Conservation of the Asian elephant in Central India

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Introduction

In central India, elephants are found in the States of Orissa, Jharkhand (part of the erstwhile Bihar), and southern part of West Bengal. In all three States elephants occupy a habitat of approximately 17,000km^2 constituted by Orissa (57%), Jharkhand (36%) and southern West Bengal (7%). A large number of elephant habitats in this region are small, degraded and isolated. Land fragmentation, encroachment, shifting cultivation and mining activities are the major threats to the habitats. The small fragmented habitats, with interspersed agriculture land use in and around, influence the range extension of elephants during the wet season, and have become a cause of concern for human-elephant conflicts. Long distance elephant excursions from Singhbhum and Dalbhum forests of the Jharkhand State to the adjoining States of Chattisgarh (part of erstwhile Madhya Pradesh) and West Bengal respectively, have been a serious conservation problem since 1990. While there was no earlier record of elephant presence in Chattisgarh, yet from West Bengal they were once displaced following forest losses.

Biogeographically, the elephant habitats in the region fall in two major biotic provinces (Rodgers and Panwar 1985), namely Chotanagpur Plateau in the Northern and Eastern Ghats in the south. The former Province comprises the forests of Jharkhand tapering through Dalbhum tract to western border of southern West Bengal and north-western portion of Orissa. The majority of the forests are deciduous in nature but hill ranges have greater diversity value. The major elephant habitats in the Chotanagpur biotic province are Palamau, Singhbhum and Dalbhum Forests. On the north of the Mahanadi River, lie the separate hill ranges of Simlipal and Keonjhar Plateau. These hill ranges have relics of many archaic landmasses with elevated ridges and densely forested valleys. Topography of this area is very rugged comprising hill and peneplains. The highest peaks of those hill ranges are Mankarcha (1,117m) and Malayagiri (1,187m) in Keonjhar Plateau and Meghasani (1,165m) in Simlipal. Forest Divisions having elephant in these ranges are Baripada, Karanjia, Keonjhar, Bamra, Rairakhol, Angul, Dhenkenal, Athamalik and Athgarh. The Eastern Ghats extending from south of the Mahanadi River to Mahendragiri forms the elephant habitat in the southern region with areas falling only in Orissa State. The Forest Divisions containing elephant habitat are: Boudh, Nayagarh, Phulbani, Baliguda, Kalahandi, Raygada, Parilakhmundi and Ghumsur North. The average elevation of this tract is 1,100m a.s.l., and the highest point in the Eastern Ghats is Mahendragiri (1,501m). The habitat of Chandaka Elephant Reserve in the Khurda upland of coastal plains is beyond the limits of Eastern Ghats.

Forests lying in Orissa constitute the major habitats of elephant in the central India and are distributed across over 22 out of the 27 Forest Divisions. Total elephant habitat extends over an area of nearly 10,000km^2, which is about 21% of 47,033km^2 State Forest available, assessed through satellite data (FSI 1999). Dense forest accounts for 26,073km^2, open forest for 20,745km^2 and mangrove for 215km^2. While the northern part of Orissa beyond the Mahanadi River is plagued by severe mining activities, the southern part suffers from shifting cultivation. FSI (1999) data reports that the four Districts of Orissa, namely, Sundergarh, Keonjhar, Jajpur and Dhenkenal, have 164 mining leases of iron, manganese and chromate over 376.6km^2 which include 192.6km^2 of forest. About 5,030km^2 (or 8.8% of total forest area) is affected by shifting cultivation, most of which is on the southern part. Human population density is 236 persons/km^2. Nearly 53% of the elephant habitat is currently networked through 11 Protected Areas (PA) out of total 18 found in the State. The PAs of value to elephant conservation are: Simlipal National Park or NP (845.7km^2), Simlipal Wildlife Sanctuary or WLS (1924.3km^2), Hadgarh WLS (191km^2), Kuldiha WLS (116km^2), Satkosia Gorge WLS (795.5km^2), Baisipali WLS (168.3km^2), Chandaka-Dampara WLS (175.8km^2), Kotgarh WLS (399km^2), Lakhari valley WLS (185.5km^2), Khalasuni WLS (116km^2) and Badarma WLS (304km^2). The Simlipal Tiger Reserve that covers the areas of Simlipal NP and Simlipal WLS enjoys better protection under the umbrella of the Project Tiger. The majority of PAs, except for Simlipal Tiger Reserve and Satkosia Gorge Sanctuary, do not have management plans. Recently, under Project Elephant, the following three Elephant Reserves (ERs) were declared in Orissa: Mayurbhanj ER (7,044km^2; 500 elephants); Mahanadi ER (1,000km^2; 550 elephants); and Sambalpur ER (500km^2; 100 elephants)

