Conservation of the Asian elephant in North-West India

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Introduction

The north-western elephant population in India once had a continuous range in Uttar Pradesh (UP), from Katerniaghat Wildlife Sanctuary (WLS) in Bahraich Forest Division (FD) in the east, to the Yamuna River in the west (Singh 1978). Over time, this continuity has been broken, and now the total population of about 1,000 elephants occurs in six isolated sub-populations. From east to west, these populations are in Katerniaghat Wildlife Division (WLD), 10-20 animals migrating to and from Nepal's Bardia National Park (NP), in and around Dudhwa Tiger Reserve (TR, 880km^2, *c.* 40 elephants) (Javed 1996), between Sharda River and Haldwani town, Haldwani and Khoh River, Khoh River and Ganga River, and between Ganga River and Yamuna River. Bulls, however, still cross Khoh and Ganga Rivers. The major breaks in this elephant range are along the Ganga River, along the Gola River that runs to the west of Kathgodam-Haldwani-Lalkuan Highway, across Khatima Range of Terai East FD and between Dudhwa NP and Katerniaghat WLD. Although isolated, Katerniaghat WLD is identified as an area to be managed along with Dudhwa TR. The Khatima Range has become unsuitable for elephants and other large mammals as a result of the construction of Sharda Main Canal, Tanakpur-Khatima Highway and enormous increasing biotic disturbances, from the human settlements in and around. Steep terrain and biotic disturbances deter the movements of elephant groups across Gwalgod *sot* in the hilly terrain of Rajaji-Corbett corridor (Sunderraj *et al.* 1995). Nevertheless, elephants use the stretch of forests south of Rajaji-Corbett corridor (parts of Haridwar and Bijnor Plantation Division, *c.* 300km^2) as a corridor between Rajaji NP and Corbett TR. But this forest belt is also under enormous biotic pressures. Sand and boulder mining started in the riverbeds of this area, in the recent years, have added to the pressures.

From east to west, the Protected Areas (PAs) and forest divisions in this elephant range are: Katerniaghat WLD, Dudhwa NP, Kishanpur WLS, North Kheri FD, Pilibhit FD, Haldwani FD, Champawat FD (South Pithoragargh), East Terai FD, Central Terai FD, West Terai FD, Ramnagar FD, Corbett TR (including Sonanadhi WLS), Bijnor FD, Lansdowne FD, Bijnor Plantation DIivision, Haridwar FD, Rajaji NP, Dehra Dun FD, Narendra Nagar FD (part), Shivalik FD and Kalsi FD. The elephant range here is about 500km long and narrow in most places.

Altitude varies between 200 and 1,000m a.s.l., and Kanda, which is situated on the northern boundary of Corbett TR, is the highest point. The total elephant habitat available is around 10,000km^2. The Outer Himalaya and the Shivaliks are the mountain and hill ranges that run through this tract.

West of Sharda River, the fertile water-rich *terai* tract has been lost to cultivation and monoculture plantations, and the elephant habitat is largely confined to the *bhabar* tract, which is full of boulders and has a low water table. *Terai* habitat is still available east of the Sharda River, in Pilibhit and North Kheri FD, Dudhwa TR and Katerniaghat WLD. Major rivers in this range are the Yamuna, Ganga, Ramganga, Sharda, Suheli and Geruwa. Besides these, there are numerous streams and ephemeral water courses known as *raus*, which in the *bhabar* tract remain dry during most parts of the year. See Johnsingh *et al.* (2004) for more details of this area.

Vegetation types

The vegetation in this tract is dominated by moist and dry sal (*Shorea robusta*) forests, interspersed with northern tropical dry deciduous forests, Northern tropical moist deciduous forests, and bamboo (*Dendrocalamus strictus*) clumps. Himalaya sub-tropical forests dominated by chir pine (*Pinus roxburghii*) occur on the peaks of the Shivaliks. Cane (*Calamus tenuis)* brakes, seasonal swamp forests dominated by *Syzygium*, riparian fringing forests dominated by *Trewia nudiflora*, *Ficus hispida* and *Putranjiva roxburghii* also occur at mesic sites. The *terai* grasslands east of the Sharda River are dominated by *Phragmites karka*, *Saccharum spontaneum*, *S. bengalensis*, *S. munja*, *Narenga porphyrocoma*, *Sclerostachya fusca*, *Themeda arundinaceae* and *Vetiveria zizanoides*. Several parts of this range, particularly the remaining *terai* belt, are planted with exotics like teak (*Tectona grandis*), gum (*Eucalyptus*), poplar (*Populus deltoides*), *Haplophragma heterophylla* and *Ailanthus excelsa*. The area is classified into six broad natural vegetation classes, Moist Sal Forest, Dry Sal Mixed Forest, Mixed Forest, Acacia-Dalbergia Forest, Open Woodland/Plantation and Open scrub and Grassland (Figure10.1).

Legal and management status

At present, there are six PAs in this range: Corbett NP (core of Corbett TR), Rajaji NP (still proposed), Sona Nadi WLS (part of Corbett TR), Dudhwa NP, Kishanpur WLS, and Katerniaghat WLD (the last three from the Dudhwa TR).

(a) Corbett NP (*c.* 521km^2), which forms the core area of the 1,288km^2 Corbett TR, has had a chequered

history. In 1936, it became India's first National Park under the United Provinces National Parks Act. Originally called Hailey NP, it became the Ramganga NP after independence. Finally, it was named Corbett NP in honour of late Jim Corbett, legendary hunter and author, and later a consultant to demarcate the limits of the proposed national park. On 1 April 1973, India's laudable conservation programme, Project Tiger, was inaugurated at the park headquarters in Dhikala.

