Research Article

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Elephant Corridors in Northern West Bengal

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Abstract. The elephant habitat in northern West Bengal is highly fragmented. We studied elephant corridors in the area during 2003 - 2006. Details of elephant movement gathered from Forest Department and Tea Association Offices and radio-telemetry data from the Wildlife Institute of India and the Indian Institute of Science were used to identify elephant corridors. GPS points were collected for each corridor on field visits and a total of 59 corridors were characterized. The main challenge for the preservation of elephant corridors was the presence of tea gardens, army establishments and villages within them.

Introduction

Small and isolated populations are vulnerable and can become extinct (Crooks & Sanjayan 2006). The challenge of habitat shortage can be mitigated if animals can move between isolated populations (Haddad *et al.* 2003). Corridors are passages or parcels of land wherein animals pass from one geographical area to the other (Nahonyo 2009). Corridors connect populations, facilitating gene flow, optimize habitat utilisation through reduction of pressure on grazing or browsing areas, and provide resources to animals passing through. Corridors increase the biological and ecological viability of species and populations. Therefore, maintaining corridors is important for conservation.

Conservation of species like the Asian elephant (*Elephas maximus*) needs the conservation of large areas (Owen-Smith 1988; Sukumar 1989). The home ranges of Asian elephants may vary from 32 - 4349 km^2 (Olivier 1978; Datye & Bhagat 1995; Sukumar *et al.* 2003; Fernando *et al.* 2008).

Elephant habitat in northern West Bengal is highly fragmented owing to the conversion of forests to tea plantations, settlements and agriculture, and due to exploitation of timber (Lahiri-Choudhury 1975; Barua & Bist 1995). At present, elephants move mostly on an east-west axis along the forest areas of northern West Bengal, Nepal, Bhutan and Assam through a series of corridors distributed across northern West Bengal. There is also some movement on the north-south axis from the hill slopes of southern Bhutan to the Terai region of northern West Bengal. The objective of our study was to identify the corridors that elephants currently use with a long-term goal of developing plantation forests on lands currently used for growing tea and connecting habitats for the free movement of elephants.

Methods

Study area

Northern West Bengal in north-eastern India is bound by Nepal on the west, Bhutan in the north, Assam in the east, and Bangladesh towards the south, covering a total area of 9394 km^2. The study area lies within N27.218576°, E88.011095°; N26.639646°, E88.172676°, and N26.734619°, E89.862003°, N26.332775°, E89.809966°. The total range of the elephants in NW Bengal is 3051 km^2 and the forest cover is 1954 km^2 (Lahiri-Choudhury 1980; Barua & Bist 1995). The elevation varies from 60 to over 2000 m. The natural vegetation is primarily tropical moist forest with grasslands along the floodplains of rivers. Major land-use types in the study area are forest, cultivation, and tea gardens.

Climatic conditions vary from tropical to sub-tropical. A cool, dry period occurs from November to March (11 - 23°C) followed by a warm, pre-monsoon period during April-May (16 - 30°C), a hot, monsoonal period from June to August (25 - 32°C), and a moderately warm, late-monsoonal period during September–October (21 - 31°C). The coldest months are January and December (11 - 12°C). The mean annual rainfall in Northern West Bengal ranges from 3000 - 3500 mm (Sukumar *et al.* 2003).

Data collection

Literature on elephants in the area (Lahiri-Chowdhury 1975, 1980; Barua & Bist 1995) was reviewed and squads dealing with elephant movement in these areas were consulted (Mal, Khunia, Binnaguri, Sukhna and Taipu Squads). Information on elephant movement during 2000 - 2005 was collected from the Tea Association offices at Dooars Branch Indian Tea Association and Terai Branch Indian Tea Association.

Radio-telemetry studies were conducted in non-forested areas by the Wildlife Institute of India (1995–1997) using VHF and collaring five elephants (two family herds and three bulls). Studies by the Centre for Ecological Sciences, Indian Institute of Science (2001 - 2006) were conducted by collaring 13 elephants (7 family herds and 6 bulls) using 9 VHF and 4 GPS collars. We initially identified corridors based on the data from these two studies.

If two successive radio telemetry locations were located in two forest patches, then the movement of elephants was assumed to have occurred through a corridor linking the two patches. Ground searches were conducted in such locations for evidence of elephant presence through detection of dung piles, tracks, and feeding sign. GPS points were taken of such evidence and mapped. For example, radio-collared family herd 23 was located on October 29, 2003 at Nayabasti (Buxa Tiger Reserve), and on November 3, 2003 at Titi-4 compartment (Jaldapara National Park). There is a gap of 6 km between Buxa and Jaldapara forests, which is covered by Bharnobari, Dalsingpara and Beech tea gardens. So it was assumed that this family herd moved through a corridor in the tea gardens to reach Jaldapara, and Titi forests. Roads in the three tea gardens were searched and fresh dung piles and tracks were found on particular roads, and thus these were identified as corridors.