Elephant habitat in Jharkhand covers an area of approximately 6,000km^2, which is 28% of 21,644km^2 forests assessed through satellite data in the State (FSI 1999). Singhbhum forests are the only major elephant habitat affected by mining of iron, manganese and copper. Total leased area of the District is 115.4km^2, which includes 31.9km^2 of forest. A study conducted by Singh and Chowdhury (1999) reports operation of 12 mines in Saranda Forest Division where 17km^2 of forest area have been opened up out of the lease area of 81km^2. Plamau District does have bauxite mining in a smaller area. The human population density of the State is 880 persons/km^2. There are two PAs: Palamau Tiger Reserve (1,920km^2) and Dalma WLS (193.2km^2), both of which lack a management plan. Unfortunately, the Singhbhum Forests, with their sizable elephant habitat

and population, did not have any PAs until recently. In 2001 this area was brought under the category of Elephant Reserve (ER), with an area of 4,350km^2 for about 350 elephants.

The elephant habitat in southern West Bengal includes Districts of Midnapore, Bankura and Purulia where elephant range expansion takes place from adjoining Dalma WLS, Jharkhand. Nearly 50-60 elephants enter southern West Bengal annually during the wet season from September to February. However there are about 26 resident elephants remain localized in the southern West Bengal habitat (Chowdhury *et al.* 1997). This habitat has fragmented forests mostly in protected and unclassed categories. The major land use in the area is agriculture, which over the decade has boosted due to better water harvesting regime developed through dams and lift irrigation (Chowdhury *et al.* 1997). According to the human census data 2001, the human density in the State is 904 per km^2. To date, there is no PA here. Mayurjharna ER has recently been created to conserve 60 elephants in an area of 450km^2.

The general vegetation types in the region are mainly tropical moist deciduous forests interspersed with tropical dry deciduous forests available through the influences of dry climatic factors. The moist deciduous forests having sal (*Shorea robusta*) as predominant tree in association with various other species such as: *Terminalia* spp., *Adina cordifolia*, *Anogeissus latifolia,* etc. occur in large extent. In the deeper valleys where soil and moisture condition are better, tropical semi-evergreen forests occur in patches. The tree species associations are: *Macaranga peltata*, *Bischofia javanica*, *Pongamia pinnata*, etc. The tree ferns *Alsophila glabra* and *Cyathea spinulosa* occur in lower reaches of the semi-evergreen forests. However, at higher elevations, the plant associations are *Alstonia scholaris*, several *Ficus* spp., *Anthrocephalus cadamba*, *Michelia champaca*, *Toona ciliata*, *Mesua ferra*, *Mangifer indica*, etc.

The elephant habitat immediately adjacent to the north of Mahanadi River and beyond to south has plenty of bamboo available. *Bamboosa arundinacea* occurs at places where soil condition and moisture remain good. *Dendrocalamus strictus* occurs extensively in dry and deficient soils, along with *Sal* understory. In northern half of Orissa, *Dendrocalamus* occurs sporadically.

The tropical dry deciduous forests occur in interspersion mostly in the southern part of Orissa and north-eastern part of Jharkhand. The important species associated with sal are *Anogeissus latifolia, Terminalia tomentosa, Mitragyna parviflora, Ougenia dalbergoides, Cassia fistula, Bauhinia racemosa, B. purpurea, B. retusa, Adina cordifolia,* etc.

Status and distribution of wild elephants

Population estimates of elephants in this region have varied according to the available sources of information as summarized in Table 1. The figure for Central India may range between 2,400 and 2,700 including Orissa (1,800-2,000); Jharkhand (600-700) and southern West Bengal (25-35). Elephants migrating into southern West Bengal have been enumerated with those in Jharkhand. Elephant numbers in Jharkhand were estimated regularly by the Forest Department in Palamau, Dalma WLS, but in other areas they were carried out only occasionally. In some selected habitats in Orissa, such as Simlipal Tiger Reserve, Kuldiha WLS Hadgarh WLS, Satkosia Gorge WLS and Chandka-Dampara WLS, elephant numbers were estimated methodically on the basis of direct sighting. For other areas such estimations were based on rapid local inquiries as well as educated guesses.