(b) Rajaji NP, which encompasses three former wildlife sanctuaries – Rajaji, Chilla and Motichur – as well as parts of the Shivalik and Dehra Dun FDs, also has a history. In 1966, 90km^2 of the Dehra Dun FD was upgraded as Motichur WLS. An area of 247km^2 of the Shivalik FD and an area of 249km^2 of the Lansdowne FD were upgraded as Rajaji and Chilla WLSs in 1967 and 1974, respectively. In 1984, these three sanctuaries, and parts of the above mentioned FDs, were intentionally notified as Rajaji NP.

(c) Sonanadi WLS is contiguous to the Corbett NP, and along with it and some adjoining reserved forests (RFs), forms the Corbett TR. The Sanctuary was established in 1987 over an area of 301.76km^2. Lying between the Corbett NP and Rajaji NP, the Sanctuary is a part of the link between the two.

(d) In the *terai* region of Lakhimpur Kheri in UP, Dudhwa WLS, spread over an area of 212km^2, was created in the year 1958, to protect a population of swamp deer (*Cervus duvauceli duvauceli*). This was upgraded to National Park in 1977, and enlarged to an area of 490 km^2, along with a buffer of 124km^2.

(e) South of Dudhwa, on the southern bank of Sharda River, another PA, Kishanpur WLS, was established in 1972, over an area of 204km^2. In 1987, these two PAs of the UP *terai* were brought under the umbrella of Project Tiger. The Dudhwa TR so formed was further enlarged in 1994, by adding some buffer areas to the south, and extending the area of the reserve to 884km^2.

(f) Katerniaghat WLS was created in the forests of Bahraich FD in the year 1976. This Sanctuary had an area of 400km^2 on the eastern bank of the Ghaghra River. In 1997, along with 150km^2 of contiguous buffer, this Sanctuary was reorganized administratively as the Katerniaghat WLD, and in 2001, it was merged with Dudhwa TR.

The rest of the areas within this elephant range come under the category of Reserved Forests.

10.4 Density and status of elephant population

The elephant population in this range, from Yamuna to Katerniaghat, could be around 1,000 animals, giving a crude density of one animal per 10km^2. Area-wise population estimation is as follows: 150 to 200 elephants west of River Ganga (*c.* 1500km^2), 650 to 700 between Ganga and Gola River (Haldwani) (*c.* 4,000km^2), 50 between Gola and Sharda (*c.* 1,800km^2) which still a few years ago was reported to range into Nepal, may be into Sukhlaphanta Reserve, and 50 between Khatima Range and Katerniaghat (*c.* 2,500km^2) which moves between India and Nepal (Figure 10.2). Until recently, the population between Yamuna River and Haldwani had the best reported sex ratio in the entire Asian elephant range. Studies conducted by the Wildlife Institute of India in Rajaji NP and Corbett TR, have shown that the existing adult male:female sex ratio was 1:2-2.5, due largely to the absence of poaching for ivory. As a result, the effective population size of elephants in the forest patch between Yamuna River and Haldwani was higher than that of the southern Indian populations, despite their having a much larger number of individuals (Williams 2002). Recent poaching incidents (10 tuskers were poached in the Corbett-Rajaji area from December 2000 to December 2001) and the death of males (of the 11 elephants that died in December 2001 and January-February 2002 in the Rajaji area, including two bulls that were poached, eight were males) indicate that this healthy sex ratio can be drastically altered within a few years, if habitat degradation, deaths due to electrocution, poisoning and poaching are not brought under control.

Conservation problems

Since the steep Himalaya and Shivaliks bound this elephant range on the north, and the fertile *terai* on the south, fragmentation as a result of human habitations and associated developments, is the most serious problem. Equally serious is the problem of habitat disturbance and degradation due to overgrazing by domestic livestock, lopping of trees to feed the *Gujjar* buffaloes, and collection of *bhabar* grass (*Eulaliopsis binata*) for rope making. Overgrazing leads to proliferation of weeds and lack of regeneration of palatable plant species (Dabadghao and Shankarnarayan 1973; Johnsingh *et al.* 1990). Since October 2002, Uttaranchal Government has permitted large-scale sand and boulder mining in the river beds within the RFs. This mining brings in nearly 25,000 poor labourers from Eastern Uttar Pradesh and Bihar who camp on the riverbed for nine months (October to June) and their firewood needs combined with that of local people, cause enormous loss and disturbance to the elephant habitat.

Habitat fragmentation and threats to habitat connectivity

The once continuous elephant range is now fragmented in four places (along the Ganga and Gola Rivers, across Khatima Range and between Dudhwa NP and Katerniaghat WLD). There is a fragile connectivity between Dudhwa NP and Katernighat WLD along Bardia NP. In several other places the threats to habitat connectivity are increasing.

Kansrau-Barkote corridor

The connectivity between Kansrau Range of Rajaji NP and Barkote-Rishikesh Ranges (*c.* 120km² of elephant habitat) is a 2km-wide patch of disturbed forests, which is under enormous pressure, particularly wood-cutting from the adjacent villages (Lal Thapar and Chhidarwala). The corridor is being degraded at present. The Dehra Dun–Haridwar National Highway, passing through this corridor, is an additional source of disturbance. Bulls and groups occasionally use this corridor.

On the banks of Ganga River (Chilla-Motichur corridor)

As stated earlier, the habitat is almost completely fragmented for elephant groups, between Chilla and Motichur Ranges of Rajaji NP, on the banks of Ganga River. The factors that have led to fragmentation on the right bank of Ganga River are the expanding Haridwar Township, the Raiwala Army Camp, and the settlements of Tehri Dam oustees (Khand Gaon I, II and III) between Raiwala and Motichur *rau*. On the left bank of Ganga River, the 14km-long Kunaun-Chilla power channel has blocked the movement of elephants between Chilla and the river. All these developments occurred in the late 1960s and early 1970s. Now only a few bulls move at night between Chilla and Motichur, along the Motichur *rau* and through the army camp and the Khand Gaon III. The bridge on the channel near Suni *sot*, and the aqueduct built below the channel for the passage of water in Dogudda *rau*, are also occasionally used by the bulls (Johnsingh *et al.* 1990).

