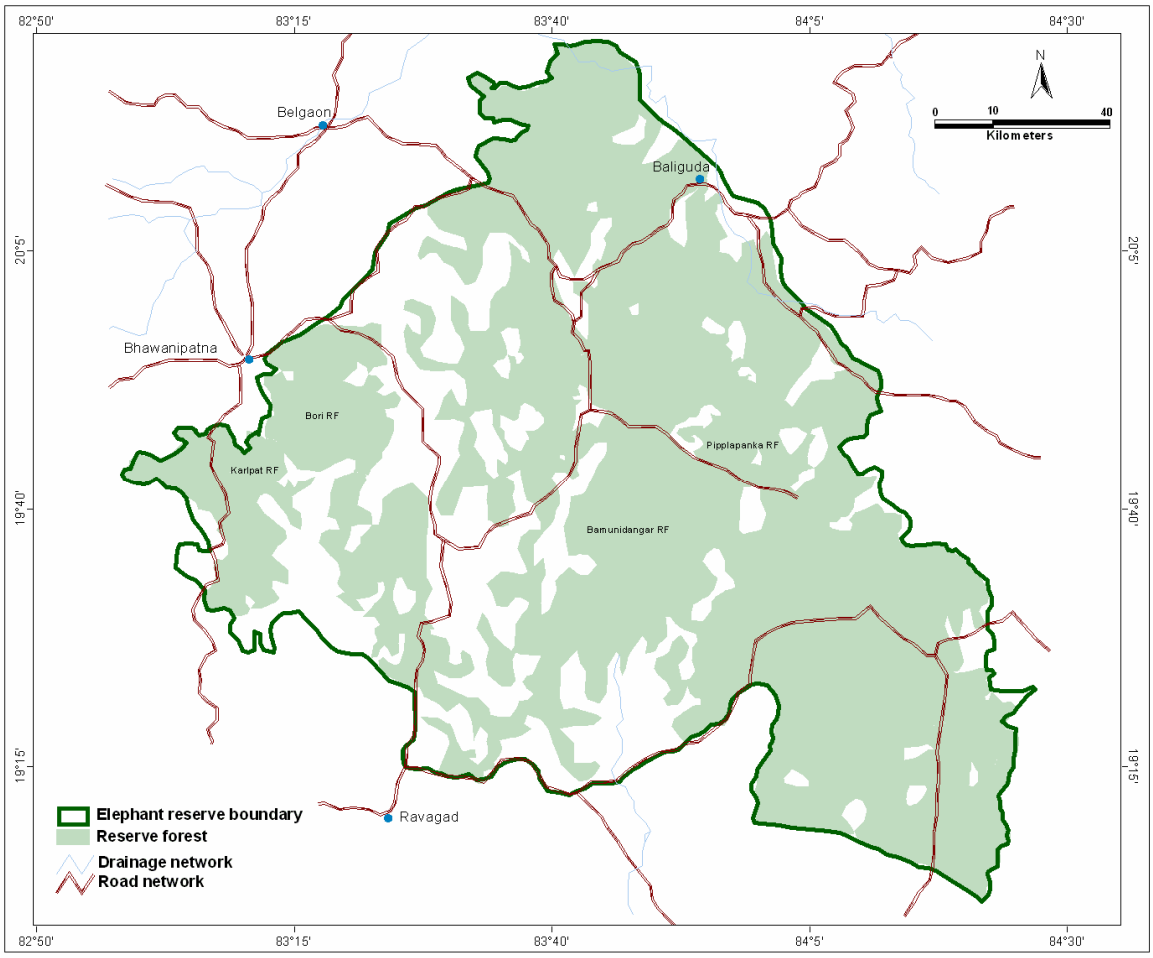


Figure 4.1: Map showing South Orissa Elephant Reserve

Approaches to the ER

Major railheads are Raigada, Moniguda, Kesinga, Berhampur and Palasa. By road, it is connected through Berhampur–Koraput, Bjanjanagar–Baliguda and Jaipur–Bhawanipatna State Highways.

History

SOER is a newly proposed Elephant Reserve in the State. There are three Wildlife Sanctuaries within this ER. The year of establishment of these WLSs and the Forest Divisions is given in Table 4.1.

Significance of the reserve for conservation

This reserve is the southern most distribution of elephant population in eastern India (earlier known as central India). This ER represents 7.6% of Orissa's elephants and the main area for elephants on the south bank of the river Mahanadi. About 25 years ago, the region had more than 600 elephants, and since then its population has reduced by 64%. Declaration and consolidation of viable habitat under an Elephant reserve may improve the habitat quality and increase the number of elephants.

TERRAIN

Geography

The ER is situated on the Eastern Ghat tracts. In the North and South Kalahandi Forest Divisions, the terrain falling within the ER is hilly (locally called *Dongerla* area). There are high plateaus of 300 to 600 m MSL that join the plateau of Balliguda and Rayagada Forest Divisions. Many flat hilltops are present with varying elevations between 1,000 to 1,200 m MSL, locally called "*Malis*". The ground configuration of Balliguda Forest Division is mostly hilly and undulating, where forests occupy the main ridges of the Eastern Ghats. Level slopes are very rare and are confined to the plateaus. Series of plateaus of average heights varying from 610 to 915 m MSL are scattered all over in this FD. The Rayagada FD is situated on the north and north-east corner of the ER. Forested areas are located in the Niamgiri hill ranges. This hill range rises steeply from 300 m MSL to a number of peaks of which the highest is 1,516 m MSL. In Parlakhemundi FD, the forests are mostly situated on the hills varying from 300 to 1,650 m MSL, and the slopes are moderate to steep.

Geology

The ER area is a part of the Eastern Ghats group of rocks of the extensive Archaean tract of peninsular India. It is characterised by a group of high-grade metamorphic rocks like Khondalite, Charnockite and Leptynite of Eastern Ghats (granulite facies). The Khondalite series of rocks are considered to be the oldest in the area and granite gneisses the youngest formations. In many places the top soil with humus has been washed away by repeated shifting cultivation. This has resulted in exposed rocks on hilltops and slopes.

Climate

The general climate of the region is more of the Deccan type than that of the east-coast region. Three seasons are generally experienced here. The hot summer months are followed by monsoon months. Winter extends from December to February. Particularly in Balliguda FD, the climate varies widely between two extremes, more than elsewhere in the State. Winter is very cold during December and January in Daringbadi and Belghar area, while summer is extremely hot in Khamankhol. Annual rainfall of the Forest Divisions (FD) in this ER is given in Table 4.3.

Table 4.3: Annual rainfall for different divisions of SOER

Forest Divisions under ER	Presence of WLS	Normal rainfall in mm/yr
Kalahandi (N) (FD)	Nil	1,378.2
Kalahandi (S) (FD)	Karlapat	1,365.4
Rayagada (FD)	Nil	1,521.8
Balliguda (FD)	Kotagarh	1,597.1
Parlakhemundi (FD)	Lakheri Valley	1,370.0

Maximum rainfall comes about during the months of July and August. The number of rainy days is not available, although it is more in Balliguda and Rayagada FDs and less on the Kalahandi side. Flash floods are quite normal during monsoon and a potential danger to the soil, causing maximum erosion. The mean temperature of this region varies between 23.60 ºC to 27.05 ºC (Statistical Report 1981). However, this temperature range has gone up in the recent years. Information about relative humidity of the area is inadequate. However, this

varies between a maximum of 95% during August / September (Balliguda) and minimum of 27% during February (Bhawanipatna).

River system and other water sources

Drought is common in this area, and for greater part of the year most nallas are almost dry, but during the rains, they become turbulent and water becomes unsuitable for drinking. In the proposed ER area, the rivers Khadaga, Budhanai, Raul and Rushikulya are perennial in Balliguda FD. In Kalahandi FD, the rivers Raul and Indravati are perennial. The impact of the upper Indravati hydro / irrigation project on the ER needs to be assessed, particularly the irrigation canals system. The perennial Vamsadhara flows through the Rayagada FD, and also runs into the Parlakhemundi FD. Apart from these, many small streams exist in the ER but they do not serve as a constant source of water.

Land use pattern

The total area of RF and PRF / DPF is about 29 % of the total geographical area of the Forest Divisions. Apart from the Reserve Forests, Protected Forests, Demarcated Protected forests and Sanctuaries, the available land under forests is 20.45%, Land utilization pattern collected from the District Statistical Handbook for the year 2000-2001 is given in Table 4.4. This estimate excludes urban area, Reserve Forests (RF), Protected Forests (PF / PRF), Project area, Hill blocks, and Villages submerged under river.

Table 4.4: Percentage of approximate area in different uses in SOER

Land under different uses	Percentage of land (%)
Forest Area	20.45
Miscellaneous crops and groves not included in net area sown	0.61
Permanent pasture / grazing lands	2.56
Cultivable waste	3.00
Land put to non Agricultural use	5.54
Barren / Un-cultivable land	22.13
Current Fallows	8.80
Other Fallows	3.36
Net area sown	33.55

DISTRIBUTION AND LEGAL STATUS OF FORESTS

Distribution of various areas under Elephant Reserve within the Forest Divisions and the available legally Protected Forest Areas are given in Table 4.5.

Table 4.5: Forest Divisions and legally protected forests in SOER

Forest Divisions	Geo. area of the FD km^2	Forest area under different categories– km^2			Geo. area within ER km^2	RF+PRF+DPF within ER km^2
		RF	PRF	DPF		
Kalahandi (N) (FD)	4,132.40	826.14	277.19	183.14	519.00	270.45
Kalahandi (S) (FD)	4,064.00	622.89	222.34	217.28	510.00	350.00
Rayagada (FD)	7,073.00	771.62	0	1,147.17	400.00	250.00
Balliguda (FD).	4,260.39	1,031.82	1,185.95	0	4,260.39	1,916.00
Parlakhemundi (FD)	4,983.70	437.52	34.05	91.11	2,024.00	1,430.00
Total	24,513.49	3,689.99	1,719.53	1,638.70	7,713.39	4,216.45

RF= Reserve Forest, PRF= Proposed Reserve Forest, DPF= Demarcated Protected Forest.