Table 1. Estimation of elephants in Orissa, Jharkhand and southern West Bengal.

S. No.	State	Reporting year	Elephant estimation	Source
1.	Orissa	1985	1,351	Chowdhury *et al.* 1985
		1989	1,600 –2,000	Orissa Forest Department in 1989 Elephant Action Plan Workshop, Dehradun, India.
		1989	1,692 – 1,947	Singh 1989
		1993	1,500 – 2,000	National Elephant Conservation Action Plan
		1999	1,827	Orissa Forest Department quoted in PE review committee report 2001
Orissa			1,800-2,000	
2.	Bihar	1985	300 – 360	Chowdhury *et al.* 1985
		1989	750	Bihar Forest Department in 1989 Elephant Action Plan Workshop, Dehradun, India
		2001	655 –700	Bihar Forest Department Report quoted in PE review Committee Report 2001
Bihar			600-700	
3.	Southern West Bengal	1997	24-26 localized and 35-40 migratory from Dalma WLS	Chowdhury *et al.* 1997
		2000	35 localized and 55 migratory	West Bengal Forest Department
Southern West Bengal			25-35	
Total			2,400-2,700	

There are four large zones in Orissa and two in Jharkhand, where habitat integration is possible to make them viable for elephant range and number. The six zones so identified collectively make up about 87% of conservation coverage available to the elephant population in the region. These zones need to be managed on an enhanced priority for elephant conservation, where other priorities such as forestry, non-forestry land-use activities should be subservient and made compatible with the overall objectives of elephant conservation. A large number of isolated elephant populations (see Fig. 1) that are medium to small in size, are described below:

ORISSA

Large habitats

Simlipal-Kuldiha-Hadgarh (Zone 1): This zone comprising an area of approximately 3,200km² has three PAs – Simlipal Tiger Reserve (2,770km²), Kuldiha Sanctuary (116km²) and Hadgarh Sanctuary (191km²). Furthermore, this zone is also contiguous to the Reserve Forests (RFs) of Noto (63km²) and Gadsahi (40km²), which can be integrated to make it more effective for long-term elephant conservation. Estimation of elephant numbers based on direct counts was first attempted by AsESG, Central India Task Force in May/June 1983 and came out with an estimate of 375 elephants (Chowdhury *et al.* 1985). Subsequently, in 1989, transects studies during the monsoon indicated a population of 500 elephants (Singh 1989). A comprehensive block count in 1994 estimated 491 elephants in the zone including 432 in Simlipal Tiger Reserve, 31 in Kuldiha WLS and 25 in Nato and Satkoshia RFs and 3 in Gorumahisani (Prusty and Singh 1994). This zone, if integrated, could provide protection to 550-600 elephants with a crude density of 1 elephant/5.3-5.8 km². This zone is remarkably well known for its biodiversity attributes available within the tropical semi-evergreen forests and moist deciduous forests. The well-wooded rolling plateau with deep folds of hills, interlaced with a network of perennial streams and rivers provide ideal habitat for elephants. The immediate management actions required in this zone are the reduction of hunting by the locals, eliminating ivory poaching, maintaining the corridor links with the Kuldiha and Hadgarh Sanctuaries with the South Simlipal Tiger Reserve, relocation of a few small hamlets from South Simlipal, and monitoring ferro-alloy mining activities in Hadgarh Sanctuary.