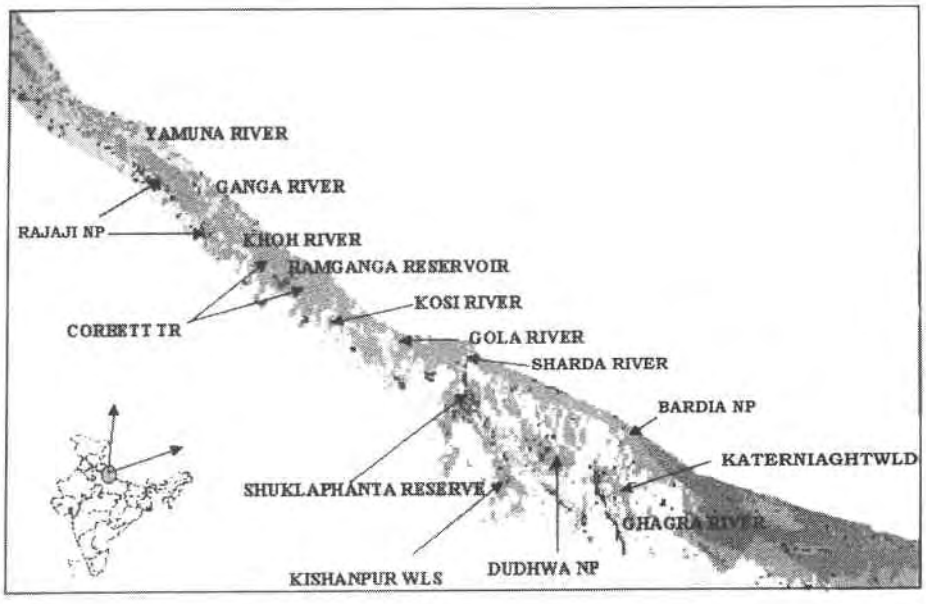
Between Rajaji NP and Corbett TR

In the past, there was a continuous stretch of forest south of the hilly tract that extends between Khoh River (west of Corbett TR) and the eastern end of Rajaji NP (Rawason River). In due course, forests closer to Khoh River were lost to cultivation and human settlements, forcing elephants to move across the hilly terrain in the eastern part of the corridor. Over the years, this narrow hilly corridor has come under immense biotic pressures from the *Gujjar* camps and villages situated on the northern and southern boundary. As a result of the growing biotic disturbances and the steep terrain, elephants have stopped using the habitat between Gwalgod *sot*, which is about 10 km west of Khoh River, and Khoh River (Sunderraj *et al.* 1995).The forests south of this hilly area, Haridwar and Bijnor Plantation Division, though under increasing biotic pressures, are still being used by elephants.

On the southern boundary of Corbett TR

The construction of a reservoir across the Ramganga River, and the building of the Kalagarh Township on the south-western boundary of Corbett TR in the early 1970s, has put an end to the movement of elephant groups across the Ramganga River, from Corbett NP to Kalagarh FD (Sona Nadi WLS and now part of Corbett TR). Only a few bulls occasionally cross the river along the southern boundary. Fortunately, the hilly habitat north of the Ramganga Reservoir is disturbance-free, and is used even by groups to move between the Park and the Sona Nadi WLS. The Kalagarh Project and associated township was built on 90km² of forest land and according to an agreement between the Irrigation and Forest Departments, 3.5km² of this area should have been vacated and returned to the Forest Department soon after the completion of the construction of the reservoir. After much persuasion 3.1km² were returned by the Irrigation Department. The remaining area (0.4km²) has colonies with about 4,000-5,000 encroachers. Now Forest Department, supported by NGOs, has filed cases against 724 individuals for evicting them and their families and the case is in the court of Sub-Divisional Magistrate, Kotdwar.

Fig. 1 The North - West elephant range, India



Kosi River corridor

The Kosi River flows between Corbett TR and Ramnagar FD, and although there are human habitations along the river, the connectivity is good in the following four places: (a) about 5km between Mohan and Kumaria; (b) 1.5km between Dhangari Gate and Sunder Khal; (c) 100m between the two blocks of Sunder Khal; and (d) 6km between Infinity Resorts and Bijrani. The growing problems of Sunder Khal, an encroachment since 1974, now 3.5km long, along the right bank of Kosi River, pose the most serious threat to this corridor.

Boar River corridor

This is the forest connectivity around Kaladhungi, in Ramnagar FD.

Nihal-Bhakhra corridor

The 4km-wide Nihal-Bhakhra corridor is between Boar River and Gola River connecting the Ramnagar FD with Terai Central FD, a plantation division. There are seven villages – Bedrampur, Pratappur, Kharakpur, Lachchampur, Rampur, Sakatpur and Sherpur – with about 700 families, and a human and cattle population of 4,000 and 3,000, respectively. However, the major threat to the corridor comes from the powerful landlords who have large land-holdings on lease. Large-scale farming means not only more biotic pressure on the corridor, but a direct threat to the forest – clear-felling for agricultural purposes, besides legal and illegal commercial felling.

Gola River corridor

The major break in the elephant range has occurred as a result of the growth of Haldwani Town situated at the base of the steep Shivalik Hills, and the various developments that have occurred south of Haldwani. Notable among them is the Lal Kuan Industrial Complex. Heavy traffic along Haldwani–Lal Kuan Road throughout the day and night, and large-scale sand and boulder mining from October-June by hundreds of labourers along the Gola River have also contributed to this fragmentation. The firewood demands of these labourers, who camp on the river bed, are eroding the forests in the Tanda Range of Terai Central FD and Doli Range of Terai East FD (Johnsingh *et al.* 2004).