VEGETATION TYPES

According to Champion and Seth, the forests of this elephant habitat belong to the following types:

Sub-group 3C – North Indian Moist Deciduous Forests

1. Type – 3C/C2e – Moist Peninsular Sal forest
   - 3C/C2e (i) Moist Peninsular High Level Sal
   - 3C/C2e (ii) Moist Peninsular Low Level Sal
   - 3C/C2e (iii) Moist Peninsular Valley Sal
2. Type – 3/Ds1 – Moist Sal Savannah
3. Type – 3/E1 – Terminalia Tomentosa
4. Type – 3/2S1 – Dry Bamboo Brakes

Sub-group 5B – Northern Tropical Dry Deciduous Forests

1. Type – 5B/C1 – Dry Sal Bearing Forests
2. Type – 5B/C2 – Northern Dry Mixed Deciduous Forests
3. Type – 5D/S1 – Dry Deciduous Scrub

Density of forest cover

The South Orissa reserve has about 48% dense forest cover and about 40% under open forest (Forest Survey of India 2001). District wise density of forest cover as a whole (in km^2) is given in Table 4.6. Also given is percentage density of different forest types available to the elephants.

Table 4.6: District-wise density of forest cover (area and %) showing different density type of forests available to elephants

District	Dense Forest		Open Forest		Scrub		Total	
	km^2	%	km^2	%	km^2	%	km^2	%
Kalahandi	1,161	42.8	978	36.1	569	21.1	2,708	100.00
Rayagada	1,308	39.2	1,425	42.8	601	18.0	3,334	100.00
Gajapati	1,429	51.8	1,123	40.7	205	7.5	2,757	100.00
Kandhamal	3,063	53.1	2,327	40.4	376	6.5	5,766	100.00
Total	6,961	47.8	5,853	40.2	1,751	12.0	14,565	100.00

LEGAL AND MANAGEMENT STATUS

Ownership of land

Out of the total proposed area of 7,713 km^2 for SOER, revenue land constitutes 3,496.94 km^2 or 45.34%, and forest department owned lands account for 4,216.45 km^2 or 54.66% of the total area. Out of the 4,216.45 km^2 of legally protected forests, 749.95 km^2 area is under sanctuaries as shown in Table 4.7. There are 103 villages situated within the sanctuary areas (Figure 4.2).

Figure 4.2: Cultivated land and villagers from villages located within sanctuary

In Lakheri Valley WLS, out of 36 villages six were revenue villages while 30 were encroachments. The main valley portion is encroached by the villagers.

Table 4.7: Status of core area of each Wildlife sanctuary within SOER

Wildlife Sanctuary	Area km^2	Core area km^2	No. of village within sanctuary
Lakheri Valley WLS (P. mundi FD)	174.96	57.87	36
Kotagarh WLS (Balliguda FD)	399.50	NA	65
Karlapat WLS (K. South FD)	175.50	35.51	2
Total	749.95		103

NA= Not available.

Core area available for elephants

There are three Wild Life Sanctuaries within the reserve, which could be treated as core area for elephants, covering only 15% of the total reserve area. It is important to ensure that within the sanctuary areas there is no harvesting of timber. However, there are number of villages situated within the reserve, including sanctuary areas, which may affect the core area of the elephants.

Status of working plans and management plans

It was observed that none of the division-working plans have specific management plans for elephants, and focused only on the overall wildlife status and management. Wildlife focused management plans may have little value for elephant management. The status of working plans for the five forest divisions under this reserve is given in Table 4.8.

Table 4.8: Status of working plans for divisions under SOER

Forest Division	Status of working plan	Period from	Period to	Extended up to	Remarks
Balliguda	Working Plan	1980-81	2000-01	Not extended	New plan under preparation
Parlakhemundi	Working Scheme	1977-78	1996-97	30 .6 .1999	New plan under preparation
Kalahandi (S)	Working Plan	1997-98	2006-07	–	Valid
Kalahandi (N)	Working Plan	1997-98	2006-07	–	Valid
Rayagada	Working Plan	1990-91	1999-2000	Not extended	New plan under preparation

EXISTING CONSERVATION INITIATIVES

As mentioned earlier, SOER has five Territorial Forest Divisions and three wildlife sanctuaries with another wildlife sanctuary still in the proposal stage (Chandragiri WLS). These legally protected areas can be considered as existing conservation initiatives.

ELEPHANT POPULATION

Status of elephant population and trend

A total of 140 elephants are estimated for the reserve (Census 2002). Table 4.9 summarizes the results of the census operation carried out in these divisions since 1979. The results show a decline in the number of elephants reported.

Table 4.9: Elephant numbers estimated in different Forest Divisions of SOER

Forest Division	Forest Area in km^2	Year of census			Details of 2002			
		1979	1999	2002	M	F	Young	Calf
Kalahandi (N)	270.45	60	24	47	13	30	Nil	4
Kalahandi (S)	350.00			14	6	4	Nil	4
Rayagada	250.00	102	10	4	Nil	4	Nil	Nil
Balliguda	1,916.00	54	17	32	11	15	Nil	6
Parlakhemundi	1,430.00	217	86	42	6	26	Nil	10
Total	4,126.45	433	137	139	36	79	0	24

Forest range-wise elephant distribution

Based on the results of 2002 elephant census, elephants were distributed in eight ranges, during summer. The details are as shown in Table 4.10.

Table 4.10: Forest Range-wise elephant numbers

Forest Division	Forest-Range	Male		Female	Calf	Total
		Tusker	Makhna			
Kalahandi (N)	Madanpur-Rampur	13	Nil	30	4	47
Kalahandi (S)	Karlapat	6	Nil	4	4	14
Rayagada	Guduri,	Nil	Nil	4	0	4
Balliguda	Baliguda,	1	Nil	5	2	8
	Katagarh Sanctuary	5	Nil	6	2	13
	Belghar	5	Nil	4	2	11
Parlakhemundi	Chandragiri	3	Nil	17	5	25
	Mohana	3	Nil	9	5	17
Total		36	0	79	24	139

Elephant density and age-group distribution

Estimated elephant density for SOER is 0.03/km^2. The age and sex class distribution is available for only two Divisions and is given in Table 4.11. Adult male to female ratio was 1:6 in these two forest divisions and the same ratio for sub-adults was 1:2.8.

Table 4.11: Elephant age and sex class distribution

Forest Division	Up to 4' (Calf)			4' to 5' (Juvenile)			5' to 7' (Sub-adult)			7' & above (adult)			Extra adult unattached			Total
	M	F	Us	M	F	Us	M	F	Us	M	F	Us	M	F	Us	
Parlakhemundi	0	0	8	0	0	0	11	44	0	2	20	0	1	0	0	86
Balliguda	0	0	2	0	0	0	6	4	0	1	4	0	0	0	0	17

M= Male, F= Female, Us= Sex un-known.

Seasonal distribution and movement of elephants

Like other elephant reserves, during the paddy-harvesting season elephants are known to spread out from the sanctuary area and move within the SOER area. However, detailed information about their movement is not available. According to information collected from the Forest Division offices, the movement of elephants is restricted to Forest Divisions of the SOER.

Elephant corridors

As per forest division records, fourteen corridors have been identified for the reserve, and among all the divisions, the number of corridors identified for Parlakhemundi appears to be the highest. Table 4.12 summarizes the number of corridors for each forest division.

Table 4.12: Identified elephant corridors of different Forest Divisions of SOER

Forest Division	Corridors as mentioned by the Divisional Office
Kalahandi North	Corridor not present
Kalahandi South	Sargiguda RF – Benbhata RF– Niyamgiri RF – Machul RF – Jugsaipatna RF – Karlapat RF – Ghana RF – Singari RF
Balliguda	1) Koatagarh to Daringbadi and bordering Rayagada FD 2) Belghar to Kalahandi district on the north –West 3) Landagam / Khamankhola to Kantamal on the North 4) Godapur to Kotagarh on the South – East. 5) Daringbadi to Nuagaon & Pokharibandha to Phulbani.
Rayagada	1) Corridor – (I) 2) Corridor – (II)
Parlakhemundi	1) Lakhari to Ghodahad 2) Lakhari to Olieda and Jubagaon 3) Jubagaon to Antaraba 4) Antaraba to Gambharigaon 5) Puspango to Parimala 6) Lanjipadar to Bomika.

CONSERVATION PROBLEMS AND ISSUES

Threats to habitat, degradation and fragmentation of forest can be classified under habitat encroachment, illicit felling, mining, irrigation projects, roads and railway lines within the reserve, industrial establishments, and tea, coffee and other commercial plantations. Status and threat by these factors are not well known.

i) Encroachments

Encroachment is a major conservation problem in all the divisions of the ER and details for each Forest Division is given in Table 4.13.