Satkosia-Baisipalli Complex (Zone 2): This zone is situated in the central part of Orissa covering two PAs – Satkosia Gorge Sanctuary (795.5km²) on the north of the Mahanadi River and Baisipalli Sanctuary (168.3km²) on the south of the Mahanadi River. An 800km² contiguous RF area available to the south of Baisipalli Sanctuary makes it possible to integrate the entire area into a larger landscape zone (comprehensively 1,763km²) for elephant conservation. A summer water hole count revealed a population of 100 elephants in Satkosia Gorge WLS by the Central India Task Force, AsESG (Chowdhury *et al.* 1985). Singh (1989) reports a population of 300-400 elephants both in Satkosia and Basipali WLS. The estimated population in this zone could be between

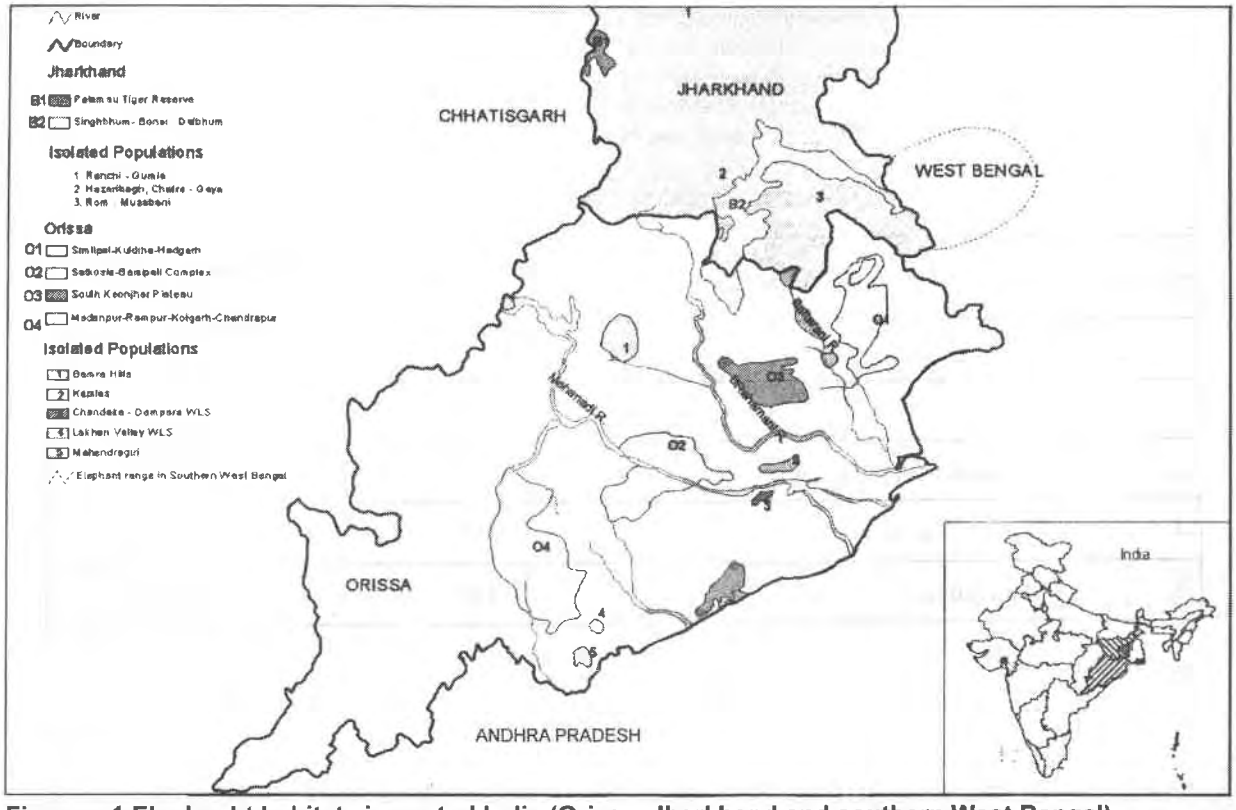


Figure 1 Elephanbt habitats in central India (Orissa, Jharkhand and southern West Bengal).

400-500 elephants with a crude density of 1 elephant/3.5-4.4km^2. Sal, in association with bamboo (*Dendrocalamus strictus*), in the northern tropical dry deciduous forest is the major component of elephant habitat. Water management in this dry deciduous habitat, making forestry operations more wildlife oriented, controlling cattle grazing and forest fire, and attention to cattle-borne diseases are the major issues for management. Habitat conversions of dense mixed forests with commercial monoculture plantations need to be reviewed for developing management priorities and actions.

