Tracing straying routes of rhinoceros in Pabitora Wildlife Sanctuary, Assam

Bibhab Kumar Talukdar[1,*], Mrigen Barua[2] and Pranjit Kumar Sarma[1]

[1]Aaranyak, 50 Samanwoy Path, Survey, Guwahati 781 028, India
[2]O/o Conservator of Forests (Central Assam Circle), Guwahati 781 001, India

The population of the Great one-horned or Indian rhinoceros, *Rhinoceros unicornis* has been gradually increasing in the small protected area in Assam, the Pabitora Wildlife Sanctuary (WLS). From 54 in the year 1987, the rhinoceros (rhino) population has touched 81 in April 2006. Keeping the increase in rhino population in mind and also the tendency of the rhinos to stray out of the sanctuary, particularly during winter season, a detailed study was made between 2000 and 2005 in and around Pabitora WLS, to mark the routes used by rhinos to stray out of the WLS using GPS and remote sensing-based mapping. During the field study, it was observed that on an average 20–30 rhinos strayed out from the sanctuary every night between November and March. Few rhinos were tracked down outside the boundary of the WLS during the study and the routes were mapped to assist the sanctuary managers to initiate appropriate remedial measures.

Keywords: Conservation, Pabitora, remote sensing, rhino, straying.

THE Pabitora Wildlife Sanctuary (WLS)[1] falls within 26°12′–26°15′N lat. and 91°57′–92°5′E long. The sanctuary area is flat with a gentle east-to-west inclination, excluding Bura-Mayong hillock (Figure 1). The sanctuary is located in the floodplains of rivers Brahmaputra, Kolong and Pokoria[2]. Though the total area of the sanctuary is 38.81 sq. km, the State Government is yet to hand over an area of about 11.07 sq. km to the sanctuary authority. Hence, a total of 27.74 sq. km area is under the present management of the Assam Forest Department.

The density of rhinoceros (rhino) in Pabitora is the highest[3] within the current distribution range of the Indian rhino. Intense cattle grazing in Pabitora has forced the rhinos to stray out of the WLS[4]. About 20–30 rhinos stray out during winter due to shortage of palatable fodder inside the WLS, on account of cattle grazing inside the sanctuary. As the rhinos stray out to nearby unprotected areas, they fall prey to poachers[5]. Twenty rhinos have been killed outside the sanctuary in the last ten years. Keeping this in mind, a study was carried out for five years (2000–05) in an attempt to identify the routes used by the rhinos to stray out of the WLS and map them using GPS, remote sensing and GIS. It is envisaged to assist the managers of the Pabitora WLS in better management of this endangered species. The routes used by the straying rhinos were tracked using GPS and then plotted using GIS software. The details are given below.

The study also took into account unpublished records on the existence of the rhinos in Pabitora area. Records in the Forest Department mention the existence of around fourteen rhinos in Pabitora during 1961–62. On 18 November 1971, a total area of 15.84 sq. km was declared as Reserved Forest by State Government notification. After successful results in Kaziranga and Orang National Parks, scientific grassland management was adopted in Pabitora Reserved Forest in 1981. This has resulted in considerable increase in rhino population in Pabitora and subsequently, the area was acclaimed on the world's wildlife map as a place with the highest density of the Great one-horned rhino. In view of the steady increase in rhino population, the area was further notified and declared as Pabitora WLS on 16 July 1987.

The historical documents reveal the presence of rhinos in Pabitora and Mayong areas since 1925. Table 1 gives details of the rhino population between 1987 and 2006 in Pabitora WLS.

The census of rhinos carried out in Pabitora WLS during 1999 revealed the existence of 43 adult rhinos that represented 58.11% of the total population, followed by 12 sub-adults representing 16.22% and 19 calves representing 25.68% of total rhino population in the WLS in a total of 74 rhinos. Of the 74 rhinos, 24 were identified as adult males while 31 were identified as adult females, in addition to 19 calves. The male–female ratio stood at 1 : 1.29. However, the latest rhino census carried out in Pabitora on 8 April 2006 recorded a total of 81 rhinos, of which only 18 are adult males and 30 are adult females, besides 21 calves and 12 with sex unidentified. The male-female ratio in 2006 was at 1 : 1.66.