Table 4.13: Status of encroachments in different Forest Divisions of SOER

Forest Division	Pre-1980 encroachment		Post-1980 encroachment		Total encroached Area (ha)	% of forest encroached
	No.	Area (ha)	No.	Area (ha)		
Kalahandi (N)	NA	336.69	NA	258.37	595.06	0.29
Kalahandi (S)	NA		NA	273.71	273.71	
Rayagada	24	21.77	1940	1,599.50	1,621.27	0.57
Balliguda	95	185.02	403	294.98	480.00	0.16
Parlakhemundi Reserve Forest	67	134.5	238	130.53	265.03	0.25
Parlakhemundi Revenue Forest	3491	416.26	Nil	Nil	416.26	

ii) Illicit felling

Illicit felling of trees is a major problem. The division wise details of forest offence cases booked during the last five years are presented in the figure 4.3

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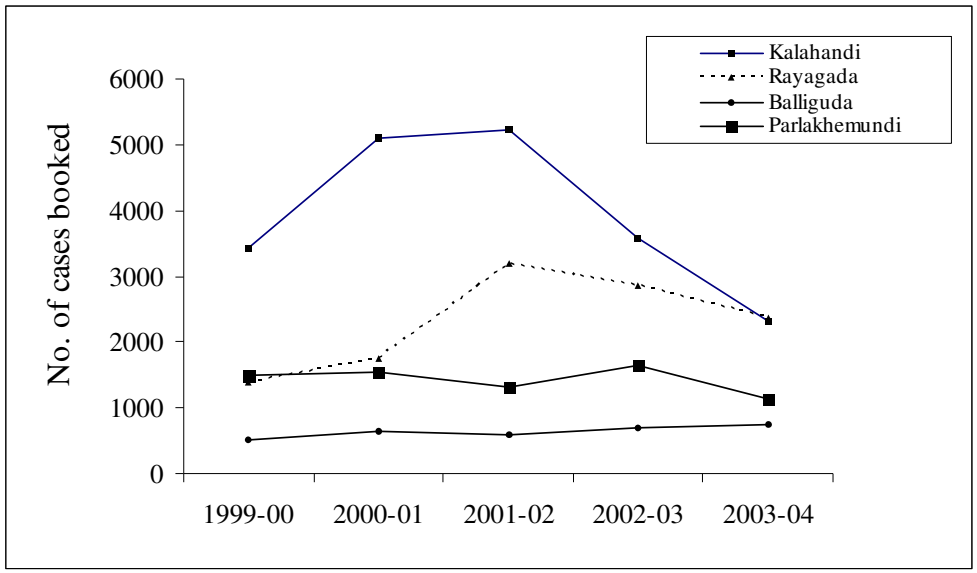

Figure 4.3: Trend of Forest offence cases in different FDs: No. of forest offence cases booked under different forest divisions plotted against different years starting from 1999 April to 2004 March

iii) Mining activity

At present, there is only a 2.5 ha revenue land in Kalahandi North FD under working mines. A new mine based alumina industry of Rs. 4400 crores, namely Vedanta Alumina Ltd., is coming up near Lanjigarh at Kalahandi and Rayagada Forest Division border in Niyamgiri hills, on the border of the ER. Undoubtedly, there will be diversion of forest land for mining purpose and this has to be monitored.

iv) Irrigation projects

A major irrigation project, the Indravati hydroelectric / irrigation project is under progress in the Kalahandi area. Although it is outside the proposed ER area, its impact will be felt on the habitat quality of the Karlapat WLS. Apart from this major irrigation project, there are few medium irrigation projects existing within the SOER. In Rayagada FD these medium irrigation projects are just south of the ER area. In Kalahandi FD, in the Madanpur–Rampur area, a project exists on the fringe of the ER. No major or medium irrigation projects exist in Balliguda and Parlakhemundi FDs.

v) Roads and railway lines

There are only State highways in this ER, though the exact length of the roads in the ER is not known. Rayagada–Sambalpur Railway line runs for approximately 70 km, through the ER. However, there is no history of elephant accidents involving motor vehicles or trains in the reserve area.

vi) Industrial establishments

Food and food processing and light engineering industries have been established within the ER area. One big industry (Vedanta Alumina) is under construction in the border of Kalahandi and Rayagada FDs.

vii) Tea and coffee cultivations

Experimental cultivation of coffee plantation for one to two hectares is seen in Parlakhemundi FD. In the south of the ER in Rayagada FD, a 50 hectare area has been taken up in Gunupur range by the Forest Department for shade plantation of coffee.

viii) Monoculture plantations

The actual area under monoculture plantations is not known. However, total area of plantations during the last five years in each FD is given in Table 4.14. Of this 7.4% was under Teak plantation.

Table 4.14: Status of plantations in different Forest Divisions of SOER (area in ha.)

Forest Division	2000-01	2001-02	2002-03	2003-04	2004-05	Total	Teak Mono
Kalahandi North	2,830	2,305	1,667	1,640	1,020	9,462	1,107
Kalahandi South	1,930	1,085	208	755	1,125	5,103	738
Rayagada	4,852	2,580	1,660	3,055	915	13,062	-
Balliguda	0	500	0	85	0	585	85
Parlakhemundi	0	150	350	400	275	1,175	250
Total	9,612	6,620	3,885	5,935	3,335	29,387	2,180

xi) Human population

Except for Balliguda FD, no other Forest Division has detailed information on human population or number of villages present within the ER. Number of inhabited villages within Balliguda FD was 1,107 and human population was 2,29,029, all 1991 census figures. Demographic distribution of ST and SC population is not available for the area covered by ER, but available for districts involved, as shown in Table 4.15.

Table 4.15: District wise % of ST and SC

District	Forest Division	%of ST	%of SC
Kalahandi	Kalahandi North	28.88	17.01
	Kalahandi South		
Rayagada	Rayagada	56.04	14.28
Phulbani	Balliguda	51.51	18.21
Gajapati	Parlakhemundi	47.88	8.77

x) Cattle population and grazing

Except for Balliguda FD, no other Forest Division has detailed information on cattle population. The cattle population of Balliguda FD was 1,64,646 (1991 census). There is a provision for collection of grazing fees from concerned people from all villages situated within and around the forests, which release their cattle into the government forests. No

regular inoculation program was undertaken for cattle on the fringe areas of the elephant habitat, except near sanctuary area.

xi) NTFP collection

NTFP collection is undertaken from all the divisions and like other reserves, most of the NTFP items are now collected under the jurisdiction of Gram Panchayats, except Sal leaves and gum.

xii) Forest fire

Around 5 to 60% of the ground forest growth is being affected by fire annually. Many people are engaged in charcoal production by burning wood-logs inside the forest; these are used by hotels and house owners.

xiii) Elephant deaths

Various causes such as natural death, poaching, and retaliatory killings (poisoning / electrocution) have been identified. There are about 13 reported cases of elephant deaths from 1999-2000 to 2003-04, of which 7 were adult males; one adult female, 2 calves (one male and one female) and details are not available for 3 cases. Annual mortality of 1.56% was recorded for the ER, including poaching.

Causes

a) Natural deaths: Of the 4 natural deaths, one is adult male, one adult female, one male calf and one female calf.

b) Poaching: Out of the 13 cases of elephant death, 7 were of poaching. From December 2002 to January 2003, five tuskers were poached in Kalahandi North FD. The poachers from northeast used poisoned arrows for killing the elephants. In this connection, 24 persons have been arrested by the forest department, of which six are from Arunachal Pradesh.

c) Retaliatory killings–poisoning / electrocution: In Rayagada FD, a farmer electrocuted 2 tuskers. The tusks have been recovered by the Forest Department.

Figure 4.4 Recovered tusks – indicators of poaching intensity

xiv) Trend and sensitive areas of elephant deaths

From 1999-2000 to 2003-04, poaching was a major cause of death, and over a period of time elephant population has reduced drastically. It also appears that, population reduction has not been caused by poaching of male animals alone. Forest Division-wise sensitive ranges, where elephant deaths have occurred, are given in Table 4.16.

No ivory market exists in the area. However, according to Forest Department sources, people from North-East states and Andhra Pradesh have been involved in ivory poaching with the help of local people. As per the Forest Department assessment in all the divisions, the relationship with Police was very good in controlling wildlife offences.

Table 4.16: Range wise elephant deaths in different divisions of SOER

Forest Division	Sensitive Forest Range
Kalahandi (N)	Madanpur-Rampur
Kalahandi (S)	Biswanathpur
Rayagada	Guduri and Muniguda
Balliguda	Kotagarh Sanctuary and Belghar
Parlakhemundi	Chandragiri

xv) Human – elephant conflict

a) Human deaths and injury by elephants: Five human deaths occurred during the period from 1999-2000 to 2003-04. Two each occurred in Balliguda FD and in Parlakhemundi FD. Most cases were accidental, as reported by Divisional Office. There was no report of human injury by elephants in these Forest Divisions.

b) Crop damage by elephant: During 1999-2000 and 2003-04 elephants damaged 122.00 acres of paddy crop in these Forest Divisions. Crop damage was restricted to only 20 villages in Kalahandi North and Kalahandi South FDs. Totally 123 persons received the compassionate amount.

c) House damage by Elephants: From 1999-2000 to 2003-04 elephants damaged only 18 houses in Kalahandi North and Balliguda Forest Divisions.

Existence of stakeholders, advisory committee and management of elephants outside the protected areas

The status or existence of stakeholders**,** advisory committee, management of elephants outside the legally protected forest areas, Joint Forest Management (JFM) and its impact on elephant, is not well known. The status of other management issues such as co-ordination priorities between other ERs, and participation of different agencies in the habitat management is also not available.

CONSERVATION PRIORITIES / RECOMMENDATIONS:

1. There are variations in the boundary description of SOER in maps available from the Divisional Forest and PCCF Offices. The boundary description with a map on an appropriate scale (1:50,000 or 1:2,50,000 topo-sheet) has to be prepared for elephant management purpose.
2. Division-wise area of forest cover is beyond the scope of this present perspective plan and a detailed vegetation map for the SOER should be prepared.
3. Shifting cultivation, with its reduced cycling pattern time, has been the most adverse biotic factor. This issue has to be addressed immediately to maintain viable habitat for elephants and other species. Apart from the Reserve Forests, Protected Forests, Demarcated Protected Forests and Sanctuaries, the available land under forests is 20.45%, and this could be used for habitat improvement. Revenue forests need to be given legal protection to maintain habitat contiguity and quality.
4. From the descriptions of the corridors, it appears that all corridors need ground verification and a clear definition for their identification. It is essential to find out if there is any movement of elephants from Lakheri Valley to Ghumsur North FD, Balliguda FD to Ghumsur North FD, and Balliguda FD to Boudh FD through

Phulbani FD. This is most important for the long-term viability of the elephants of this ER, considering genetic viability of the population. Areas outside the protected area network used regularly by elephants need to be identified. Priority should be given to maintain the movement of elephants between the three WLSs and with the Mahanadi ER. Identification and protection of corridors between sanctuaries and ERs is also a crucial conservation strategy.