South Keonjhar Plateau (Zone 3): This zone, with an area of about 2,600 km^2 includes Deogan, Ghatgan and Telkoi Ranges of the Keonjhar Forest Division (or FD) and Kamkhya east and west ranges of Dhenkenal FD in Orissa. No systematic estimation of elephant population has been made here. There could be 200–250 elephant in this zone, giving a crude density of one per 10-13 km^2. This zone does not have any PAs at present to enhance elephant conservation. Elephant habitat is mostly constituted with northern tropical moist deciduous forests. Land encroachment, mining and shifting cultivation practices are the major conservation problems in this zone.

Madanpur-Rampur-Kotgarh-Chandrapur (Zone 4): This zone in the Eastern Ghats covers the Civil Districts of Phulbani, Kalahandi, Koraput and Ganjam. Although a vast stretch of area (approximately 8,000km^2) is available in the three elephant bearing FDs of Balliguda, Kalahandi and Raigada, about 70–80 % area is under shifting cultivation that has badly fragmented the entire landscape. At present the Kotgarh Sanctuary is the only PA in this zone, covering an area of 399km^2. No systematic estimation of elephant population has ever been carried out here. Proposed status of two more Sanctuaries – Belghar and Subrnagiri is unclear. This zone could have 300-400 elephants. The crude density of elephant per unit area is very low, i.e., one per 27-36km^2. Elephant habitat in this zone is represented by northern tropical moist and dry deciduous forest. The northern portion of the elephant habitat is drier compared to the southern portion.

Isolated elephant habitats

Besides the above-mentioned four large habitats, there are five isolated, medium to small sized elephant populations in Orissa. The Bamra Hills contain a habitat constituted by two PAs, i.e., Khalasuni (116km^2) and Badrma (304km^2). Recently this area was identified as an Elephant Reserve for protecting some 100 elephants over an area of 500km^2. Other small and isolated elephant populations include, Kapilas, Chandaka–Dampara WLS, Lakhari Valley WLS and Mahendragiri (see Table 2). All these habitats need to be managed separately with stronger objectives of elephant population management.

Table 2. Isolated elephant populations in Orissa.

Sl. No.	Name of isolated elephant populations	Estimated elephant population	Habitat (km^2)
1.	Bamra Hills, (Kalhasuni and Badarma WLS	100-110	500
2.	Kapilas	40-50	129
3.	Chandaka–Dampara WLS	50-60	175.8
4.	Lakhari Valley WLS	50-60	185.5
5.	Mahendragiri	10-15	130

JHARKHAND

Large habitats

Palamau Tiger Reserve (Zone B_1): This zone has an area of nearly 1,250km² most of which comes under the umbrella of the Project Tiger. Population estimates of elephants through direct counts are an annual feature of Forest Department census in Palamau Tiger Reserve. This zone has an elephant population numbering between 100-125 animals giving a crude density of one per 10-12.5km². Threats to elephant population are few. However, people's antagonism towards the elephant for crop depredation, dealing with an occasional straggler group of elephants straying into adjoining areas, and the management of water in the habitat are the important issues for elephant conservation.

Singhbhum–Dalbhum–Bonai (Zone B_2): This zone includes three FDs – Saranda, Kolhan and Porahat of Singhbhum District of Bihar. Contiguous with this on the south are the Joda and Koira Ranges of Bonai FD of Orissa, and on the north, the Dalma WLS. At present there is only one PA in the zone, namely the Dalma WLS (193.2km²) where elephant numbers are estimated annually through waterhole counts by the Forest Department (Chowdhury *et al.* 1985). Datye (1995) estimated the population to be about 66 elephants in Dalma WLS. The comprehensive elephant habitat in this zone amounts to 2,900km² that could support a population of 350-450 elephants. Major management problems in this zone are: pollution and habitat degradation due to iron-ore mining; illegal forest felling; fragmentation of habitat; and tribal hunts. Shifting cultivation occurs in the Bonai Forest Division, Orissa. Replacing dense mixed forests with teak plantations needs to be reviewed. Among the recent developments, the canal layout of the Subernarekha Multipurpose Project might pose a barrier to the movement of elephants from Porahat in Singhbhum Forests to Dalma WLS which needs to be reinvestigated to mitigate the problem.

Isolated habitat/problem populations

There are two problem populations and one small population in the Rom-Musabani Forests south of the Subrnarekha River (see Table 3). The Hazaribagh–Chatra and Ranchi-Gumla are the stressed populations, which do not have any clearly discernible movement range. Habitat fragmentations in both these ranges are severe with extensive human population and biotic pressures. A national policy document for managing such dislocated populations on sub-optimum habitat needs to be developed.