Kilpura-Khatima corridor

The Haldwani-Sharda population of about 50 elephants range mostly in the Haldwani FD and in the Jaulasal and Kilpura Ranges of Terai East FD. During rains, some of these elephants from the Kilpura Range cross the Sharda Canal 2km upstream of Lalkhoti in the Navakhal block of Khatima Range. Beyond Khatima Range the status of forest in Nepal is unknown. There may be some connectivity with the Sukhlaphanta Reserve. The inhabitants of Devipura Majgaun in Khatima Range, an area encroached for about 20 years, report of occasional crop raiding by elephants during the rains. They also reported that the elephants, until recently, during the rains, used to migrate to Nepal, possibly to Sukhlaphanta Reserve. The Kilpura-Khatima corridor is severely threatened by enormous wood cutting and fodder collection by the inhabitants of Khatima Township, the encroached villages such as Devipura Majgaun, Pachoria and Patta and Nepali villages north of Khatima Range (Kanchanpur *teshil*, Mahendra Nagar District).

Lagga Bagga–Haripur–Belha–Kishanpur–Dudhwa corridor

Lagga Bagga lies in the Barahi Range of Pilibhit FD. It is a corridor of *c.* 6km^2, connecting the Pilibhit Forests with those of Royal Suklaphanta Reserve in Nepal. It is thus an important link in the movement of animals from Dudhwa and Kishanpur to Nepal, via Haripur range of Pilibhit FD, which is contiguous to Kishanpur WLS. While Lagga Bagga has the status of Reserved Forest, the forests of Belha (a stretch of forest bordering Pilibhit and South Kheri FD) are still in the process of being acquired by Government. Both these areas have serious problems of encroachment and other biotic pressures such as illegal felling, grazing (mainly by feral cattle), and poaching, which occur at a larger scale due to the proximity to the international border. The Bhira and Mailani Ranges of South Kheri FD, and the Khutar Range of Shahjahanpur FD, are also contiguous to Kishanpur WLS on the south and south-western side, and help provide a corridor to Pilibhit FD further west.

There is another break in this forested continuum, in the *terai* between Kishanpur WLS and Dudhwa NP. While the Kishanpur WLS extends to the southern bank of the Sharda River, the northern bank is devoid of forests. It is only after travelling 5-10km north of the river that one reaches the forests of Dudhwa NP. The area in between consists mainly of agricultural crops such as sugarcane, wheat and paddy, and small patches of forests/plantations and reed-covered water courses and ox-bow lakes. In early winter, from October-November, elephants are known to use these water courses and lakes while moving between the two PAs.

Dudhwa-Katerniaghat corridor

There is hardly any contiguity between these two PAs at present, except that of riverine corridors along Mohana and Suheli Rivers. Even the much better connectivity along the Mohana River is broken for about 5km. Both riverine corridors are quite patchy, nonetheless they provide some cover in the otherwise agricultural landscape. The distance and area between these two Protected Areas are between 15-20km^2 and 200km^2 respectively. Nearly 5% of this 200 km^2 has patches of RFs belonging to the North Kheri FD which are largely under *terai* marshes. The remaining area is under agriculture (mainly sugarcane) tenanted by nearly 20,000 people. Recreating a corridor here for elephants capable of causing enormous damage to crops in a landscape dominated by sugarcane, is difficult, as it would require

decades of dedicated conservation effort.

There exists a weak corridor between the Katerniaghat WLD and Royal Bardia NP of Nepal, which is a very narrow strip of riverine vegetation along the Geruwa River (the eastern branch of Karnali/Ghagara) and has been used by rhinos and elephants in moving into Katerniaghat WLD in recent years. This Division has enormous problems due to settlements inside and around the periphery.

Encroachments

These forests have suffered in many places as a result of large-scale Government-sponsored encroachment that took place in the early 1970s. Two examples are worth recording: one is Sunder Khal, and other in the Terai East FD.

In 1974, about 400 people, prompted by Parvati Shilpkar Samiti-Sunderkhal, encroached into the Western Kunkhet Beat, Dhulwa Block 5, 9 and 11, an area of 73.84ha in the Kosi Range of Ramnagar FD. The Forest Department filed cases in the Kashipur Court to evict these encroachers: 24 cases in 1974-75, 114 in 1989 and 131 in 1990, a total of 269. The Kashipur Court gave a verdict in 1992 that 172 families should leave, but no decision was made on the other 97 families. The 172 families refused to leave as they were not given alternative sites in one area for resettlement. According to the 1999 census, there are some 300 families with 1,500 individuals and they have built 100 *pucca* houses and 200 temporary huts. This entire population gets its fuel, fodder and timber from the surrounding elephant habitat. Resettlement of this entire population should be a priority to secure the future of this corridor.

The Terai East FD has an area of 820km^2 and of which 60km^2 are encroached. The Ranges affected are: Barkoli (encroached area 22.40ha), Doli (138.44), Gaula (4312.63), Khatima (373.9), Kishanpur (84.1), Ranshali (250.71), South Jaulasal (159.57 and Surai (497). Encroachment has occurred in other forest divisions, gradually growing in size as well. An early solution to mitigate this problem is urgently needed.

Habitat degradation

With the exception of the Corbett NP and parts of the Rajaji and Dudhwa NPs, all other forest areas in this tract are used by people for livestock grazing, and firewood and grass collection. Timber, bamboo, minor forest produce and cane are also extracted in some forest divisions. One major factor that has drastically reduced the habitat quality of this tract for elephants is the conversion of natural vegetation into monoculture plantations of eucalyptus, teak and *Haplophragma heterophylla*. The Divisions that have come under this conversion are: East *Terai*, Central *Terai*, West *Terai*, Bijnor, and Haridwar. Plantations are also common in Pilibhit, Kheri and Katerniaghat Divisions. Kalagarh FD (Sona Nadi WLS), Lansdowne FD, Rajaji NP, Shivalik FD and Terai East FD have the problem of pastoral *Gujjar*s and their buffaloes. Lopping by the *Gujjar*s and grazing by the buffaloes have contributed to habitat degradation resulting in the spread of weeds such as *Parthenium hysterophorus*, *Lantana camara* and *Adhatoda vasica*, and lack of regeneration of palatable tree species. *Gujjar* buffaloes urinate and defecate in waterholes making them unfit for use by elephants (Johnsingh and Joshua 1994).