5. Encroachment appears to be a major negative factor for the conservation of elephants in this ER. In most of the cases, the main valley portion of the land has been encroached by many villagers and priority should be given to recover the forest lands from the encroachers, particularly 7 villages within Kotagarh WLS need to be shifted.
6. Around 45 to 70% of the human population of the proposed ER area is primarily dependent on the forest resources. Alternative arrangement of resources for their livelihood will be the major challenge for ER managers. Restriction has to be imposed on people engaged in burning wood-logs for charcoal production inside the forests.
7. Although Human – elephant conflict is not at present a major problem in this ER, sufficient measures should be taken to keep it at its lowest level in coming years. There are reports of elephant deaths due to electrocution in many places inside the ER area indicating standards regarding the height of electric line have not been strictly followed. Experienced veterinary doctors are not available, particularly for post-mortem of elephants. Pathological and forensic test facilities in the elephant reserve are absent. These needs have to be attended to on a priority.
8. There are reports of elephant deaths due to poaching and there is no system of fixing of responsibilities for the lapses; this may cause repeat elephant poaching in future. Again, no reward has been given for detecting and arresting culprits. Metal detectors have not been in use during the post-mortem of elephants. Elephant protection units are essential solutions for this problem and there is a need for improving the intelligence network and mobility of the Forest Staff.
9. The Advisory Committee meeting has to be organized where the stakeholders will be identified.
10. Information available on elephants and their conservation and management in working and management plans is very poor. For all wildlife sanctuaries, management plan have to be prepared. A separate management plan for this ER has to be prepared as soon as possible for the proposed area.

CONCLUSIONS

The elephant reserve and its elephants are isolated from other elephant reserves of Orissa. There was also an indication of population reduction from this reserve. Going by the number and the area available for elephants, the effective population size of elephants in this reserve appears to be much less than its potential size. However, demographically and genetically the viability of the population from a long term perspective is not known. Ground surveys to link forest patches or consolidate the actual habitat available for the elephants, regular population monitoring, and bringing of revenue forests under legal and regular management status could be the targets for next ten years for the reserve.

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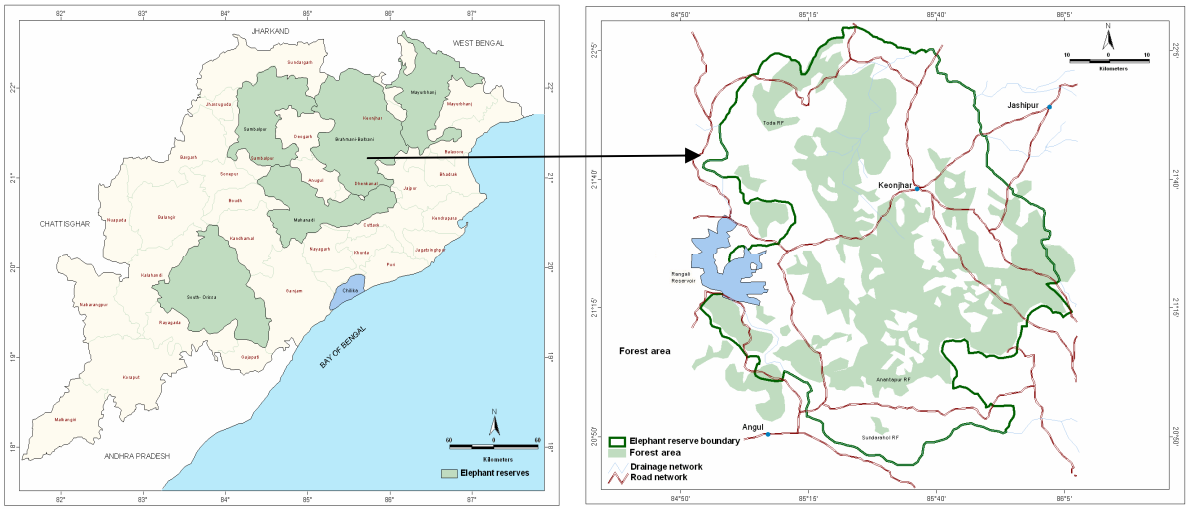
Chapter 5 Baitarani Elephant Reserve (BER) of Orissa, India (proposed): Population status, conservation and management of Asian elephants (*Elephas maximus*)

Profile

Name of the reserve: Baitarani Elephant Reserve



Latitudes: 20º 44’ to 22º 09’ N
Longitude: 84º 54’ to 86º 06’ E

Total area: 10,520 km^2
Forested area: 2,866 km^2

Geography: Situated between the rivers of Baitarani and Brahmani, the area can be divided into two dissimilar tracts – the lower valley regions and the mountainous high lands

Altitude: Ranges from 75 to 1,117 m MSL

Rainfall: 1,298 to 1,655 mm
Water sources: Baitarani and Brahmani Rivers

Major vegetation types: North Indian Moist Deciduous, Northern Tropical Dry Deciduous and Semi Evergreen Forests

Elephant density: 0.05/km^2
Adult male to female sex ratio: 1:1.6

Significance / Conservation issues

i) This reserve is located between three Elephant Reserves of Mahanadi, Sambalpur Mayurbhanj. Although the ER has a less effective elephant distribution area compared to all the elephant reserves, it allows for elephant movement across these ERs.

ii) There is no Protected Area network within the Baitarani ER; forests are highly fragmented, but forest patches are located close to each other.

iii) Mining activities are at their peak; about 48,500 ha land has been allotted for mining activities in this ER. All major and influential companies operate from this region.

iv) Elephant population in this ER is mostly in transit and about 145 elephants have been reported. Elephants use more than the actual elephant area - they move from Keonjhar to Similipal, Keonjhar to Bonai to Badarma WLS and also to Jharkhand.

v) Human – elephant conflict is very high. 68 people have died and 26 injured during 1999-2000 to 2003-04. The crop area damaged by elephants is 1,600 acres / year and the ER has the highest incidents of household damage, with 245 cases being reported per year.

vi) Poaching is one of the major issues and every year two elephants die due to this problem. Poaching and natural deaths are higher in this ER.

vii) This region has the highest density of human population among all ERs. The increase was due to migration of people from other regions because of mining related activities. The population density along the forest areas has become very high.

viii) Shifting cultivation with a reduced cycle time reported in Dry Deciduous Forest region is another conservation issue is. Initially, forest areas were taken over for shifting cultivation and later left mostly for illegal mining.

Conservation priorities

i) Monitoring all developmental activities, specifically mining activity, is one of the conservation priorities for Baitarani ER. Legal and illegal mining areas, labour settlements, constant movement of vehicular traffic restricting the movement of even smaller animals across habitats, needs to be monitored. For example, from Rourkella to Paradeep Port, vehicular traffic restricts the movement of animals in many forests.

ii) The area close to Similipal ER (Atai RF and Rebana RF) has to be declared as a Wildlife Sanctuary. This will act as a protected area link to Similipal. This particular region has comparatively less disturbance (example; minimum mining activities) and elephants stay here for relatively longer period of time.

iii) Human – elephant conflict areas such as Keonjhar and Joda-Barbil Police Station (PS) need to be brought under effective elephant barrier mechanism. Electrocution problem is severe in this location and about 7 elephants were electrocuted from this region.

iv) Surveying the actual mining and mined areas in upper Keonjhar area to link crucial elephant habitats in this area should be undertaken.

v) A relatively large number of elephants traverse through this Elephant Reserve and regular estimation of elephant numbers is very crucial. This exercise has to be carried out throughout the year, with additional focus towards transit and permanent populations that use this Elephant Reserve.

INTRODUCTION

The Baitarani Elephant Reserve (BER) is a newly proposed area for constituting a Elephant Reserve between Baitarani and Brahmani rivers. Almost 30% of the elephant habitat here is under intense pressure due to various activities, including mining, shifting cultivation, monoculture plantation, etc. Some of these activities, such as mining, cannot be stopped as they are the main sources of revenue for the State. There is no Protected Area (Sanctuary or National Park) within this proposed Elephant Reserve. The area experiences severe Human – elephant conflict. During 1991-92 and 1999-2000, in Keonjhar FD alone, 86 people and 37 elephants were killed in the conflict along with damage to 718 houses (Sar & Lahiri Choudhury 2002a). Elephants of Jharkhand State and Mayurbhanj ER (in Orissa) have to move through this area to reach Sambalpur and Mahanadi ERs. Under these circumstances, it is important to have a specific management plan for the Baitarani Elephant Reserve. However, undisturbed portions of the Keonjhar Wildlife Division and southern Keonjhar Territorial FD of the ER can provide suitable habitats and safe passages for the elephants. Elephants of Jharkhand State have a safe passage along the border of Keonjhar and Bonai Forest Divisions to the Sambalpur ER, and conserving these areas would be an important conservation strategy for the reserve.

Location

The Baitarani Elephant Reserve is situated between 20º 44' to 22º 09' N latitude and 84º 54' to 86º 06' E longitude. It is spread over the civil districts of Sundargarh, Keonjhar, Dhenkanal and Angul. A complete map at 1: 250,000-scale topo-sheet and boundary description are available for the Reserve. The names of the Territorial Forest Divisions (T) and Wildlife Divisions (WL) along with their eighteen forest ranges within the Elephant Reserve are given in Tables 5.1 and 5.2.