After identifying the corridors, the actual corridor/ movement paths of each corridor was walked through and marked by taking GPS points every 100 m or wherever elephant sign was found. Forests on both sides of the corridor were also mapped. Field surveys were done during 2003 - 2006 by a team consisting of a researcher, two field assistants and two or three forest staff from the relevant squad.

Images from the Indian Remote Sensing satellite 1D/L-III bearing paths and row numbers 108 - 53 and 109 - 53, respectively, of March 16th and 13th, 2001, were used to make maps. A false colour composite was generated using different bands (red, blue and green) of satellite data. The main landscape features were mapped using ARC GIS software version 9.3. GPS points of corridors were marked as line features. The landscape was segregated into three zones: Zone I (Sankosh to Torsa), Zone II (Torsa to Tista) and Zone III (Tista to Mechi), with rivers as natural boundaries.

Results

In total 59 corridors were identified, of which 47 had land owned by communities, tea gardens and the army and 26 of them had people living within the corridors, consisting of villages, tea garden labour lines and army camps.

The total length of corridors identified was 369.30 km. The total length of corridors with people living there was 58.20 km, of which 29.52 km consisted of tea garden labour lines, 22.34 km villages and 6.34 km army camps. Individual tea garden labour lines varied in extent from 0.11 - 2.08 km with a mean of 0.62 ± 0.42 km, villages from 0.32 - 2.53 km with a mean of 1.02 ± 0.57 km and army camps from 0.23 - 2.31 km with a mean of 1.27 ± 0.89 km.

Zone I: Sankosh to Torsa

Fourteen corridors were identified with a total length of 71.30 km in Zone I. Of this, 7 had villages and tea garden labour lines amounting to 10.86 km. The villages within corridor areas totalled 7.50 km, with individual villages varying from 0.36 - 1.61 km in length with a mean of 1.25 ± 0.53 km. Tea gardens labour lines within corridors totalled 3.35 km with individual labour lines varying from 0.54 - 2.00 km with a mean of 0.84 ± 0.54 km. The details of corridors in Zone I are given in Table1 and Figure 1.

Zone II: Torsa to Tista

In total 28 corridors were identified with a total length of 238.30 km, of which 23 had land owned by communities, tea gardens and the army and 14 had people living within the corridors which amounted to 41.50 km. Villages within corridor areas totalled 13.40 km, with individual villages varying from 0.32 - 2.53 km in length with a Mean of 1.03 ± 0.59 km. Tea Gardens labour lines within corridors totalled 24.12 km with individual labour lines varying from 0.11 - 2.05 km with a mean of 0.65 ± 0.42 km and army camps within corridors totalled 4.01 km, varying from 0.85 - 2.31 km with a mean of 1.34 ± 0.84 km. The details of corridors in Zone II are given in Table 2 and Figure 2.

Zone III: Tista to Mechi

In total 17 corridors were identified with a total length of 59.70 km. All corridors had land owned by communities, tea gardens and the army. Five corridors had people living within them amounting to 5.91 km. Villages within corridor areas totalled 1.53 km, with individual villages varying from 0.36 - 0.75 km in length with a mean of 0.51 ± 0.21 km. Tea garden labour lines totalled 2.05 km with individual labour lines varying from 0.12 - 0.43 km with a mean of 0.29 ± 0.10 km. Army camps totalled 2.33 km, with individual areas varying from 0.85 - 2.31 km and a mean of 1.17 ± 1.32 km. Details of corridors in Zone III are given in Table 3 and Figure 3.