Elephant mortality due to train accidents

One of the major problems of Rajaji NP is the death of elephants due to train accidents along 19km-stretch of railway track passing through the Park. The track extends 4 km into Haridwar Range, 7km into Motichur Range and 8km into Kansrau Range. Between 1987 and May 2002, 20 elephants were killed, of which 10 were adult females, one adult male, two sub-adult males, two sub-adult females, four juvenile males and one female calf. The length of track where the elephants are vulnerable to accidents is 1.5km in Haridwar Range, 5km in Motichur Range and the entire 8km in Kansrau Range. Comparatively more elephants died in Haridwar Range (8) than in Motichur (7) and Kansrau (5). Records for different months show that 16 animals died during the dry season, from January to June, with a peak in May (5). This dry season mortality is correlated with the water-induced movement of elephants. All accidents occurred between 1830 and 0530hrs. Trains responsible for accidents are the Doon Express, Mussoorie Express, Janta Express, Ujjain Express, Haridwar-Rishikesh Passenger, Sahranpur-Dehra Dun Passenger and goods trains (A. K. Singh pers. comm.).

Recommendations

Priorities for elephant conservation for this Range include the following:

(a) Maintenance of habitat continuity, by establishing and strengthening corridors, consolidation of habitat through translocation of *Gujjars* and several other human settlements including encroachments;
(b) Reducing biotic pressures through eco-development measures and conservation education;
(c) Total ban on sand and boulder mining in river beds crucial for establishing corridors;
(d) Creation of mini core areas;
(e) Converting plantations into better elephant habitats, by planting patches of browse species;
(f) Control of poaching; and
(g) Reducing mortality caused by trains.

Establishing and strengthening corridors

The first two corridors that need to be established and strengthened are the Chilla-Motichur corridor and Gola River corridor. Priority should go to the Chilla-Motichur corridor, which will help consolidate habitat

integrity from Yamuna to Gola River (Haldwani), an area of about 8,000km^2.

Chilla-Motichur corridor

Chilla-Motichur corridor across the Ganga River needs the immediate attention of the Government of Uttaranchal and the Government of India. Over the last 20 years, several discussions took place, and numerous reports submitted, but the corridor has not yet been established. Two major problems in this corridor area are due to the presence of the army ammunition dump and the settlements of the Tehri Dam oustees. What is urgently needed is the resettlement of Khand Gaon III of the oustees. Land has already been identified for resettlement in Bibiwala near Rishikesh, and the oustees are willing to move there as it is closer to a perennial spring, to the Haridwar-Rishikesh Road and to Rishikesh, where employment and educational opportunities are better. Bibiwala is in the north-western corner of the much-disturbed Elephant Range (Barkote and Rishikesh Range), and sacrificing this land for creating the corridor would go a long way in strengthening elephant conservation in its north-western range. This corridor will be beneficial for several other large mammals, particularly tiger.

It has often been suggested to build big bridges across the Kunaun-Chilla power channel, which runs parallel to the left bank of the Ganga — this is not necessary. What is urgently needed is to make the adjacent Suni *sot* and Dogudda *sot* totally free of *Gujjar* settlements. If this is done, even groups of elephants will start using the aqueduct built below the power channel for the flow of water from Dogudda, and the bridge across the channel near Suni *sot*. At present only the bulls use the bridge, and the aqueduct is only used when *Gujjars* do not camp in the *rau* near the aqueduct entry. Other measures for strengthening this corridor are the banning of further development around the place of worship between the army camp and Ganga River, banning of construction of an all-weather road to this place of worship and night traffic along Chilla-Rishikesh Road, keeping the islands on the Ganga River free of disturbances, and if possible, shifting the Gangabhagpur Thalla and Malla villages. More suggestions are given in Johnsingh *et al.* (2004).

Gola River corridor

There is a good possibility of restoring the continuity between East and Central *Terai* FD, which is broken due to development activities between Haldwani and Lal Kuan. This may be possible by translocating the timber depot of Uttaranchal Government just north of Lal Kuan, acquiring an equal amount of land east of the Haldwani-Lal Kuan Road and west of Gola River, which is fortunately only sparsely populated by illegal settlers of boulder collectors in Gola River. It will be crucial to ban sand and boulder mining along the entire stretch of Gola River. Intensive management of forests on either side of this corridor, particularly of Doli Range, by planting of suitable fodder tree species and bamboo, and protection from grazing and cutting should also be carried out.

Rajaji-Corbett corridor

The corridor forests between Rajaji NP and Khoh River (west of Corbett TR) need immediate attention to control growing biotic disturbances that emanate from the villages south of the corridor and Kotdwar Township. Through appropriate eco-development measures, villages along the northern boundary should be made ecologically self-sufficient in terms of their fodder and fuel requirements, or alternate fodder and fuel provided, so that the growth of their impact on the corridor forests can be minimized. *Gujjars* from this area should be resettled on a priority basis.

Kosi River corridor

In the Kosi River corridor, the forests between Mohan and Kumaria Villages should be kept free of disturbance, by shifting the Indian Medicines Pharmaceutical Corporation Limited from its present location, closer to Ramnagar Town, as most of the 200 or so employees come from this town, which is about 15km away. Gargia Chemicals, where less than 10 people work, should be immediately closed. There is a colony of 15-20 huts, *c.* 75m north of Mohan, on the way to Kumaria. The people in this colony depend on cutting firewood and transporting them to Ramnagar. Immediate attention is needed to address this problem. The encroachers at Sunder Khal could be resettled in Gabua forest patch (13km^2), between Ramnagar and Kaladhungi, in Terai West Forest Division. Gabua, surrounded by human habitations, may eventually be encroached or used by Government for some other purpose. Before this happens the encroachers should be settled in Gabua forest patch so that the elephant habitat can be protected. The connectivity between Infinity Resorts and Bijrani can be strengthened further if people in the two small villages, Ringora and Amdanda, are resettled.