Table 5.1: Basic data of the Baitarani Elephant Reserve

Forest Divisions involved in the BER	Presence of WLS	Average rainfall mm/y	Area within BER km^2	RF and PRF within BER km^2	Elephant population 2002
Angul (FD)	Nil	1,298	439.06	44.43	8
Dhenkanal (FD).	Nil	1,432	2,243.68	400.78	27
Keonjhar (WL)	Nil	1,535	6,548.00	1,745.32	5
Keonjhar (FD)	Nil	1,535			90
Bonai (FD)	Nil	1,656	1,289.86	676.45	15
Total	Nil		10,520.60	2,866.98	145

Table 5.2: Forest Divisions and their Forest Ranges under Baitarani ER

Forest Division – establishment year	Forest Range
Bonai (T) – 1948	1. Koira, 2. Barsuan, 3. Kuliposh.
Keonjhar (T) – 1948	1. Barbil, 2. Champua, 3. Patna, 4. Keonjhar, 5. BJP (Suakati), 6. Telkoi, 7. Ghatagaon.
Keonjhar (WL) – 2003	1. Deogaon, 2. Brahmanipal.
Dhenkanal (T) – 1948	1. Kamakshyanagar East, 2. Kamakshyanagar West, 3. Odapada (Mahabir road), 4. Bhuban.
Angul (T) – 1885	1. Talcher, 2. Kaniha.

Boundary description

The boundary of the proposed Elephant Reserve begins at the tri-junction of Sundargarh district and Keonjhar district with Jharkhand State, near Gunjaghar, and then runs in a north-east direction along the interstate boundary of Jharkhand and Orissa (Figure 5.1) Crossing the road from Champua to Chainbasa and then leaving the inter-state boundary, it follows the Baitarani river in the south-east direction crossing NH 6 at Turumunga and meeting the border of Keonjhar and Mayurbhanj districts up to Bhimkund. It then runs along the Baitarani river in a southward direction and thereafter along Musal river in a western direction near Kanto / Kolimati.

From Musal river the boundary follows the Atei RF boundary line in a south-eastern direction up to Sailong. From here it takes a western deviation following the Atei RF line meeting the Harichandanpur-Brahmanipal road at Dantuani Ghati. It then follows the Rebna RF line in a southward direction and meets Keonjhar / Jajpur district boundary line near Brahmanipal, following the inter Division boundary line in a western direction

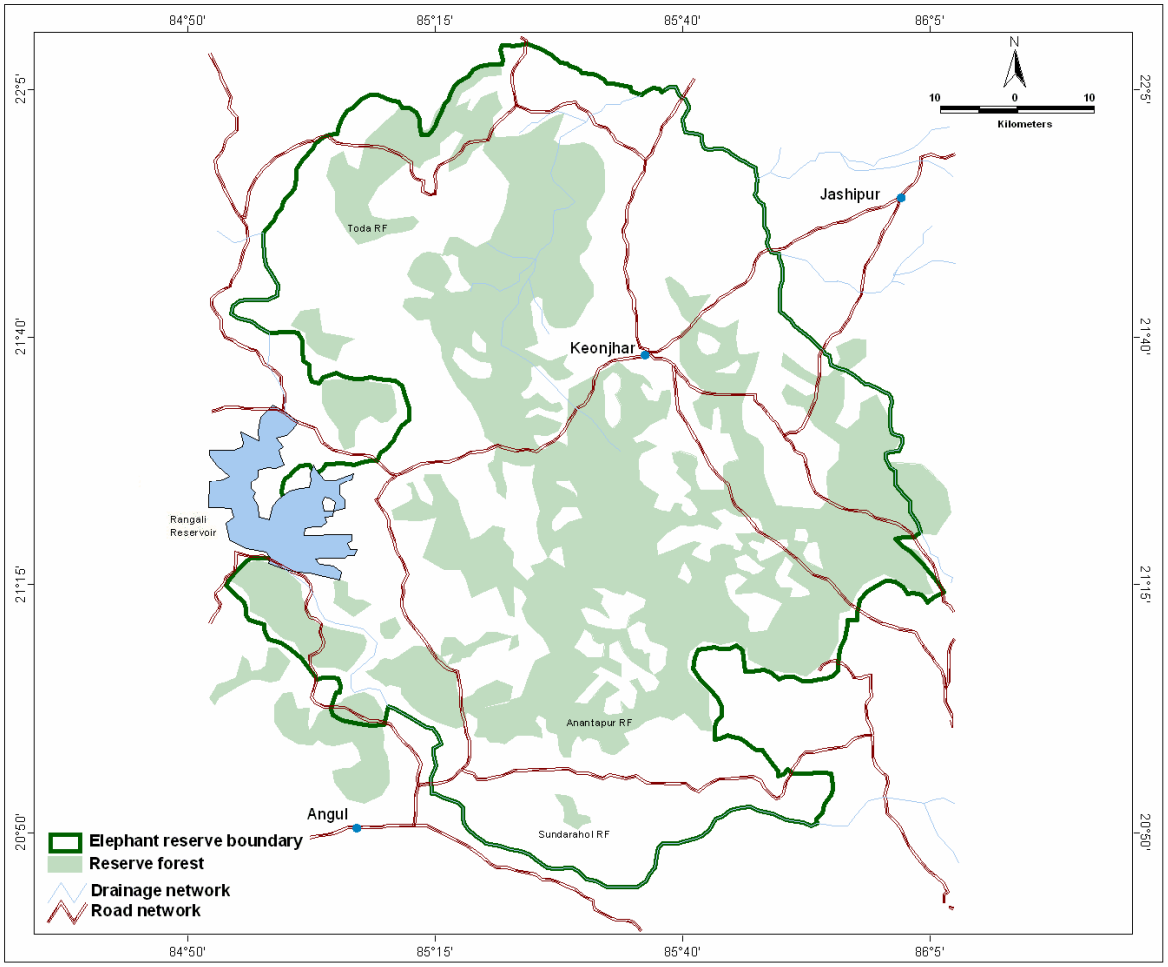


Figure 5.1: Map showing Baitarani Elephant Reserve

to meet the tri-junction point of Keonjhar–Dhenkanal–Jajpur districts near Ekul. Following the inter-district boundary line of Jajpur and Dhenkanal in a southern and south –eastern direction, it meets Brahmani river at Kashipur near Bhuban. Running alongside the river in a western direction it crosses Dhenkanal-Kamakhyanagarroad and Talcher-Kamakhyanagar

road to meet the Dhenkanal district boundary line again at Samal. It then takes a southward direction along Pallahada–Talcher road i.e., NH 23, and from Gurujang takes a western direction up to Jhulubandha to meet Singra Jor. Following Singra Jor in a northern direction it again meets the Brahmani river running along up to the confluence of the rivers Tikranala and Brahmani. Subsequently, it follows the Tikranala in a north-western direction, and meets the inter-district boundary line of Deogarh and Angul districts and takes an eastern direction from Khairipal to meet the Brahmani river again at Ruchila. Crossing the Brahmani river to the east, it proceeds in an easterly direction along the inter-division boundary of Angul–Deogarh and Dhenkanal–Deogarh. Thereafter, it follows the inter-division boundary of Keonjhar–Deogarh in a northerly direction and next Bonai–Deogarh in a westerly direction until it meets the Brahmani river. The boundary of the ER follows the inter division boundary line of Bonai and Rourkela Divisions in a north-eastern direction and meets the Jharkhand state boundary line in the north. Following the inter-state boundary line of Jharkhand and Orissa (Bonai Division) in a eastern direction, it culminates at the tri-junction point of Jharkhand state, Sundergarh district and Keonjhar district.

Approaches to the ER

In the east, the ER is approachable by NH-6 road from Kolkata (350 km). From the south-east – Keonjhar is approachable from Bhadrak / Panikoili by road (120 km). From south – Daitary is approachable from Bhubaneswar by road (130 km). In the west – Pallahada, the nearest town to ER, is approachable from Sambalpur by NH 6 road (150 km). In the Northwest - Barbil is approachable from Rourkela by road (135 km). From the north – Keonjhar and Barbil are approachable from Jamshedpur by road (170 km and 120 km respectively). In the south – Kamakhyanagar is approachable by road from Bhubaneswar via Dhenkanal (120 km). Major railheads are Tata Nagar, Barbil, Rourkela, Bhadrak and Jajpur Road. State boundary of Orissa and Jharkhand is the northern boundary of the ER. This will not be an administrative problem for the ER.

History

The "Baitarani Elephant Reserve" is a newly proposed Elephant Reserve in Orissa. *Kheda* was in operation in the Keonjhar area. The year of establishment of each Forest Division is given in Table 5.2.

Significance of the reserve for conservation

The area serves as a passage for elephants between Mayurbhanj Elephant Reserve and Sambalpur Elephant Reserve, and between elephants of Jharkhand State and Sambalpur Elephant Reserve. It serves as a link for gene flow, enhancing the long term survival of Orissa's elephants.