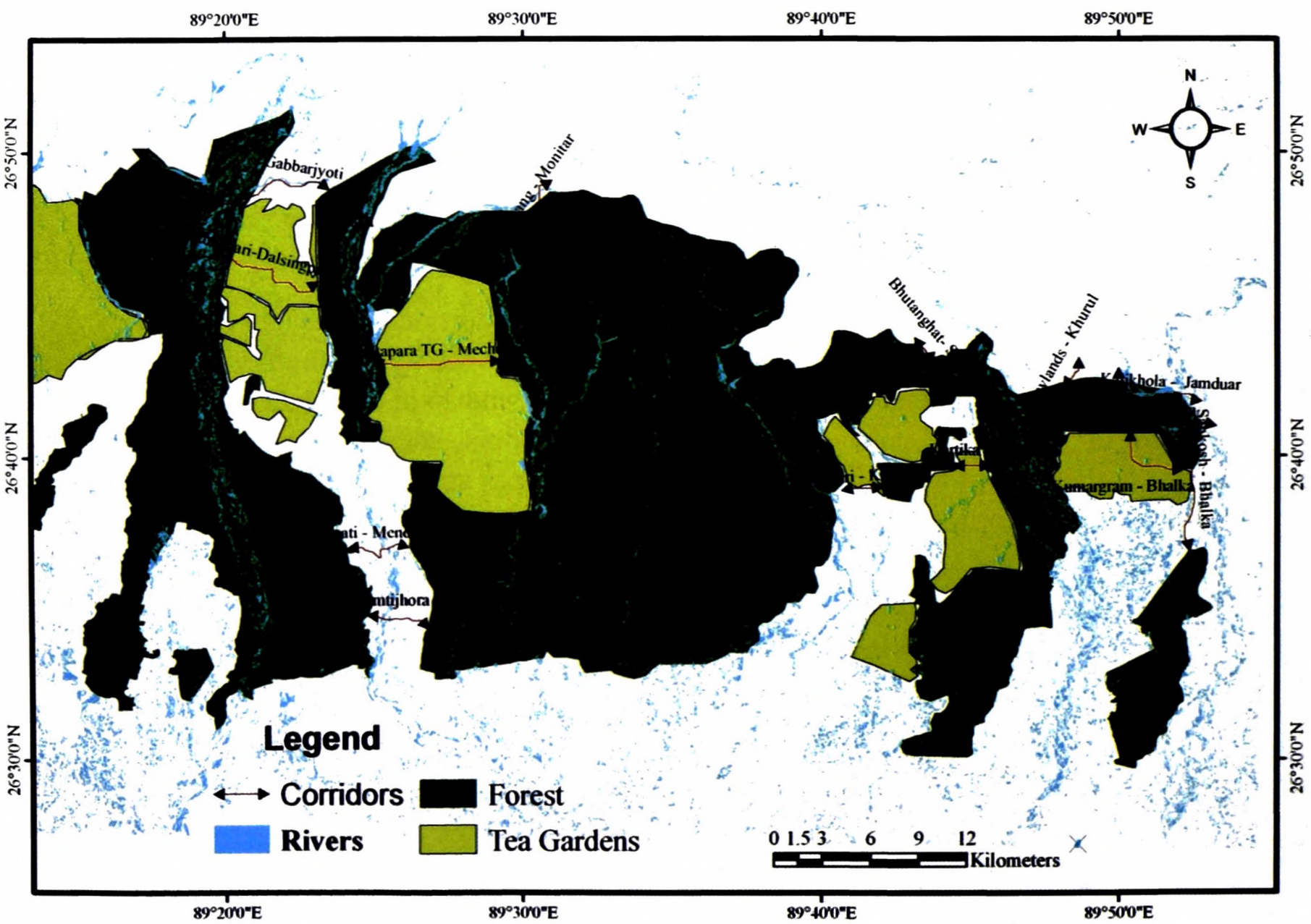

Figure 1. Elephant corridors in Zone I (Sankosh to Torsa).

Table 1. Corridors in Zone I from Sankosh to Torsa (FD = Forest Division; NP = National Park; RF = Reserve Forest; RFP = Riverine Floodplain; TE = Tea Estate; TG = Tea Garden; TR = Tiger Reserve; WB = West Bengal).

No	Corridor	Length	From		To (veg. type)		Corridor	
		[km]	Location	Vegetation type	Location	Vegetation type	Via	Land-use
1	Sankosh - Jamduar	2.6	Jamduar RF, Kachu-gaon FD, Assam	dense mixed	Sankosh RF, Buxa TR East, WB	dense sal	Sankosh RFP	RFP
2	Sankosh - Bhalka	8.5	Sankosh RF, Buxa TR East, WB	dense sal	Bholka RF, Buxa TR East, WB	mixed plantation, RFP	Sankosh RFP	RFP
3	Kumargram - Bhalka	5.3	Kumargram RF, Buxa TR East, WB	dense mixed	Bholka RF, Buxa TR East, WB	mixed plantation	Kumargram TG, Sankosh TG	TG, villages
4	Newlands - Khurul	2.4	Newlands RF, Buxa TR East, WB	dense mixed	Lamoyjhankha, Sarpang FD, Bhutan	dense mixed	Contiguous forest patch	dense mixed forest
5	Kalikhola - Jamduar	6.6	Lamoyjhankha, Sarpang FD, Bhutan	dense mixed	Jamduar RF, Kachu-gaon FD, Assam	dense mixed	Kalikhola RFP	RFP
6	Bhutanghat- Shakhu	2.2	Bhutanghat RF, Buxa TR East, WB	teak plantation, mixed plantation	Shakhu RF, Sarpang, Bhutan	semi-evergreen	Contiguous forest patch	dense mixed forest
7	Panbari - Kartika	2.4	Kartica RF, Buxa TR East, WB	teak plantation, mixed plantation	Panbari RF, Buxa TR East, WB	dense mixed	Katrica TE, Chuniajhora TE, Nurpur village	TG, villages
8	Kartika - Rydak	2.1	Rydak RF, Buxa TR East, WB	RFP, khair-sissoo serial, simal siris serial	Kartica RF, Buxa TR East, WB	teak plantation, mixed plantation	Tutiri TG, Rydak RFP	RFP, TG
9	Raimatang - Monitar	4.0	Raimatang RF, Buxa TR West, WB	semi-evergreen	Monitar, Gedu, Bhutan	dense mixed semi-evergreen	Contiguous forest patch	dense mixed semi-evergreen
10	Bhatapara - Mechepara	7.5	Raimatang RF, Buxa TR West, WB	dense sal, dense mixed	Basra RF, Buxa TR West, WB	mixed plantation, RFP, khair-sissoo	Bhatpara TG, Mechpara TG	TG, villages
11	Basra - Titi	9.9	Basra RF, Buxa TR West, WB	mixed plantation, RFP, khair-sissoo	Titi RF, Jaldapara NP, WB	dense mixed	Bharnobari TG, Dalsingh-para-Beech TG, Torsa RFP	TG, villages, RFP
12	Gabbarjyoti - Titi	8.9	Basra RF, Buxa TR West, WB	mixed plantation, RFP, khair-sissoo	Titi RF, Jaldapara NP, WB	dense mixed	Gabbarjyoti jhora RFP	RFP
13	NImtijhora - Chilapata	4.1	Nimati RF, Buxa TR West, WB	mixed plantation, degraded	Mendabari RF, Jaldapara NP, WB	dense mixed	Nimaljhora TE, Madhya Patkapara, South Mendabari	TG, villages
14	Nimati - Mendabari	4.8	Nimati RF, Buxa TR West, WB	mixed plantation, degraded	Mendabari RF, Jaldapara NP, WB	dense mixed	Nimati Domohoni-Uttar La-tabari-Nakadala-Mendabari	TG, villages