Table 3. Isolated small and problem populations in Jharkhand.

S. No.	Name of isolated elephant populations	Estimated elephant population	Habitat (km²)
1.	Hazaribagh, Chatra and Gaya	43	>2,412
2.	Ranchi and Gumla	11	>1,510
3.	Rom-Musabani Forests (South of the Subernarekha River)	20-30	60

Southern West Bengal

The elephant population in southern West Bengal is made up by about 35-40 elephants migrating annually from Dalma WLS, Jharkhand, and 26 localized elephants in four sub-groups (Chowdhury *et al.* 1997). The habitat here is altered agriculture-dominated interspersed with revived forests through community efforts. The *Zamindari* land tenure system was major cause of forest destruction during pre-independent India.

Status of captive elephants

The status of captive elephants in the region has been documented and compiled by the Ministry of Environment and Forests. According to the information available, there are 15-20 elephants in captivity in Jharkhand, and eight in Orissa. In West Bengal, although there is a much larger number (110-120) of elephants in captivity, most of them are Government-owned and confined to northern West Bengal. In southern West Bengal they are brought if and when domestic elephants are required for tackling the marauding wild elephants, and in elephant captures. As in West Bengal, almost all the elephants in captivity in Orissa also belong to the State Forest Department. However, in Jharkhand, there are quite a number of privately-owned elephants. The registration process of all the privately-owned elephants has not been completed. Captive elephants belonging to the State Forest Department are relatively well looked after in all the three States. The Forest Department provides veterinary care to the elephants as and when it is needed.

Legal status of elephants and their habitat

As in other parts of India, elephants in this region are legally protected under the Wildlife (Protection) Act of 1972. However illegal poaching, electrocution and cases of poisoning need to be monitored. Annually about 14 elephants are being killed for ivory in Orissa, while in West Bengal about three elephants are killed per year and one per year in Jharkhand (Project Elephant 2001). Mohanty (2001) reports the death of 48 elephants between 1991-2000 from the Simlipal Tiger Reserve alone, of which 22 were confirmed cases of poaching. Furthermore, he points to the activity of an international gang of ivory poachers in Simlipal in 1993. The major vulnerable areas are the northern and central part of Orissa including Simlipal, Kapilas and Satkosia WLS. There is a single report of an elephant by the locals for meat in the Chandaka-Dampara Reserve in Orissa (Dash 1983). Cases of elephant killing by electrocution, based on the data from 1997-2001, indicate an average of 1-2 elephants/year in Orissa, followed by Jharkhand and West Bengal (Project Elephant 2001). Poisoning of elephants in the same reporting years has been known only from West Bengal at average rate of 1 elephant/ year. Most of the cases of electrocution and poisoning are retaliatory actions by people affected by elephant depredation.

Addressing elephant conservation policy issues for several small and fragmented elephant populations as described above remains a top priority. The current laws and regulations permit the capture of such isolated individuals. However, under these circumstances, there must be clear strategies to deal with the animals captured. There is a need to consider the demand for domesticated elephants elsewhere in the country. This needs to be integrated into the overall national planning.

Conservation problems and issues

Habitat fragmentation

Habitat fragmentation has been a major threat for the conservation of elephants in central India. In broader terms, the agents of forest fragmentation in northern part of the region are mines and mining activity, encroachments and conversion of lands for cultivation, human settlements and commercial forestry operations. In contrast to the situation in the north, the southern part of the region beyond the Mahanadi River has suffered largely from indiscriminate shifting cultivation (*jhum*), which has led to the fragmentation of forests in Phulbani, Balliguda, Raygada, Kalahandi, Paralakamedi, Koraput and Ghumsur south of Eastern Ghat where elephants occur. Repeated short cycle *jhumming* on the steep hill slopes, has washed away the topsoil and at many places, exposing the parent rocks. Both the reserve and protected forests are harmed in this way. Aggressive weeds such as *Eupatorium* and *Lantana* have taken over the elephant habitat, following repeated fires. In addition, the practice of growing teak on a commercial scale has also led to the replacement of the dense mixed forests containing several fodder plants for elephants. The affected areas are Kuldiha, Satkosia Gorge, Kapilas and Lakhari Valley Sanctuaries in Orissa, and Singhbhum Forests in Jharkhand.