TERRAIN

Geography

The proposed ER is almost nearly situated between the rivers Baitarani and Brahmani in the civil districts of Sundargarh, Keonjhar, Dhenkanal and Angul. The area can be divided into two widely dissimilar tracts – the lower valley area and the mountainous high lands. In Bonai FD on the left bank of the river Brahmani, there are flat cultivated lands with varying width

from 5 to 15 km. The rest of the area is mountainous. The ridges are generally in a north to south direction, in continuation with the Karampada Range of Singhbhum district of Jharkhand state. The highest peak is Badamgarhpahad (1,074 m MSL) in Khajurdihi forest block. High grade iron and manganese ore deposits exist in these mountainous areas. The Keonjhar Forest Division, as mentioned earlier, is divided into the Keonjhar valley (or lower Keonjhar) and mountainous high lands (upper Keonjhar). The upper Keonjhar is a chain of mountains forming the Western and Southern borders of the Keonjhar Forest Division. The general altitude of these hill ranges varies from 600 m to 900 m MSL, with the highest peak at Mankadanacha (1,117 m MSL) on the western border of the FD. Other principal peaks are Gandhamardan (1,060 m MSL), Gonasika (978 m MSL), Khajaru (918 m MSL), Thakurani (915 m MSL), and Khandadhar Parbat (915 m MSL). As in Bonai FD, the mountainous areas of Western Keonjhar contain high-grade iron and manganese ore deposits. In Keonjhar Wildlife Division, the Brahmanipal Range is mountainous and contains iron ore deposits, while Deogaon Range is comparatively less hilly. In Dhenkanal FD, the proposed ER lies between Brahmani river and the border of Keonjhar FD. The northern hill ranges along the border of the Keonjhar FD run roughly west – northwest to east – southeast direction. The highest peak in this range is Sarai Parbat (751 m MSL) in Ranjagarh RF. South of these hill ranges and north of the river Brahmani, a few hills like Nandbir, Sundarkhol, Sunajhari, Maulabhanja etc., lie scattered. In Angul FD, the ER area consists mainly of hill blocks which are isolated but arranged in such a manner that they form three broken chains running in an east – west direction across the Brahmani river.

Geology

The geology of the ER area is very interesting due to its varied rock formation. A portion of Bonai and Keonjhar Forest Divisions is on the northern extension of the Deccan Plateau, and mostly underlain by Precambrian rocks of Archean age. A very small proportion of the total area of these two Forest Divisions is constituted of Quaternary to Recent formations and is chiefly confined to the wide river valleys. The Precambrian rocks are represented by the iron ore series. In the Dhenkanal and Angul Forest Divisions the Gondwana group of rocks covers the area, separating the Eastern Ghat group of Archean age rocks of the southern portion. High-grade iron and manganese ore deposits exist in Bonai, Keonjhar, and part of the Dhenkanal Forest Divisions, while coal is found in the Angul (Talcher) area.

Climate

The climate of the area is divided into distinct seasons. Summer starts from March to June, monsoons from July to October, and winter from November to February. A post monsoon season covering the months of October and November is seen in some portions of the ER. Average rainfall varies between 1298.2 mm / year and 1655.99 mm / year. Maximum rainfall falls during the months of July and August. Average number of rainy days varied between 76 (at Bonai), 75.4 (at Kamakhyanagar) and 70.3 (at Talcher). The mean minimum temperature during December and January is around 15º C and the mean maximum temperature during May and June is around 41° C (Mishra, 2000). Humidity data is not available.

River system and other water sources

In Bonai FD the river Brahmani forms the western boundary of the ER and flows in the north south direction. It receives Kuradhi, Karo, Khandadhar and Amrudhi nallas from the left. Most of these nallas are perennial in nature. In Keonjhar FD the river Baitarani runs through

almost three-fourth of the Forest Division. It originates from "Guptaganga Pahar" near Gonashika and flows in the northern direction up to Chamakpur village, and then takes a northeast direction. Before taking a southward turn, the river forms the boundary between the states of Jharkhand and Orissa, which constitutes the northern boundary of the ER. After taking the southerly turn the river re-enters Orissa and forms for a certain distance the boundary between the civil districts of Keonjhar and Mayurbhanj, thereafter entering the Keonjhar FD once more. Baitarani river forms the eastern boundary of the ER till it meets the Musal river in Keonjhar Wildlife Division. It receives Ardai, Kanijhari, Sita and Musal from the right bank. The Dhenkanal portion of the ER is drained by the river Brahmani through its tributaries on the left bank – the Ramial and its feeder network, and Ghoradiajor. These tributaries flow from north to south. Singra Jor and Tikar nalla drains the Angul portion of the ER from the right bank, and Samakoi drains from the left bank up to the Brahmani River. Ramial, Dadaraghati, part of Rengali, Kanjhari and Kanhupur reservoirs are situated within the ER area. These irrigation projects serve as an alternative source of water for wild animals. There is no scarcity of water in the Bonai FD area due to a large number of perennial streams flowing through the forest areas. In Keonjhar FD, drinking water scarcity for people is observed in around 7% inhabited villages, and in 17% of the villages both humans and elephants use the same water source (village pond or well).

Land use pattern

The total area of RF and PRF / DPF is about 29.61% of the total geographical area of the Forest Divisions. Plain lands are under a major thrust of irrigation in many parts of the ER. Land utilisation pattern for the districts of Keonjhar, Sundargarh and Dhenkanal is not available.

DISTRIBUTION AND LEGAL STATUS OF FORESTS

Distribution of Elephant Reserve areas within the Forest Divisions and the available legally protected forest areas are given in Table 5.3.

Table 5.3: Details of area of distribution of Forest Divisions within BER

Forest Division	Geo. area of the F.D km^2	Forest area under different categories – km^2			Geo. area within BER km^2	RF+ PRF within BER km^2
		RF	PRF	DPF		
Bonai	2,934.21	1,028.95	341.05	58.81	1,289.86	676.45
Keonjhar (FD)	6,273.40	1,150.46	177.47	224.99	5,931.00*	1,277.00*
Keonjhar WL	2,029.60	683.63	Na	Na	617.00*	468.32*
Dhenkanal	4,599.01	1,141.02	Nil	13.79	2,243.68	400.78
Angul	2,909.54	511.71	Nil	218.54	439.06	44.43
Total	18,745.76	4,515.77	518.52	516.13	10,520.60	2,866.98

RF= Reserve Forest, PRF= Proposed Reserve Forest, DPF= Demarcated Protected Forest,
* = Area given is approximate.

VEGETATION TYPES

According to Champion and Seth, the forests of this elephant habitat belong to the following types:

Sub-group 3C – North Indian Moist Deciduous Forests

1. Type – 3C/C2 – Moist Sal Bearing Forest

3C/C2e (i) Moist Peninsular High Level Sal
3C/C2e (ii) Moist Peninsular Low Level Sal
3C/C2e (iii) Moist Peninsular Valley Sal

2. Type – 3/1E – Terminalia Tomentosa Forest

Sub-group 5B – Northern Tropical Dry Deciduous Forests

1. Type – 5B/C1 – Dry Sal Bearing Forests
   (i) 5B/C1c Dry Peninsular Sal Forest
2. Type – 5B/C2 – Northern Dry Mixed Deciduous Forests
3. Type – 5B/E9 – Dry Bamboo Brakes
4. Type – 5B/DS1– Dry Deciduous Scrub

Sub-group 2B – Northern Tropical Semi Evergreen Forests

1. Type – 2B/C3 – Orissa Tropical Semi Evergreen Forest

Density of forest cover

The reserve has 55% dense forest and 40% open forest (Forest Survey of India 2001). District wise density of forest cover as a whole (in km^2) is given in Table 5.4. The values given in Table 5.4 are percentage density of different forests available to the elephants.

Table 5.4: District-wise density of forest cover (area and %) showing different density type of forests available to elephants

District	Dense Forest		Open Forest		Scrub		Total	
	km^2	%	km^2	%	km^2	%	km^2	%
Sundargarh	2,625	60.1	1,471	33.7	275	6.3	4,371	100.00
Keonjhar	1,669	48.7	1,709	50.0	45	1.3	3,423	100.00
Dhenkanal	660	45.7	606	42.0	179	12.3	1,445	100.00
Angul	1,658	59.1	992	35.4	156	5.5	2,806	100.00
Total	6,612	54.9	4,778	39.7	655	5.4	12,045	100.00

LEGAL AND MANAGEMENT STATUS

Ownership of lands

Out of the total proposed area of 10,520.60 km^2 for "BER", revenue land constitutes 7,653.62 km^2 or 73% and forest department owned land (RF + PRF) makes up 2866.98 km^2 or 27% of the total area. Revenue land includes agricultural lands, human settlements and all other type of forests, except RF & PRF. There is no Sanctuary or National Park area available to the elephants within the Baitarani ER**.**

Status of working plans and management plans

The status of working / management plans for the five divisions under this reserve is given in Table 5.5. Except for one, the time period of working plans has expired for all the divisions. For the newly created Keonjhar Wildlife Division, a management plan is under preparation for the first time. Like other ERs, working plans have no specific management plans for elephant. As such, these overall wildlife focused management plans have little value for elephant management.

Table 5.5: Status of working / management plans for different Forest Divisions of BER

Forest Division	Status of plan	Period from	Period to	Extended up to	Remarks
Bonai	Working Plan	1997-98	2016-17	–	Valid
Keonjhar (T)	Working Plan	1984-85	1993-94	2003-04	New plan under preparation
Keonjhar (WL)	Management Plan	–	–	–	First plan under preparation
Dhenkanal	Working Plan	1979-80	1998-99	31/3/2002	New plan submitted
Angul	Working Plan	1990-91	1999 -2000	Not extended	New plan under preparation

EXSITING CONSERVATION INITIATIVES

Converting part of Keonjhar Territorial Division into Keonjhar Wildlife Division (2029.60 km^2) can be considered as the only existing conservation initiative.

ELEPHANT POPULATION

Elephant population and trend

A total of about 145 elephants have been estimated for the reserve (2002 census). Census estimates carried out during different period suggest that the population is in a decreasing state. Table 5.6 summarises the results of the census operation carried out in these divisions since 1979. The census figure for Bonai FD covers both the portions under Sambalpur ER (SPER) and BER. For comparison, divisional figures are used from three elephant censuses, which showed an increase in the number of elephants. However, it has to be ascertained whether this increase was within the ER area or not. In Dhenkanal FD within the ER area (Kamakshyanagar area), the 27 elephants reported are certainly a new group, which joined the few elephants using the area earlier. The increase in elephant population in Bonai FD was mainly in the SPER area. The elephant number for 10 forest ranges of different divisions estimated during 2002 is given in Table 5.7.