Table 2. Corridors in Zone II from Torsa to Tista (FD = Forest Division; NP = National Park; RF = Reserve Forest; RFP = Riverine Floodplain; TE = Tea Estate; TG = Tea Garden; WB = West Bengal; WLS = Wildlife Sanctuary; WD = Wildlife Division).

No	Corridor	Length	From		To		Corridor	
		[km]	Location	Vegetation type	Location	Vegetation type	Via	Land-use
15	Titi - Reti	4.4	Titi RF, Jaldapara NP, WB	dense mixed, semi-evergreen	Reti RF, Jalpaiguri FD, WB	open mixed	Hunterpara TG / Garganda TG, Tulsipara TG, Makrapara TG	TG, RFP, villages
16	Titi - Dalmore	9.2	Titi RF, Jaldapara NP, WB	dense mixed	Dalmore RF, Jalpaiguri FD, WB	mixed plantation, degraded	Hunterpara TG / Garganda TG, Tulsipara TG	TG, RFP, villages
17	Titi - Dumchi	6.7	Titi RF, Jaldapara NP, WB	dense mixed	Dumchi RF, Jalpaiguri FD, WB	open sal, open mixed, degraded	Hunterpara TG, Dumchipara TG, Mujnai TG	TG, villages
18	Dumchi - Dalmore [1]	7.6	Dumchi RF, Jalpaiguri FD, WB	open sal, open mixed, degraded	Dalmore RF, Jalpaiguri FD, WB	mixed plantation, degraded	Gopalpur TG, Hasnabad TG, Ramjhora TG, Dalmore TG	TG, villages
19	Dumchi - Dalmore [2]	3.6	Dumchi RF, Jalpaiguri FD, WB	open sal, open mixed, degraded	Dalmore RF, Jalpaiguri FD, WB	mixed plantation, degraded	Gopalpur TG, Hasnabad TG, Ramjhora TG, Dalmore TG	TG, villages
20	Dalmore - Dalgaon	11.5	Dalmore RF, Jalpaiguri FD, WB	mixed plantation, degraded	Dalgaon RF, Jalpaiguri FD, WB	mixed plantation, degraded	Jaybirpara TG, Nangdala TG, Dimdima TG	TG, villages
21	Titi - Bhutan	3.5	Titi RF, Jaldapara NP, WB	dense mixed, semi-evergreen	Bhutan forest	semi-evergreen	Titi RF	continuous forest patch
22	Reti - Diana	14.5	Reti RF, Jalpaiguri FD, WB	open mixed, degraded	Diana RF, Jalpaiguri FD, WB	RFP, khair-sissoo, degraded	Reabari TG / Kathalguri TG, Redbank TG, Debpara TG, Laxmipara TG, Prayagpur village	TG, villages
23	Reti - Moraghat [1]	14.5	Reti RF, Jalpaiguri FD, WB	open mixed, degraded	Moraghat RF, Jalpaiguri FD, WB	dense sal, mixed plantation	KarballaTG, Bannarhat TG, Gendrapra TG	TG, villages
24	Reti - Moraghat [2]	9.0	Reti RF, Jalpaiguri FD, WB	open mixed, degraded	Moraghat RF, Jalpaiguri FD, WB	dense sal, mixed plantation	Binnaguri TG, Moraghat TG / Haldibari TG	TG, villages
25	Reti - Moraghat [3]	12.4	Reti RF, Jalpaiguri FD, WB	open mixed, degraded	Moraghat RF, Jalpaiguri FD, WB	dense sal, mixed plantation	Binnaguri Cantonment, Sarugaon basti, Shisujhumra, Telepara TG	TG, army, villages
26	Moraghat - Diana	9.0	Moraghat RF, Jalpaiguri FD, WB	dense sal, mixed plantation, semi-evergreen	Diana RF, Jalpaiguri FD, WB	RFP, khair-sissoo, degraded	Totapara TG, Mogulkata TG, Jalapara, Upper Kalabari	TG, villages
27	Reti - Bhutan	1.9	Reti RF, Jalpaiguri FD, WB	open mixed, degraded	Gomtu, Bhutan	dense mixed, semi-evergreen	Reti forest	continuous forest patch