Mines and mining

The northern region is important for mining. Large tracts of land in Keonjhar, Angul, Dhenkenaland, Jajpur Districts, Orissa, and Singhbhum District, Jharkhand, are under mining activity related to the extraction of iron-ore, copper, manganese, ferro-alloy, coal etc. An environment impact assessment (EIA) is very much needed in such areas where elephants also occur. A study carried out by the Wildlife Institute of India in Singhbhum forests has clearly shown the impacts of iron-ore mine discharges in polluting the Koina River. The high turbidity and TSS (total suspended solids) from an unregulated mine was one of the major reasons for the altered water quality of the Koina River resulting low utilization of the riverine forests (Singh and Chowdhury 1999). This suggests the need for a stronger monitoring of mining activities and their discharges to avoid ecosystem degradation and health impairment.

Tribal hunts

The entire Chotanagpur Belt and its adjoining areas including Simlipal Tiger Reserve has a major impact on the decline of wildlife due to annual tribal hunts prevailing in this region. However, elephant killing and poaching in particular is not known in any of the areas except for Simlipal Tiger Reserve. There were few cases of elephants being killed with bows and arrows or through poisoning and the subsequent removal of tusks in Simlipal Tiger Reserve.

Straying of elephants

During 1988 and 1989, long distance movements of 18 elephants were recorded from the Porahat FD to the adjoining of Gumla in Ranchi District, Jharkhand, from where they moved to Basia, Palcot, Raidih and entered in neighbouring State in Chattisgarh via the Jaspur Forests. After their rampages, the elephants reached the north Sarguja Forest Division via Kurog. From the Bihar border these elephants traveled 50-60km in Madhya Pradesh. Managing such straying herds of elephants is an issue that needs serious attention.

Human-elephant conflict

The human-elephant conflicts in agricultural areas are widespread and serious in the region. On the whole, crop depredations, property losses and human kills in a year are much more severe in West Bengal than Jharkhand and Orissa. Annual manslaughter by elephants, based on 10-year data in Orissa, is 17 per year (Project Elephant 2001). Sar and Choudhury (2001) studied the human-elephant conflict in Nyagarh FD and estimated crop and property losses. Other sensitive areas for such conflicts in Orissa are, Chandaka, Kapilas, Lakhari-valley, and Satkosia Gorge Sanctuaries and their adjoining areas. The major human-elephant conflict occurs in southern West Bengal where a group of 45-40 migratory elephants enters every year from Dalma WLS through Kankrajhore of West Midnapore FD. This phenomenon has been going on since 1987 with the revival of forest cover in south West Bengal due to Joint Forest Management activities.

During the stay of elephants for 5-6 months from September to February, they utilize the forest ranges of Hoomgarh, Garbeta, Goaltore, Nayabasat, Arabari, Lalgarh, Bankada, Joyapur, and Bishnupur in eastern Midnapore, Rupnarayan and Bishnupur Divisions. Besides the migratory elephants from Dalma WLS, there are four resident sub-populations, which remain throughout the year in southern West Bengal. The study carried out by Wildlife Institute of India under the West Bengal Forestry Project revealed that the majority of human kills occurred during the post paddy harvest season and with the advent of potato crops (Chowdhury *et al.* 1997). The bulk of human kills was the result of the resident populations (mostly constituted by males) rather than migratory ones. In Jharkhand, on average about 24 people are killed annually (Project Elephant 2001). This problem is on the increase mainly with the two problem populations mentioned above.

Past and present conservation measures

In 1969, an expert committee of Indian Board of Wildlife recognized the threat of ivory poaching as a factor for decimating elephant populations. With the advent of Wildlife (Protection) Act of 1972, elephants were included in the category of game under the Schedule II. The first recognition of endangered category of elephant came through CITES listing the species on Appendix I. The Asian Elephant Specialist Group (AsESG) was constituted in 1976 with four task forces to look into the status and distribution of elephants (Daniel 1980). Subsequently, in 1977 the Asian elephant was brought under the Endangered category of Schedule I of the Wildlife Act of 1972.