One important habitat alteration immediately needed in the corridor patches identified (Kumaria-Mohan, Dhangari and the western block of Sunder Khal, and between Infinity Resorts and Bijrani) is the planting of the existing teak plantation with cover-giving and fodder species including bamboo (*Bambusa arundinacea* and *Dendrocalamus strictus*) and browse species including *Zizyphus mauritiana*. It is known that these species are heavily browsed by ungulates, but their survival could be improved by planting grown-up saplings in the beginning of the rainy season.

Boar River corridor

This corridor needs total protection from development, particularly from excess tourism. The buildings of Sterling Resorts, the construction of which was stopped by Supreme Court intervention, should be dismantled and taken away from the forest area. Uttaranchal

Government should acquire other private holdings in this corridor area.

Nihal-Bhakhra corridor

This area needs intense management input in the form of eco-development measures in the surrounding villages to control further degradation. If this corridor forest is lost, the connectivity between Ramnagar FD and Central Terai FD would go as well, and there will not be any opportunity to restore the Gola River corridor.

The corridors between Dudhwa NP and Kishanpur WLS, and between Katerniaghat WLD and Dudhwa NP, may be difficult to recreate, owing to large-scale private ownership of highly productive agricultural land there. Restoration of a 100-200m wide riverine corridor along Mohana River, with the involvement of local people, should be attempted. The patches of Government-owned forest land between Dudhwa NP and Katerniaghat WLD, including the marshy areas, should be intensively planted and managed with cover-giving species such as bamboo, *jamun*, cane and *Ficus hispida*. The fragile connectivity between Dudhwa NP–Bardia NP–Katerniaghat WLD is a hope.

Relocation of human settlements

Resettling of *Gujjars*

It is vital that the forests of this elephant range should be made as disturbance-free as possible. In this regard, relocation of pastoral *Gujjars* who live in the Shivalik FD, Rajaji NP, Lansdowne FD (including Rajaji-Corbett corridor), the western portion of Corbett TR (former Kalagarh FD or Sona Nadi WLS) and Terai East FD is a must. The presence of *Gujjars* within the forest has become incompatible with the conservation of the elephant, an endangered species, which needs enormous amounts of forage, clean water, and disturbance-free cool forests for resting during the day. *Gujjars* should be involved in every step in the resettlement process. Resettlement should be done following the model of Ghaindikatha where *Gujjars* have been resettled in fringe forest areas and are given incentives to build and live in their traditional huts.

Relocation of villages

It is imperative to translocate several villages and encroachments which will strengthen the corridors, habitat integrity and reduce biotic disturbances.

Chilla-Motichur corridor area

People in two villages (Khand Gaon III, and Ganga Bhagpur Thalla village between Ganga River and the power channel on the left bank of the river), in the Chilla-Motichur corridor area, have to be resettled. This latter village of about 30 families is close to the only patch of riverine forest about 2.5km long, along the entire length (2,500km) of the Ganga River that is still being used by elephants. If people from this village are not translocated, the riverine forest will eventually disappear, as a result of the firewood and timber needs of the village people. Translocation of this village would create at least 1km^2 of flood plain grassland habitat. Land for the resettlement of Ganga Bhagpur Thalla village can be found in Bibiwala, where Khand Gaon III is to be resettled. Johnsingh *et al.* (2004) even recommend the shifting of Ganga Bhagpur Malla and Kunaun *goth* villages to Barkote Range which has lost all the large mammal values because of the firewood needs of the Rishikesh population.

Corbett Tiger Reserve

Three villages from Corbett TR have to be shifted as soon as possible. These are Ringora between Dhangari and Bijrani, Amdanda near Bijrani, and Laldhang on the southern boundary. Ringora and Amdanda were once cattle camps but have now become established villages. They can both grow further, disturbing and destroying the contiguity between the reserve and Ramnagar FD. The villagers of Laldhang are willing to move out, and the Government of India has already approved their proposal for resettlement. The proposed relocation site in West *Terai* FD has already been clear-felled. The encroachers in the Kalagarh Colony should be evicted. This is possible only when the Government of India, the Government of Uttaranchal, Government of Uttar Pradesh and NGOs interested in the conservation of Corbett TR work together.

Ramnagar FD

Tedha Village near Bangajhala Valley (Ramnagar FD), which has about 50 families and 600 cattle, causing immense damage to the habitat, also needs translocation.

It is urged that all the above-mentioned villages be translocated as soon as possible. The successful resettlement of Jhirna, Dhara and Kothi Rau Villages, which was done in 1994, stands as an excellent model to be emulated. For the relocation of Ringora, Amdanda, and Tedha Villages, sufficient fertile land is available in Gabua forest patch of West *Terai* FD.

Terai East FD

There are numerous encroachments, *Gujjar* camps and Bengali villages in Terai East FD. Efforts should be made to resettle all these people in patches of forests along the southern boundary of the FD. Priority should be given to resettle the encroachments from Khatima Range (e.g., Devipura Majgaun, Pachoria and Patta) as the Range has to play a crucial role in corridor connectivity.

From Pilibhit and Katerniaghat FDs

The encroachments from Belha in Pilibhit FD need to be removed. In the Katerniaghat WLD, only one village, Bharthapur, is located in the very important trans-Girwa area of the Sanctuary. If this village could be removed,

the entire biodiversity-rich trans-Girwa area, which is of great importance for large mammals like rhino and elephant, would be free from permanent human inhabitation. No scheme, however, has been proposed to date.