Rhinos are more prone to poaching outside the boundary of the WLS compared to the inside, according to the record

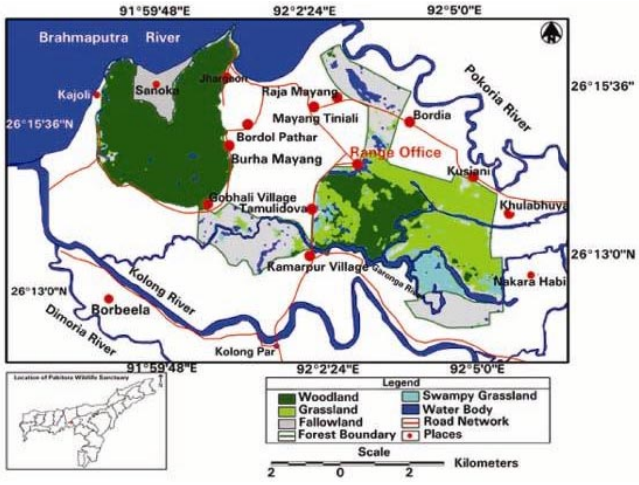

Figure 1. Map of Pabitora WLS showing various land-cover types.

*For correspondence. (e-mail: bibhab@aaranyak.org)

Table 1. Number of rhinos in Pabitora WLS during the past 17 years

Year	Adult			Sub-adult			Calf	Total
	Male	Female	Unidentified*	Male	Female	Unidentified*		
1987	17	19	–	5	8	–	5	54
1993	18	21	1	1	2	2	11	56
1995	11	28	3	3	1	13	9	68
1999	17	26	–	7	5	–	19	74
2006	18	30	–	–	–	12	21	81

Source: Assam Forest Department. *Individuals where sex could not be determined.

Table 2. Rhinos poached in Pabitora WLS during the last 16 years

Year	Rhinos poached inside WLS		Rhinos poached outside WLS	
	Bullet	Electrocution	Bullet	Electrocution
1988	1	0	2	0
1989	0	1	2	1
1990	1	0	1	0
1991	0	0	1	0
1992	0	0	1	2
1993	1	0	3	0
1994	0	1	0	3
1995	2	0	0	0
1996	1	2	0	2
1997	2	0	1	0
1998	1	1	2	0
1999	3	0	0	3
2000	2	0	0	0
2001	0	0	0	0
2002	0	1	0	0
2003	0	2	0	0
2004	0	0	1	0
2005	0	0	2	0
Total	14	8	16	11

Source: Assam Forest Department.

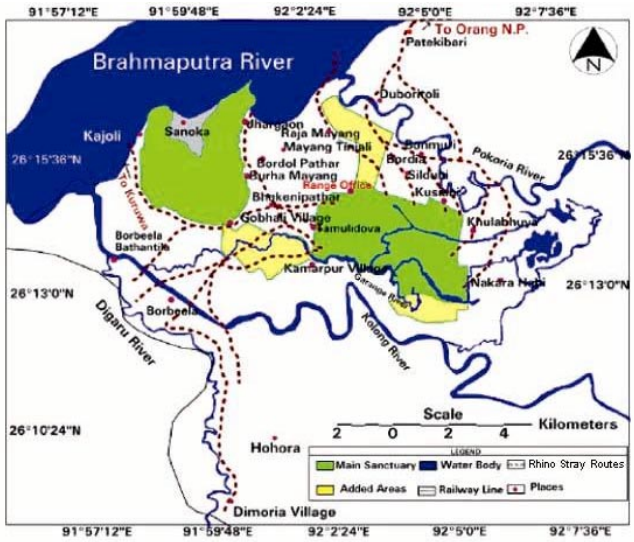

Figure 2. Rhino straying routes around Pabitora WLS.

of the last 18 years (1988–2005). A total of 27 rhinos were poached outside the WLS, while 22 were poached inside (Table 2).

The present study focused on the various routes that the rhinos follow to stray out of the WLS to nearby human-inhabited areas and crop fields. Three major tracks through which rhinos stray out of the WLS have been identified and marked using GPS (Figure 2).

(i) The Kholabhuyan–Sildubi–Bonmuri–Murakata–Duboritoli/Hatimuria–Gagoldubi–Patekibori track was widely used by the rhinos during early winter (November) to early spring (mid-March). Every winter, about 10–15 rhinos stray out of the WLS and follow this track. The rhinos move from Nekera, Kholabhuyan and Kusuani areas of the WLS to Sildubi and Bonmuri, and then move further towards Bordia and Murakata. From Murakata, some rhinos move towards Hatimuria, while others move towards Duboritoli and then again reunite near Gagoldubi, and finally the herd move towards Patekibori. On five occasions during the study period, it was found that some rhinos moved beyond Patekibori, towards Bhuragaon and then moved towards Orang National Park (Figure 3).