The Central India Task Force of the AsESG took up a detailed survey of elephants in Orissa, Jharkhand and in southern West Bengal. In 1985, a complete status survey of the elephants in Central India was carried out (Chowdhury *et al.* 1985). A national workshop on elephant management issues was organized in 1989 at the Wildlife Institute of India to consolidate the actions required for elephant conservation in the country. Authorities of all elephant-bearing States also participated in this meeting. In 1992 Project Elephant came into force with the objectives of protecting elephants, improvement of habitats and corridors, welfare of domestic elephants, public cooperation and support services. Within a decade, the Project provided assistance of 738 Lakh Indian Rupees to the three States of the region, which was 23% of total National contribution (Project Elephant 2001). This enabled the concerned States to strengthen their activities for habitat protection and management, corridors, anti-poaching, *ex-gratia* relief for conflicts, publicity, training and eco-development. With the support of Project Elephant, the States were able to declare five Elephant Reserves in central India, of which one was in Jharkhand, three in Orissa and one in southern West Bengal. All these reserves amount to a total area of 9,694km^2 of elephant habitat for the protection of 1,560 elephants in the region. Given the enormity of the task, the present investment of 500-600 Indian Rupees per km^2 is inadequate. Out of this investment, only a third is set aside for settling compensation claims in human-elephant conflicts.

Recommendations

Priorities for elephant conservation in this region include: linking and maintaining habitat contiguity through effective protection; removal of illegal settlements and creating conservation corridors; controlling and curbing tribal hunts; relocation of a few small settlements to other developed areas; habitat improvements through enriched plantations; minimizing human-elephant conflicts through tactical methods of erecting barriers; developing better monitoring and control on mining and pollution

activities; and developing a better land-use planning and coordination and eliciting people's participation for various programmes and activities.

The zone-wise recommendations are given below:

Zone O_1

The corridor between Kuldiha and Simlipal Tiger Reserve has to be restored by eliminating encroachments for marginal cultivation in the chicken neck. The Reserve Forests of Noto (63km^2) and Gadsahi (40km^2) have to be added to Hadgarh Sanctuary for increasing the effectiveness and integration with Simlipal Tiger Reserve.

Two villages, Jenabil and Barhakamra in southern Simlipal, should be relocated in the command area of the Kalo and Subernarekha Projects. With the available irrigation facilities, the tribal economic conditions will improve.

The annual tribal hunts which last for five months (January to May) need to monitored and controlled. There should also be an awareness campaign to highlight the plight of the elephants in this area.

The ferro-alloy mining inside the Hadgarh Sanctuary needs to be investigated and reviewed.

Forest management practices for fire suppression need to be intensified.

Zone O_2

The 800km^2 RF lying to the south of the Baisipali Sanctuary, needs to be integrated towards wildlife-oriented management by developing a comprehensive management plan.

No commercial plantations should be allowed at the expense of the indigenous flora.

Well-distributed water management needs to be developed in the entire zone.

An investigation for outbreaks of diseases among wildlife should be undertaken to improve the health of wildlife populations in the zone.

The Wildlife (Protection) Act of 1972 must be strictly enforced for controlling the use of fire arms within the prescribed radius of the Sanctuary boundary.

Silviculture practices for bamboo extraction must be made wildlife-oriented.

Zone O_3

There is a need for identifying a PA within this zone, as there is none at present.
People-oriented programmes need to be initiated for tackling land encroachments by marginal cultivators.

Existing mining activities need to be appraised and evaluated.

Zone O_4

The proposed Belghar and Subarnagiri Sanctuaries must be declared and established as has been suggested by the AsESG Central India Task Force.

People-oriented programmes need to be initiated to wean the local tribals away from their present practice of shifting cultivation.

Zone B_1

Priority to be given for controlling crop depredation and manslaughter by wild elephants in Betla and its adjoining areas. Effective barriers to deter the elephants entering croplands should be established.

Research on human-elephant conflict should be undertaken with the view to mitigating it.

Sensible policies for the use of water during the dry season needs to be adopted.

Zone B_2

There is a need for protecting and maintaining the corridor between Saranda FD on the south and the forest of Bonai in Orissa.

The forest corridor between the Porahat FD on the north and the Chandil Forest of Dalbhum FD should be protected and maintained.

The mining activities and their impact on the air, water, and soil need to be monitored. For aquatic ecosystem monitoring, TSS and turbidity as key parameters, must be determined regularly.

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