Total ban on sand and boulder mining in crucial wildlife areas

Presently Uttaranchal Government may get Indian Rupees 30-50 crores annually from sand mining and this source of income may be important for this young State formed in November 1999. But the Government has to weigh its options whether to allow mining to totally degrade its reserve forests, or to stop mining to enable the reserve forests to contribute to the overall biodiversity conservation in the State which plans to carve out a future based on ecotourism. The Government of India could assist Uttaranchal by giving a special annual conservation subsidy of Indian Rupees 50 crores for several years with the agreement that no mining be allowed and Uttaranchal meanwhile will consolidate its revenue generation through other means such as ecotourism, sale of mineral water, etc.

Creation of mini core areas

As a result of the inability to create large tracts of undisturbed habitats, the establishment of 30-100km^2 mini core areas is suggested, which should be free from all forms of disturbance. The following areas are suggested to be managed as mini core areas:

(a) The Dholkhand, Malawali, Andheri, Ganjerban and Lakarkot forest blocks south of Shivalik Ridge in Rajaji NP

(b) The Motichur, Koelpura (east) and Koelpura (west), Danda and Behereda forest blocks on the northern side of the Shivalik ridge in Rajaji NP is an important area for elephants in summer, due to the availability of water.

The above forest blocks should be cleared of *Gujjars* and managed as a mini core.

(c) A few elephants use the forest blocks around Bulindwala and Phandowala areas in Ramgarh Range of Rajaji NP. There are few *Gujjars* in this area, and it will be fairly easy to clear this area of human presence and manage it as a mini core.

(d) The Dogudda, Suni and Mundal *sot* areas in Chilla, if cleared of human use by *Gujjars* and the people from Gangabagpur Thalla and Malla Villages, will form an excellent habitat for elephants on the east bank of River Ganga in Rajaji NP. Present resettlement of *Gujjars* being carried out by Uttaranchal FD may eventually create the mini-core areas mentioned here.

(e) The Rawasan catchment area, with its perennial water, can form the nucleus of another mini core. *Gujjars* from this area need to be relocated, and disturbances arising from the nearby Laldhang Village, including poaching, should be controlled.

(f) The forests on either side of Malin River in Rajaji-Corbett corridor should be made into a mini core, by controlling human use of this area.

(g) There are 20 to 30 *Gujjar* families in Koluchaur, Lansdowne FD, and they are willing to move if a proper resettlement package is offered. The main reason cited for their willingness to move is the difficulty in transporting milk over 20km to the nearest market (Kotdwar). Their ordeal becomes even more difficult during the rainy season. Steps should be taken to resettle these *Gujjars* to secure what is possibly one of the finest habitats not only for elephants, but also for other wildlife. Logging in this area should be banned and the revenue lost by this can be gained through the promotion of ecotourism in this wildlife-rich area.

(h) The Bangajhala Valley in Ramnagar FD can be another excellent mini core area which will necessitate shifting of Tedha Village with about 50 families and 600 cattle which cause enormous damage to the habitat.

(i) In Haldwani FD, the Nandaur Valley including the Durga-Pipal area, is suitable for forming a mini core. It is possible to create either a 300-400km^2 National Park or Wildlife Sanctuary in this area.

(j) The Lagga Bagga area of Pilibhit FD needs to be developed as a mini core because of its crucial value as a corridor between the Royal Sukhlaphanta Reserve and the Pilibhit FD. Intensive protection and participatory management with the villagers living on the right bank of Sharda River, who depend on Lagga Bagga for firewood and thatch grass, will be required to help the area recover.

(k) In Katerniaghat WLD, the entire trans-Girwa and Katerniaghat Ranges, along with the adjoining areas of Nishangarha Range, are well suited to be managed as a mini core area.

(l) The forests on the west bank of Sharda River, belonging to Champawat FD (South Pithoragarh FD), require special attention for conservation. Large mammals can move from this area to Nepal across Sharda River.

Planting monoculture plantations with species suitable for elephant

Presently, the monoculture plantations seen in and around the elephant range, offer very little to elephants in terms of forage and cover. This shortcoming of plantations as elephant habitat can be overcome through

the planting of other tree species in patches. It is suggested that, for example, for every square kilometre of eucalyptus plantation, one hectare be clear-felled, and planted with a patch of unpalatable species such as *Holoptelia integrifolia* and *Pongamia pinnata*. Once these patches establish themselves, then species such as bamboo can be planted in their cover. There will also be the growth of several other palatable species such as *Mallotus philippensis* from the original rootstock. This will benefit not only elephants but also several other ungulate species like sambar (*Cervus unicolor*), leopard (*Panthera pardus*) and tiger (*P. tigris*). The forest divisions that need this attention are Haridwar, Bijnor, West Terai, Central Terai, East Terai, Pilibhit, Dudhwa TR and Katerniaghat WLD. In the *terai* region of UP, the moist grasslands were planted with eucalyptus and teak in the past. These plantations should be gradually removed from these grasslands and care needs to be taken that weeds do not take over, once the overwood is removed. The grasslands, which are important habitats for species like the hispid hare (*Caprolagus hispidus*), Bengal florican (*Eupodotis bengalensis*) and swamp partridge (*Francolinus gularis*).

Eco-development and conservation education

Along its boundaries, this tract has a long interface with human settlements. An enormous number of people are dependent on the forests of this Elephant Range for their fuel and fodder requirements. To conserve and manage elephants in this area, such pressures need to be reduced. Therefore, eco-development activities in cooperation with the villagers need to be launched as early as possible. These should include fuel and fodder plantations, popularizing smokeless *chula* and solar cookers, and reduction of scrub cattle by the promotion of hybrid cattle. The corridor areas identified above, the villages along the northern boundary of Dudhwa NP, and the large enclave of Tharu Village in the Katerniaghat Range would need immediate attention. Conservation education emphasizing the importance of forests and wildlife should be an integral part of this eco-development programme (Johnsingh *et al.* 2004).