28	Diana - Gorumara	3.5	Diana RF, Jalpaiguri FD, WB		Gorumara NP, WB		Bamondanga TE, Tondu TE	TG, villages
29	Chapramari - Neora	10.9	Chapramari WLS, WB	dense mixed, open mixed, mixed plantation	Neora RF, Kalimpong Div, WB	dense mixed, open mixed, degraded	Kilcott TG / Indong TG, Aibheel TG, Zurantee TG	TG, villages
30	Kumani - Sipchu	3.6	Kumani RF, Kalimpong Div., WB	dense mixed	Sipchu, Bhutan	dense mixed, semi-evergreen	Hilla TE, Jiti TE	TG, villages
31	Baradighi-Apalchand	7.5	Baradighi RF, Jalpaiguri FD, WB	dense mixed, dense sal	Apalchand RF, Baikunthapur FD, WB		Kantadighi Kumarpara, Nepuchapur TG	TG, villages
32	Lataguri-Aplachand	11.2	Lataguri RF Jalpaiguri FD, WB		Apalchand RF, Baikunthapur FD, WB		Neoranady TE, Nepuchapur TG	TG, villages
33	Batabari-Baradighi [1]	4.1	Baradighi RF, Jalpaiguri FD, WB		Batabari RF, Jalpaiguri FD, WB		Baradighi TE, Batabari TE	TG, villages
34	Batabari-Baradighi [2]	5.5	Batabari RF, Jalpaiguri FD, WB		Khariar Bandar RF, Jalpaiguri FD, WB		Batabari TE	TG, villages
35	Neora-Batabari	12.2	Khariar Bandar RF, Jalpaiguri FD, WB	dense sal	Neora RF, Kalimpong Div., WB	dense mixed	Satkhaya TG, Songachi TG, Nakati TG	TG, villages
36	Neora - Lethi	4.0	Neora RF, Kalimpong Div., WB	dense mixed, semi-evergreen	Lethi RF, Kalimpong Div., WB	dense mixed	Patharjhora TE	TG, villages
37	Apalchand - Churanthi	9.8	Churanthi RF, Kalimpong FD, WB	dense mixed	Apalchand RF, Baikunthapur FD, WB	open sal, mixed plantation, degraded	Gish RFP	RFP
38	Neora - Apalchand [1]	16.9	Neora RF, Kalimpong Div., WB	dense mixed, semi-evergreen	Apalchand RF, Baikunthapur FD, WB	open sal, mixed plantation, degraded	Meengals TG, Ranichera TG, New Sylee TG, Chel RFP	TG, villages
39	Neora - Apalchand [2]	16.9	Neora RF, Kalimpong Div., WB	dense mixed, semi-evergreen	Apalchand RF, Baikunthapur FD, WB	open sal, mixed plantation, degraded	Meenglass TG, Rangamatee TG, Damdim TE, Gosailine, Baintgoorie TG, Kumlai TG, Goodhope TG	TG, villages
40	Apalchad - Adabari	6.2	Apalchand RF, Baikunthapur FD, WB	open sal, mixed plantation, degraded	Adabari RF, Baikunthapur FD, WB	dense sal, dense mixed	Tista RFP	RFP
41	Apalchand - Saugaon - Mongpong	14.3	Apalchand RF, Baikunthapur FD, WB	open sal, mixed plantation, degraded	Mongpong RF, Kalimpong FD, WB	semi-evergreen, dense mixed	Tista river, Sonali TE	TG, villages
42	Saugaon - Laltong	3.9	Mongpong RF, Kalimpong Div., WB	semi-evergreen, dense mixed	Laltong RF, Darjeeling WD, WB	dense sal, dense mixed	Tista RFP	RFP

Table 3. Corridors in Zone III from Tista to Mechi (FD = Forest Division; RF = Reserve Forest; RFP = Riverine Floodplain; TE = Tea Estate; TG = Tea Garden; WB = West Bengal; WD = Wildlife Division).