(ii) The Tamolidova–Kanjuli–Bhekenipathar–Hiloikhunda–Kurua track was moderately used by rhinos for straying outside the WLS. During winters, about 5–8 rhinos stray out of the WLS following this track and move towards Kurua area, which is a grassland habitat lying close to the River Brahmaputra. During the present study, it was observed that rhinos from Tamolidova area of the WLS moved towards Kanjuli (this area is yet to be handed over to the Forest Department by the District administration of Morigaon), from where they dissipated towards the eastern part of Kurua, moving further towards the Buramayong hillocks while passing through Bhekenipathar and Hiloikhunda. The Tamolidova–Kanjuli–Kajoli–Kurua track has been observed to be least used by rhinos while straying out of the WLS during winters. During the study period, it was found that only one or two rhinos strayed towards Kajoli and Kurua areas lying near the River Brahmaputra, through west of Buramayong hillocks while touching some parts of Kanjuli.

(iii) The Kumarpur–Borbeela–Digaru track has been observed to be used often by about 4–5 rhinos during every winter. These rhinos move from Kumarpur area of the

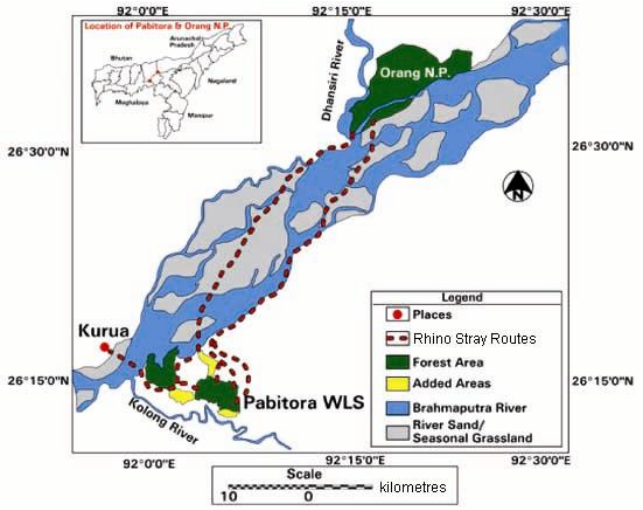

Figure 3. Routes of rhino movement from Pabitora WLS to Orang National Park.

WLS towards the Kanjuli in the west and then they move southwards towards Borbeela and Digaru. Borbeela is a rich grassland outside the WLS with an area of almost 30 sq. km that supports good rhino habitat. From Borbeela, the rhinos move towards the Digaru airbase of the Indian Air Force, where good conditions for supporting a suitable rhino habitat still exist. This poses a threat for poaching vulnerability of the species.

The study has assisted the Forest Department of Assam to set up new anti-poaching camps in the three above-mentioned tracks[6].

During the study, emphasis was also given to identify why the rhinos lose their original track and do not return to the habitat within the WLS. Although no reports are available in the literature, during field studies we found that the rhinos rely on the presence of certain scent glands below the pads of their feet for moving in and out of their habitat niche.

The study also revealed that rhinos lose their original tract particularly when

- They cross through human habitation and paddy fields, where the distinctive scent mark generally left by individual rhinos is lost due to anthropogenic disturbances.
- When the rhinos cross highways or roads cutting across their migratory routes, where vehicular traffic is high, the scent mark released by the rhinos could be eliminated by emissions from vehicles.

The outcome of the study was a GIS-based map with location and routes of rhinos straying out. This map could assist the managers of the WLS to take appropriate conservation and protection measures to stop further poaching in these tracts during winter. In addition, it is envisaged that biochemical investigations at the molecular level can provide useful information.

1. Bora, C. K. (compiler), Management plan of Pobitora Wildlife Sanctuary 2003–04 to 2007–08, Nagaon Wildlife Division, Government of Assam, Nagaon, 2003.
2. Choudhury, A. U., Pabitara, Assam's rhino reserve. *India Magazine*, 1989, vol. 9, pp. 46–54.
3. Talukdar, B. K., Status of *Rhinoceros unicornis* in Pabitora Wildlife Sanctuary, Assam. *Tigerpaper*, 1999, **26**, 8–10.
4. Choudhury, A., Threats to Pabitora Wildlife Sanctuary, Assam. *Pachyderm*, 2005, **38**, 82–88.
5. Talukdar, B. K., The current state of rhinos in Assam and threats in the 21st century. *Pachyderm*, 2000, **29**, 39–47.
6. Talukdar, B. K., Dedication leads to reduced rhino poaching in Assam in recent years. *Pachyderm*, 2002, **33**, 58–63.

ACKNOWLEDGEMENTS. We thank the Assam Forest Department for logistic support provided during the study period. We also thank Rufford Foundation, United Kingdom for sponsoring the study during 2003–05 and the David Shepherd Wildlife Foundation for sponsoring the study during 2000–03. Thanks are also due to all the officials at Aaranyak, specially Dr Hridip Sarma for his comments during the preparatory stages of this manuscript.

Received 3 July 2006; revised accepted 27 November 2006