Table 5.6: Results of census operations carried out in different Forest Divisions of BER

Forest Division	Forest Area of BER (RF+PRF) in km^2	Year of census				Details of 2002			
		1979	1999	2002	2002 in BER	M	F	Young	Calf / Unknown sex
Bonai	676.45	25	53	82	15	15	40	–	27
Keonjhar (T)	1,277.00	90	75	112	90	40	49	–	23
Keonjhar (WL)	468.32	–	–	–	5	–	–	–	–
Dhenkanal	400.78	92	94	81	27	14	45	–	22
Angul	44.43	173	162	179*	8	27	50	–	95
Total	2,866.98	380	384	454	145	96	184	0	167

M= Male, F= Female. * Total number of elephant includes the number for Satkosia WL Division (155)

Density and age-group distribution

Estimated elephant density in BER is 0.05 / km^2 of forests (elephant number is 145 and the RF-PRF area available to the elephants is 2866.98 km^2). Age-group distribution of only three Divisions is available for 2002 census. In 1999 census, the adult male to female ratio was 1:1.1 and the same for sub-adults was 1:5.4 (for sub-adults, 5 were of unknown sex). The corresponding ratios for 2002 census were 1:1.9 and 1:2.4 respectively. Tables 5.8 and 5.9 summarise results of elephant numbers and age-group distribution.

Table 5.7: Range-wise elephant number for different Forest Divisions of BER

Forest Division	Forest Range	Male		Female	Calf / Young / Sex unknown	Total
		Tusker	Makhna			
Bonai	Koira & Barsuan	4	0	9	2	15
Keonjhar	Champua,	24	0	20	7	51
	Keonjhar,	2	0	6	2	10
	BJP (Suakati)	5	0	17	6	28
	Ghatgaon	1	0	0	0	1
Keonjhar WL	Deogaon,	2	0	2	1	5
Dhenkanal	Kamakshyanagar East	3	2	9	7	21
	Kamakshyanagar West	1	0	4	1	6
Angul	Talcher	1	0	5	2	8
Total		43	2	72	28	145

Table 5.8: Details of elephant numbers in different Ranges of Forest Divisions of BER

Forest Division	Range	Up to 4' (Calf)			4' to 5' (Juvenile)			5' to 7' (Sub-adult)			7' & above (adult)			Extra adult Unattached			Total
		M	F	Us	M	F	Us	M	F	Us	M	F	Us	M	Mk	Us	
Bonai	Koira & Barsuan	–	–	2	–	–	–	–	–	–	4	9	–	–	–	–	15
Keonjhar (FD)	Champua	–	2	7	–	2	–	3	4	–	11	12	–	9	1	–	51
	Keonjhar	–	–	2	–	–	–	1	–	–	1	6	–	–	–	–	10
	BJP	–	–	6	–	–	–	1	8	–	2	9	–	2	–	–	28
	Ghatgaon	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Keonjhar (WL)	Deogaon	–	1	–	–	–	–	–	–	–	2	2	–	–	–	–	5
Total		–	3	17	–	2	–	5	12	–	20	38	–	12	1	–	110

Table 5.9: Age–group distribution for 1999 census for different Forest Divisions of BER

Forest Division	Up to 4' (Calf)			4' to 5' (Juvenile)			5' to 7' (Sub-adult)			7' & above (adult)			Extra adult Unattached			Total
	M	F	Us	M	F	Us	M	F	Us	M	F	Us	M	Mk	Us	
Bonai	–	–	12	–	–	1	1	4	3	8	21	–	3	–	–	53
Keonjhar	–	–	11	1	2	1	4	23	2	19	12	–	–	–	–	75
Total	–	–	23	1	2	2	5	27	5	27	33	–	3	–	–	128

M= Male, F= Female, Us= Sex un-known, Mk = Makhna, '–'= Nil.

Seasonal distribution and movement of elephants within ER and from ER to other areas

There is a regular to and fro movement of elephants from BER to the state of Jharkhand as well as from BER to SPER and Mayurbhanj Elephant Reserve. Like other reserves, during the paddy-harvesting season, elephants spread out from the forest area into the crop lands and take shelter in the village forest or JFM forests. Elephants of Karanjia FD also enter this ER during crop harvesting season.

Elephant corridors

As reported by the Forest Divisions, elephants move from one important forest block to another within their habitat. Revenue forestlands, Demarcated Protected Forests (DPF), and

village forest areas interlink these isolated forest blocks. They form the corridors for the elephants between the Reserve Forest blocks.

Some important forest blocks in the Keonjhar FD are Atei, Barbank, Naranpur, Balabhadrapur, Raghunathpur, Belda, Jadipada, Kalapat, Ranibeda, Benamunda, Bandhanjhari, Kanjipani, Gonasika, Suakati, Nayagarh, Sidhamath, and Baitarani. Important Reserve Forest blocks in Bonai FD are Amrudi, Budhpahad, Lunga, Mahulpada, Karo, Toda, Sarkunda, Khajurdihi, Rakshi, Khandadhar, Bhabanipahad and Mendhamaruni. The PRF blocks are Amrudi, Budhpahad, Lunga, Nagri, Khandadhar, Khajurdihi, Sarkunda, and Bhabanipahad. The forest blocks of Dhenkanal and Angul also present corridors for elephants.

CONSERVATION PROBLEMS AND ISSUES

i) Encroachments

Since 1980 a total of 2,200 hectares of forest land has been encroached and all pre-1980 encroachments have been regularized. Encroachment figures available for each FD is given in Table 5.10 (figures of Keonjhar – FD and Keonjhar WL are combined):

Table 5.10: Status of encroachment in BER

Forest Division	Pre-1980 encroachment		Post-1980 encroachment		Total encroached Area (ha)	% of forest encroached
	No.	Area (ha)	No.	Area (ha)		
Bonai	132	80.90	1,968	858.00	938.90	*
Keonjhar	688	156.42	818	337.12	493.55	0.15
Dhenkanal	214	214.11	395	320.21	534.32	0.31
Angul	111	94.80	52	50.32	145.12	0.14

*= Only revenue forest encroached.

As a whole, encroachment is a major problem in Dhenkanal FD. In many places encroachment of village / khasra forest is rampant and these need ground verifications from revenue department. In the mining area, land is being misused even in working mines; the actual used area for mining may be very small, while the leased forest area remains open to misuse. Apart from encroached area, elephants are being deprived from the leased out mining area, which are not currently in use.

ii) Illicit felling

About 12,000 cases of illicit felling have been reported for the reserve between 1999-2000 to 2003-04**.** Average forest offence cases booked during these last five years in different Forest Divisions is presented in Table 5.11.

Table 5.11: Average forest offence cases booked for five years in different Forest Divisions

Forest Division	Average* no. of cases / year
Bonai	3,139
Keonjhar both (FD) & WL	4,085
Dhenkanal	2,309.8
Angul	1,254

*= from 1999-2000 to 2003-04

iii) Mining activity

This ER is severely affected by mining activities. In Keonjhar FD (both Territorial and Wildlife) mining lease affects 5.44 % of the total geographical area. All this is prime elephant habitat. Details of mines in different Forest Divisions are given in Table 5.12.

Table 5.12: Details of mining activities within BER

Forest Division	No. of mines	Area (ha)
Bonai	58 working	9,933.68
	70 non-working	13,572.22
Keonjhar both (T) and WL	90 working	30,575.66
	95 non-working	14,570.45
Dhenkanal	1 working	113.00
Angul	12 working	7,831.00
Total area of working mines in the ER		48,453.34
Total area of non-working mines in the ER		28,142.67

iv) Irrigation projects

Ramial, Dadaraghati, Rengali, Kanjhari, Kanhupur and Samal irrigation projects and their canals (Figure 5.2) are situated within the ER area. In many places these canal systems prevent the normal movement of elephants, particularly the east-west "left bank main canal" system of Samal barrage in Dhenkanal FD. This canal can be treated as the southern boundary of this ER. Otherwise another passage should be constructed to maintain the elephant corridor. The north-south branch (minor) canals may not be a major problem for the movement of the elephants, as the main elephant habitat is on the north side of the "left bank main canal". These irrigation projects have changed the land use pattern, encouraged crop raiders and worsened the Human – elephant conflict situation.

Figure 5.2: Irrigation canals located within the ER

v) Roads and railways

National highway 6, NH 23, NH 200 and NH 215 pass through Baitarani ER. The exact length of these National Highways within the ER needs to be incorporated in the ER management plan. Maximum traffic was observed in NH 23 and NH 215, relating mostly to mining transportation. Traffic can be controlled on these roads, but realigning of any National / State highway is not possible for the purpose of the ER. The two railway lines present within the ER, are Rourkela – Barsuan line in Bonai FD, and Talcher NTPC to Talcher MGR line in Angul FD. Apart from these existing lines Daitari – Bansapani railway line is under construction in Keonjhar FD. On NH 215, movement of trucks is restricted during the day and becomes very heavy during the night as a few thousand trucks ply this road every night, severely affecting the movement of wildlife.

vi) Industrial establishments

The major industrial establishments are the SAIL plant and many ore crushing plants in Bonai FD; coal mines related activities and Thermal Power Station in Angul FD; and all mining related activities in Keonjhar FD. At present seventeen sponge-iron factories are under construction in Bonai FD, of which five are mega projects. The effect of all these industrial establishments on the ER is not very clear to the ER managers. Permission for construction of Bhusan Steel Factory is under process in Dhenkanal FD.

vii) Tea and coffee cultivations

There is only one experimental tea plantation present in the Keonjhar FD (BJP Forest Range).

viii) Monoculture plantations

The total area of plantation (ha.) during from 1999-2000 to 2003-04 for each FD is given in Table 5.13.