No	Corridor	Length	From		To		Corridor	
		[km]	Location	Vegetation type	Location	Vegetation type	Via	Land-use
43	Gulma - Sukna	9.5	Gulma RF, Darjeeling WD, WB	dense mixed	Sukna RF, Darjeeling WD, WB	teak plantation, dense sal	Mohurgong, Gulma TE	TG, villages
44	Sukna - Lamagumpha	4.4	Sukna RF, Darjeeling WD, WB	teak plantation, dense sal	Lamagumpha RF, Kurseong FD, WB	dense mixed	Sukna army area	army
45	Lamagumpha - Balasan	5.3	Lamagumpha RF, Kurseong FD, WB	dense mixed	Balasan RF, Kurseong FD, WB	RFP, khair-sissoo	Simulbarie TG, Rakti RF, Siptugiuri TG	TG, villages, army
46	Lamagumpha - Bamanpokhri	1.1	Lamagumpha RF, Kurseong FD, WB	dense mixed	Bamanpokhri RF, Kurseong FD, WB	teak plantation	Rohini TG	TG, army
47	Balasan - Dalka [1]	4.4	Balasan RF, Kurseong FD, WB	RFP, Khair-Sissoo	Dalka RF, Kurseong FD, WB	dense sal, dense mixed, semi-evergreen	ORD Terai TG, Trihannah TG, Bengdubi army area	TG, villages, army
48	Balasan - Dalka [2]	1.4	DGHC Tatari RF, Kurseong FD, WB	teak plantation, mixed plantation	Dalka RF, Kurseong FD, WB	dense sal, dense mixed, semi-evergreen	Panighatta TG, ORD Terai TG	TG, villages
49	DGHC Tatari - Mechi [1]	1.1	Mechi RF, Kurseong FD, WB	open mixed, degraded, RFP	Tiring, Jhapa FD, Nepal	sal plantation	Tukra basti, Mechi RFP	TG, villages
50	DGHC Tatari - Mechi [2]	3.6	DGHC Tatari RF, Kurseong FD, WB	teak plantation, mixed plantation	Mechi RF, Kurseong FD, WB	open mixed, degraded, RFP	Panighatta TG, Bel-gachi TG, Marapur TE, Manjha TE	TG, villages
51	DGHC Tatari - Mechi [3]	2.3	Mechi RF, Kurseong FD, WB	open mixed, degraded, RFP	DGHC Tatari RF Kurseong FD, WB		Belgachi TG, Panighatta TG	TG, villages
52	DGHC Tatari - Mechi [4]	2.5	Mechi RF, Kurseong FD, WB	open mixed, degraded, RFP	Dalka RF, Kurseong FD, WB	dense sal, dense mixed, semi-evergreen	DGHC Tatari, Dalka	TG, villages
53	Mechi - Bamandangi (Nepal)	1.8	Mechi RF, Kurseong FD, WB	open mixed, degraded, RFP	Bamandangi, Jhapa FD, Nepal	villages	Mechi RFP, Bamnadangi village	RFP, villages
54	Dalka - UCCF	8.5	Dalka RF, Kurseong FD, WB	dense sal, dense mixed, semi-evergreen	UCCF RF, Kurseong FD, WB	open mixed plantation, degraded	Deomoni-Atal TE, Bairabhita	TG, villages
55	UCCF - Tukriajhar	1.8	UCCF RF, Kurseong FD, WB	open mixed plantation, degraded	Tukriahjhar RF, Kurseong FD, WB	open sal, teak plantation	Tukriajhar TG	TG, villages
56	Tukriajhar - Mechi	2.6	Tukriahjhar RF, Kurseong FD, WB		Mechi RF, Kurseong FD, WB		Mechi RFP, Madan, Mechi (Nepal)	RFP, villages

57	Mechi-Dalka [1]	1.4	Mechi RF, Kurseong FD, WB	open mixed, degraded, RFP	Dalka RF, Kurseong FD, WB	dense sal, dense mixed, Semi-evergreen	Belgachi TG, Nepania, Sirsia TG	TG, villages
58	Mechi-Dalka [2]	4.4	Mechi RF, Kurseong FD, WB	open mixed, degraded, RFP	Dalka RF, Kurseong FD, WB	dense sal, dense mixed, Semi-evergreen	Kalabari, Nepania, Mirjangla, Jamidarguri	villages
59	DGHC Tatari - Dalka	3.6	DGHC Tatari RF, Kurseong FD, WB	teak plantation, mixed plantation	Dalka RF, Kurseong FD, WB	dense sal, dense mixed, semi-evergreen	Panighatta TG, ORD Terai TG	TG, villages