Anti-poaching measures

Poaching of tuskers for ivory needs the attention of the Government throughout this range. Vigilant anti-poaching measures are urgently required. Poaching has been a problem in the forests east of Haldwani (Haldwani, South Pithoragarh and East Terai forest divisions). As this forest tract is adjacent to Nepal, poachers have found it easy to poach in this area. Special efforts will be needed to protect this population, and enable young bulls to mature to create a genetic linkage with the elephants of Sukhlaphanta Reserve and Kheri FDs. Control of poaching should be the concerted efforts of the Uttaranchal and Uttar Pradesh forest and police departments.

Reducing mortality caused by trains

This can be achieved by the following:

(a) Build a mechanical steel barrier between Haridwar and Motichur *rau* on the western side of the railway track. There is no need for elephants to cross the railway track and come to the eastern side which is full of human habitation. The mechanical barrier should also prevent domestic livestock from entering the forests. This will lead to habitat recovery, enabling elephants to find sufficient forage in the forest. This would also reduce the pollution of waterholes by buffaloes, which is a major conservation problem in Rajaji NP (Johnsingh and Joshua 1994).

(b) As elephants often get killed in locations where the terrain on either side of the railway track is in the form of steep banks, efforts should be made to flatten these banks. This would enable elephants to move away when trains speed along the track.

(c) As elephants have the habit of feeding on the edible household wastes discarded by people, sustained efforts should be made to educate the public and railway employees not to leave garbage along the railway track.

(d) It has often been recommended to realign the railway track from Haridwar to Rishikesh, and then to Dehra Dun, bypassing Motichur and Kansrau Ranges. This is an expensive recommendation, involving nearly Indian Rupees 100 crores (US$20 million), and the track would go through Rishikesh and Barkot Ranges, which are also occasionally used by elephants. Therefore, this expensive option should be carefully considered.

Research

Although wildlife populations in the Rajaji NP have been well researched over the last two decades, much research needs to be carried out in other parts of this elephant range. Future research should focus on elephant use of corridors, human-elephant conflict, population dynamics of elephant food trees, and monitoring the habitat, population and population structure of elephants. In this regard, long-term monitoring of the elephant population dynamics in Corbett NP, and in the forest tract between Haldwani and Sharda River, should be taken up. A satellite-telemetry study of elephants in Dudhwa-Kishanpur-Suklaphanta and Katerniaghat-Bardia should also be a priority to understand the ranging patterns of elephants.

Training

The forest staff in this Elephant Range need training in assessing and monitoring the status of habitat and elephants. The methods taught should be simple, reliable, and consistent over time. The staff should also

be equipped and trained in anti-poaching measures.

Domestic elephant management

There are 18-20 domestic elephants in Uttaranchal, largely in the custody of the Forest Department, and 115-140 in Uttar Pradesh with the Forest Department and private ownership (Bist 2002).

Shivalik–Terai Elephant Range

This entire Elephant Range should be designated as the Shivalik–Terai Elephant Range, and managed by one senior-level forest officer in the rank of Chief Conservator of Forests (CCF), whose focus should be to solve the problems related to the corridors, and resettlement of *Gujjars* and villages. The CCF should also be entrusted with the task of converting the monoculture plantations to habitats suitable for elephant, strengthening protection across this elephant range, and ensuring the proper care of domestic elephants. Conservation of this elephant range should be combined with the planning of the Terai Arc Tiger Conservation Landscape (WWF 2000; Johnsingh *et al.* 2004).

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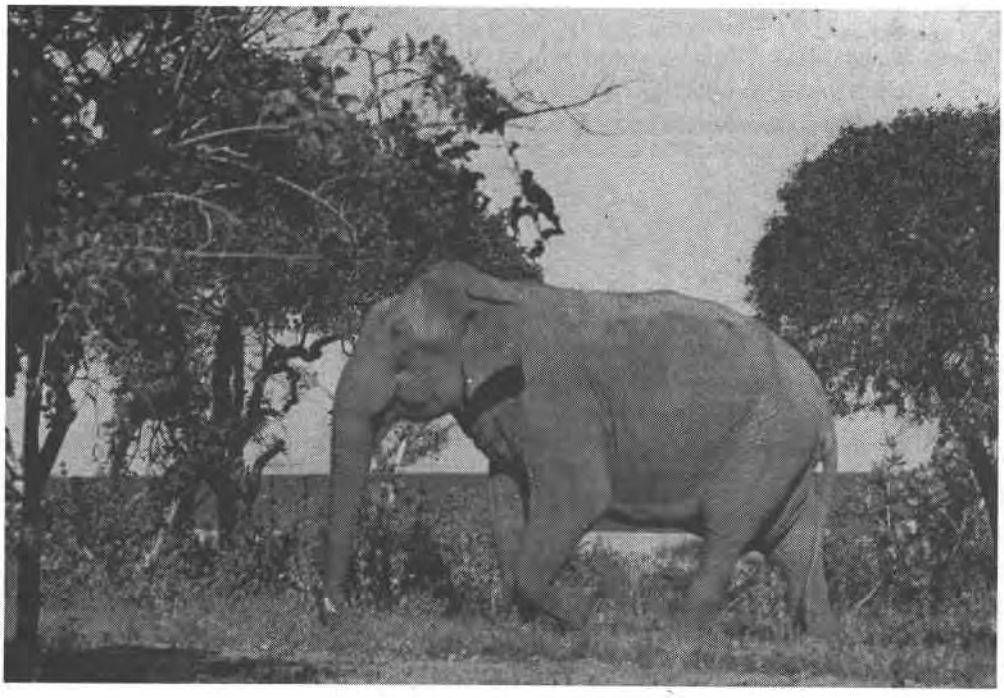


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