Table 5.13: Area under plantations for different Forest Divisions of BER

Forest Division / Years	1999-00	2000-01	2001-02	2002-03	2003-04	Total
Bonai	26.72	–	550.00	405.12	–	981.84
Keonjhar (WL) & Keonjhar (T)	439.28	584.21	1250.0	712.2	1,194.04	4,179.73
Dhenkanal	28.80	24.25	258.75	354.0	184.5	850.3
Angul	1,094.70	60.0	180.0	168.0	1,204.0	2,706.7
Total	1,589.50	668.46	2,238.75	1,639.32	2,582.54	8,718.57

ix) Human population

Census data of 2001 for human population and number of inhabited villages present in the ER is given in Table 5.14. Demographic distribution of ST and SC population for different districts within ER is given in Table 5.15. The latter shows 28 to 59% of the population of the proposed ER area belonged to these communities. Dependency of forests by ST and SC is more than other communities. Apart from dependency on forest resources, many ST and SC are engaged in mining activities as daily wagers.

Table 5.14: Details of human population within BER

Forest Division	No. of inhabited villages	Total Population
Bonai	224	87,197
Keonjhar both (T) & (WL)	1,486	13,48.577
Dhenkanal	450	4,47,473
Angul	86	1,07,835
Total	2,246	19,91,082

Table 5.15: Demographic distribution of ST and SC population for different districts within BER

District	Forest Division	%,of ST	%,of SC
Sundargarh	Bonai	50.74	8.78
Keonjhar	Keonjhar (T)	44.52	11.49
	Keonjhar WL		
Dhenkanal	Dhenkanal	12.66	16.03
Angul	Angul	11.65	16.75

x) Cattle population and grazing

All villages situated in and around the forests release cattle into the government forests. There is a provision for collection of grazing fees from the concerned people. There was no regular inoculation program undertaken for cattle in the fringe areas of the elephant habitat (RF or PRF). Details of cattle population collected from the Forest Division Office are given in Table 5.16.

Table 5.16: Details of cattle population within BER

Forest Division	No. of cattle
Bonai	2,56,852
Keonjhar both (T) & (WL)	5,21,320
Dhenkanal	3,16,327
Angul	2,64,528
Total	13,59,027

xi) NTFP collection

All the Forest Divisions have this problem, and most of the NTFP items are now collected under the jurisdiction of Gram Panchayats, except Sal leaves and gum.

xii) Forest fire

Around 7 to 40% of the ground forest growth is being affected by fire annually. The cause of fires is mainly due to collection of minor forest produce.

xiii) Elephant deaths

A total of 57 elephants occurred from 1999-2000 to 2003-04 in all Forest Divisions and the Wildlife Sanctuary (for Dhenkanal FD 2000-01 to 2003-04 and for Angul FD 2001-02 to 2003-04). Of the 57 elephant deaths reported, 9 were male, 7 female, 6 calves; details were not available for 35 cases. The number of elephant deaths increased steeply from 2 in the year 2000 to 17 in 2004.

Causes
a) Natural death: There were 30 cases of natural death, of which one was due to infighting, one due to collapse of a roof and four due to disease.
b) Poaching: Out of 57 elephant deaths, the Forest Department reported 11 as poached.
c) Retaliatory killings – poisoning / electrocution: According to the Forest Department report, seven elephants were electrocuted, of which six were deliberate and one accidental.

xiv) Sensitive areas and elephant mortality trend

From 1999-2000 to 2003-04, almost 39% (57 nos. out of 145) of the population died. Electrocution (12%), poaching (19%) and natural death (42%) were the major causes of mortality. Annual mortality rate of 7.8% was reported for this ER. Most sensitive ranges for elephant deaths are shown in Table 5.17.

Table 5.17: Details of sensitive areas for elephant deaths in BER

Forest Division	Sensitive area
Bonai	Tamra Forest Range
Keonjhar (T)	Deobandh, Malda, Ghatogaon
Keonjhar (WL)	No such sensitive area
Dhenkanal	Kopilash area of MER
Angul	Talcher

xv) Status of elephant poaching and its control measures

Details of arrest of poachers/culprits available for Angul FD show that 9 persons have been booked for elephant poaching. Traditional poachers from other states are operating in this area. Up to the point of arrest of poachers there was no problem; but prosecution levels are low and need attention. No ivory market existed within the ER area, but in neighbouring States of Jharkhand and West Bengal an underground ivory market appears to be in existence.

xi) Human – elephant conflict

a) Human deaths and injuries by elephants: From 1999-2000 to 2003-04, cases of elephant related human deaths were 68 human injury related cases were 26, in all Divisions including both ER and non-ER areas (details of 1999-2000 and 2000-01 for Keonjhar FD and 1999-2000 for Angul FD not available). Out of 68 cases of manslaughter, 44 occurred in Keonjhar Forest Division (both Territorial & WL). Seasonal occurrence of these incidents indicates that 36 % were during winter months, when crops were harvested.

b) Crop damage by elephants: During 1999-2000 to 2003-04, elephants damaged 6,293.71 acres of paddy crop in all Forest Divisions of the ER (for Angul FD, three years data is available). Maximum average crop damage annually, was in Angul FD (57% of the total area), followed by Keonjhar FD (28%). Average annual damage in these Forest Divisions was 1,633 acres. This needs compassionate amount payment per year. It was also observed that claims for relief lodged with the Forest Department were more often than not, determined by awareness of the people, gravity of the damage, proximity of the forest office, and relief payment for damage in previous crop seasons.

c) House damage by elephants: During the years 1999-2000 to 2003-04 elephants damaged 1,215 houses (Figure 5.3), mostly in Keonjhar FD (97% of the available information). The average number of houses damaged per year was 245. According to departmental staff, house damage took place because elephants were attracted to brewing of country liquor inside houses and for pilfering stored grain kept inside houses.

Figure 5.3: Human – elephant conflict: One of the houses damaged by elephant

CONSERVATION PRIORITIES / RECOMMENDATIONS

1. The estimated area of each type of forest is based on earlier working plans and a detailed vegetation map for the BER should be freshly prepared.
2. There is no Sanctuary or National Park area available to the elephants within the ER and arrangement of a Sanctuary area within the ER should be made. For this purpose, Atei RF and Rebna RF area could be considered.
3. Information about seasonal distribution and elephant movement is inadequate. This information is essential for the long-term conservation of elephants in the reserve.
4. Scientific monitoring of population trend, sex ratio, and age group structure is very crucial and needs to be undertaken.
5. In the management plan, improvement of cattle breeds and reduction of overall numbers of cattle left into forests from villages situated on the periphery as well as inside has to be incorporated for long-term ER management.
6. As is the case with other ERs, there was no system of fixing of responsibilities for lapses related elephant deaths or human elephant conflict issues in BER. Only in Keonjhar FD, reward has been given for detecting and arresting the culprits. No metal detectors have been used during the post-mortem of elephants. Experienced doctors are not available, particularly for post-mortem of elephants, and pathological and forensic test facilities in the elephant reserve area are absent.
7. The high incidence of elephant deaths (7.8% per year) points to a need for special attention to prevent poaching and wilful electrocution of elephants. This ER mostly serves as elephant passage from Mayurbhanj ER and Jharkhand state to Sambalpur ER, which exposes the elephants to many dangers. Another factor is the mining activity, which forces the elephants to stay outside their main habitat, exposing them to further dangers.
8. Though the existing control measures taken by the Forest Department appear to be adequate, intelligence network and mobility of the Forest Staff need to be improved in all the Divisions.
9. A separate Management Plan for the ER is a very urgent requirement. Working Plan / Management Plan has still to be prepared / approved for all Divisions with the exception of Bonai FD.
10. National highway crossing points of elephants need to be identified. Placing of indications for speed limit on the NH where elephant crossing points are located requires to be done. The roads between Keonjhar – Ghatagaon on NH 215 and between Keonjhar-Suakati on NH 6 are important elephant crossing stretches.
11. Priority should also be given for ground verification and providing legal status to the elephant corridors. Demarcation and legal protection of the identified corridors is a main concern.
12. Elephant Reserve falling under Dhenkanal Territorial Forest Division has to be realigned and Samal Barrage left canal can be considered as boundary. The area beyond the canal has no viability and may be one of the causes for severe Human – elephant conflict.
13. BER serves as a link between SPER and Mayurbhanj ER, and also Jharkhand state. Gathering of intelligence, monitoring of elephant movement and information about any outbreak of disease between these Elephant Reserves needs to be coordinated properly.
14. Impact study of recent industrial establishments particularly in the Bonai FD and Keonjhar FD, monitoring of irrigation canal system, monitoring and policy formulation for the mining activity, involvement of miners in the conservation

activity, compensatory plantation in the mining area are some of the crucial conservation aspects to be taken into consideration.

15. Maintenance of existing physical barriers and bringing other crucial areas under the protection of effective conflict mitigation measures are crucial. Maintenance of these physical barriers should be in collaboration with the villagers.
16. Actual fund requirement and allotment for managing the ER is not known, budgeting should be under micro Management Plan.

CONCLUSIONS

The reserve is located between three elephant reserves and there is elephant movement across these reserves. Elephant population in this reserve is mostly transit. The reserve has no Protected Area network, and Human – elephant conflict is high. Regular population monitoring and creation of sanctuary within the reserve could be the management targets for the reserve for the next ten ears.

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The elephant population in Orissa today faces serious conservation challenges. Project Elephant launched by the Government of India in 1992 aims to conserve elephant populations and their habitat through the establishment of elephant reserves. The current survey was commissioned by the Orissa State Forest Department and was executed by the Asian Nature Conservation Foundation, Bangalore. In this study, the Elephant Reserves in Orissa such as Mahanadi, and Sambalpur (declared), South Orissa, and Baitarni (proposed) were surveyed and the conservation and management challenges are presented.

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