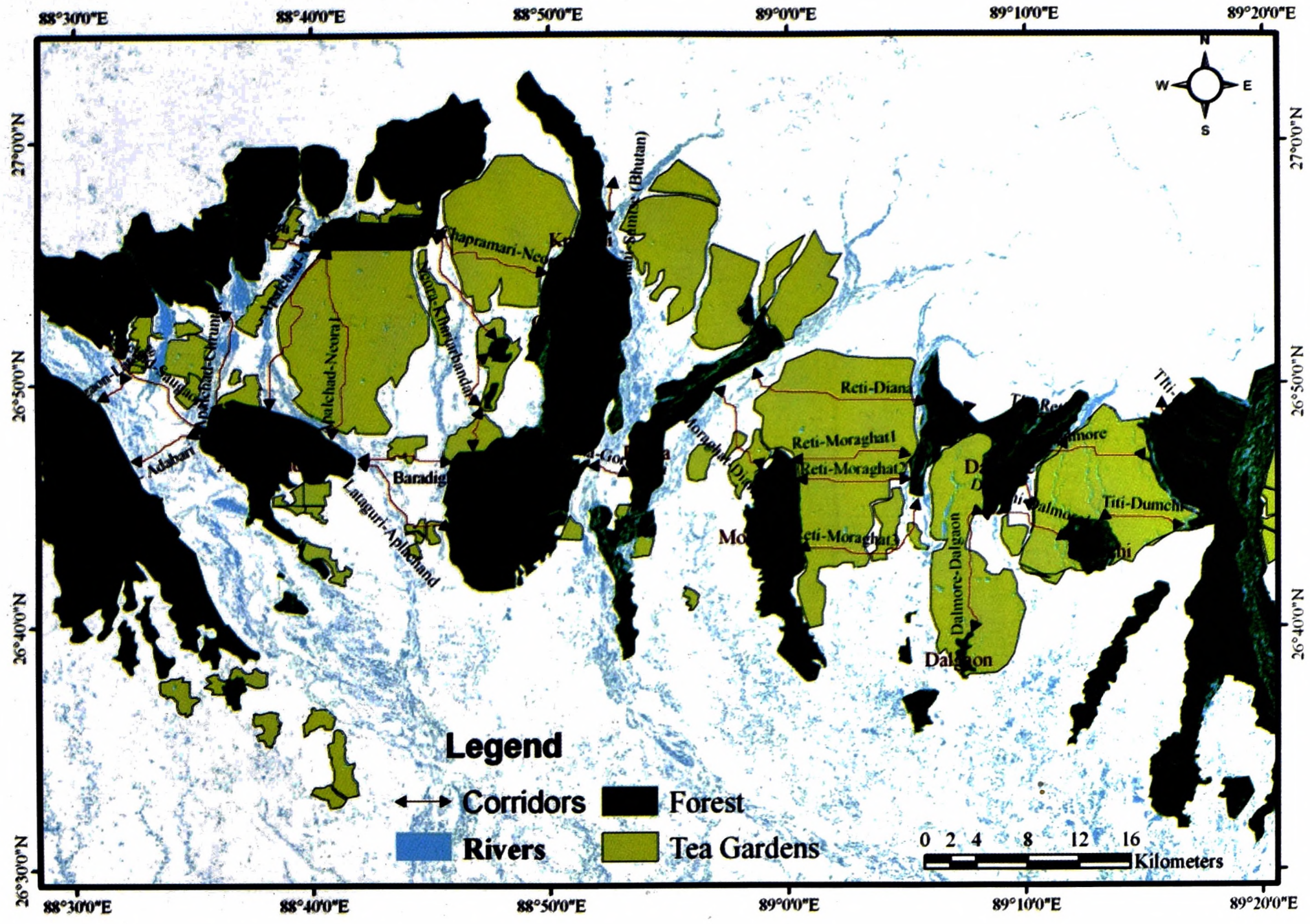

Figure 2. Elephant corridors in Zone II (Tista to Torsa).

Main corridors

The main corridors identified and characterized were the following:

- Panbari - Kartika - Rydak (corridors 7 & 8)
- Basra - Titi (corridor 11)
- Titi - Dalmore / Titi - Reti (corridors 15 & 16)
- Reti - Diana (corridor 22)
- Reti - Moraghat (corridors 23, 24, 25 & 26)
- Chapramari - Neora (corridor 29)
- Baradighi - Apalchand (corridor 31)
- Neora - Apalchand (corridors 38 & 39)
- Gulma - Sukna (corridor 43)
- Lamagumpha - Balasan - Dalka (corridors 45 & 48)
- DGHC Tatari - Mechi (corridors 49, 50 & 51)

Discussion

As the landscape is fragmented, emphasis should be laid on increased connectivity of forest patches by corridors. Preserving the main corridors will facilitate the movement of elephants in north Bengal. We found that a significant extent of corridors constituted of human dominated landscape features such as villages and tea garden labour lines which are not suitable for free elephant movement. However, tea gardens have shade trees and enable some movement of elephants, making them more suitable than villages. As a first step, if we can make the tea garden corridor areas free of human habitations and grow more shade trees, they will allow movement of elephants from one forest patch to the other with less conflict. It will be even better if we can convert corridor areas of tea gardens and human habitations to plantation forests. Such initiatives could be supported in terms of obtaining carbon credits and provision of ecosystem services. Establishing a secured corridor network would be an important objective for long-term conservation of elephants and other wildlife hence should be given priority in conservation planning.

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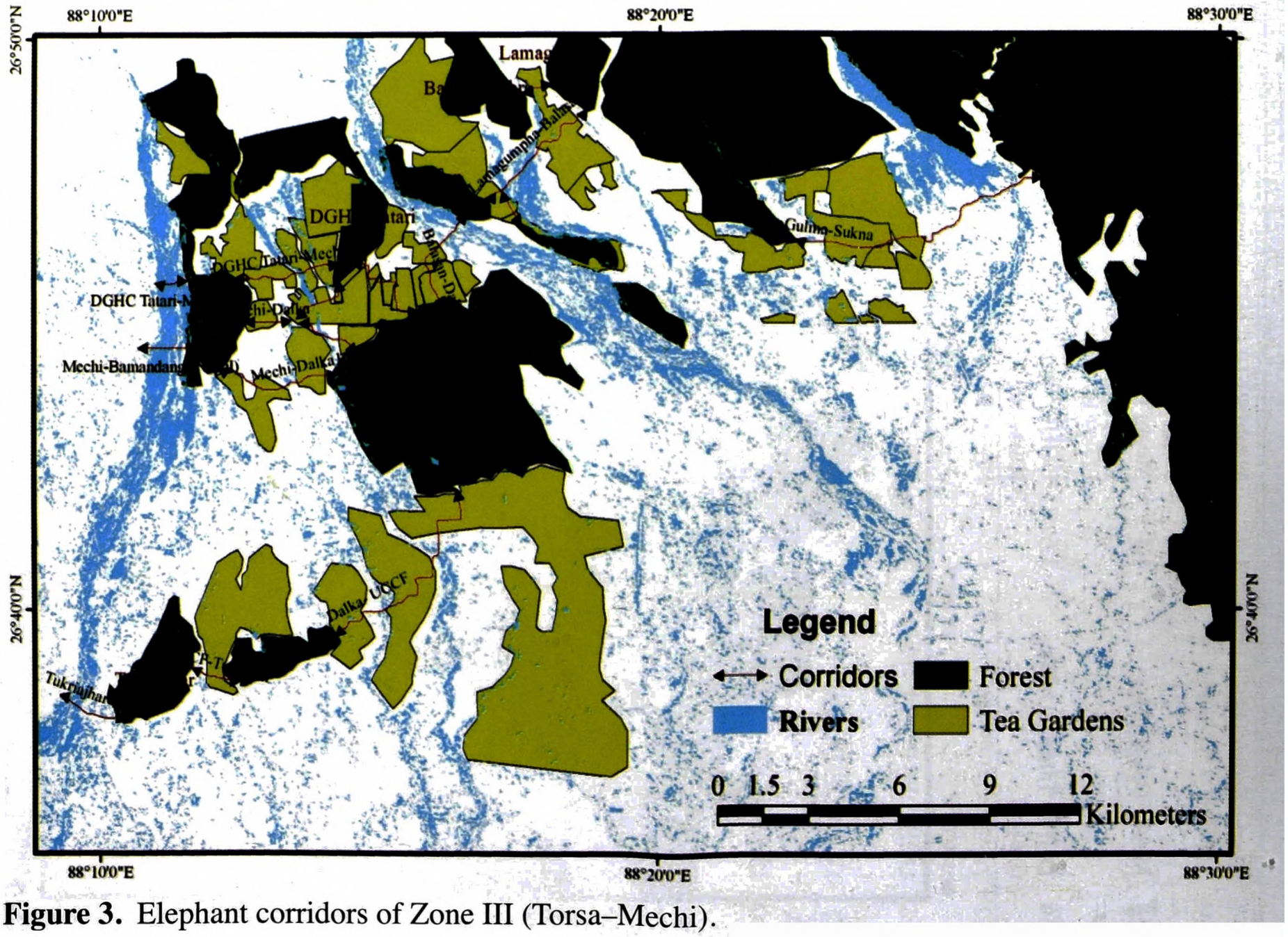

Figure 3. Elephant corridors of Zone III (Torsa–Mechi).

corridors and surveys. We also thank Tarun Mahalonibish (Range Officer Mal Squad), Dulal Chandra Das (Range Officer Khunia Squad) and Range Officers of Sukna and Binnaguri Squads for their help. We also thank Gopal Sharma, Netro Sharma, Nagraj and Ram Bagdas for help in the field. We also thank the Wildlife Institute of India and the Centre for Ecological Sciences, Indian Institute of Science, for providing access to radio-telemetry data. We also thank Beependra Singh, the Centre for Ecological Sciences, Indian Institute of Science, for help in preparing maps and R.P. Saini (IFS) for the photo shown below.

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