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How many locations do we need per day to reliably describe the habitat use of translocated rhinos in Manas NP?

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Abstract:

The Indian Rhino Vision (IRV) 2020 program was designed in 2005 in Assam for maintaining existing rhino populations and to re-introduce rhinos in the earlier distribution ranges of Assam. The programme was launched on 12th April 2008. The government of Assam with donor support translocated two male rhinos from the Pobitora WLS to the Buraburijhar area under Basbari range in Manas National Park. As a follow up to these translocations to understand the adaptation of the rhinos, it was important to assess the monitoring frequencies, habitat use and distribution pattern of rhinos in the new habitat. Monitoring was primarily based on radio-telemetry techniques and direct observation. The monitoring team maintains a vigil on the released rhinos all round the day and the observations were systematically recorded three times a day. During this exercise it was found that the rhinos prefer to use grasslands, swamps and marshy areas (*beels and rivulet)*.

Key Words: Indian Rhino Vision (IRV) 2020, Radio-Telemetry, Translocation

Introduction:

Greater one horned rhinoceros (GoH), *Rhinoceros unicornis* Linnaeus 1758 was once distributed from the Indus river valleys (currently in Pakistan) to the flood plains of Brahmaputra in Assam, North East (NE) India (*Dinerstein 2003*). However due to the importance of their body parts in traditional Chinese medicine and loss of habitat to human settlements along fertile flood plains, their numbers plummeted to a few remnant populations in Assam and Nepal. With intensive protection measures over the last century, GoH made a remarkable comeback both in both Assam and Nepal (*Jnawali, 1995*). Until the 1980s, six protected areas in Assam had breeding populations of rhinos. However, an insurgency problem, which led to a breakdown of law and order in Assam, resulted in the extermination of rhinos from Laokhowa, Bura-Chapori and Manas National Park (NP) by the end of 1990s leaving only three sites with rhinos viz.- Kaziranga NP, Orang NP & Pobitora WLS. Among the remaining populations of rhino in Nepal and India, only two sites had numbers in excess of 100 individuals, thus increasing the risk to the overall status of GoH (*Thomas J. Foose., 1997*).

The management authorities for wildlife in Assam clearly realized the dangers with having most of their rhinos at one site and thus were open to implementing a pro-active management strategy for rhinos in Assam. At the centenary celebrations of the establishment of Kaziranga NP in 2005, their case for pro-active management got a boost when comparisons between Umfolozi in Kwazulu-Natal and Kaziranga in Assam were presented. Both the sites had started with less than 100 rhinos a century ago, but due to pro-active management, that included creating new populations via translocations, resulted in southern white rhino population of over 18,000 rhinos from Umfolozi and 2000 rhinos in Kaziranga where a strict protection-only strategy was followed. The Government of Assam, with support from International Rhino Foundation, World Wide Fund for Nature (WWF) and the United States Fish and Wildlife Service (USFWS), therefore launched the Indian Rhino Vision (IRV) 2020 to help maintain existing rhino populations and to re-introduce rhinos into PAs from which they were exterminated in the recent past. The program aimed at achieving a population of 3000 rhinos in Assam by year 2020 spread over seven Protected Areas. The range expansion part of the programme was launched on 12th April 2008 with the translocation of two male rhinos from the Pobitora WLS to the Buraburijhar area under Basbari range in Manas National Park (*Bonal, 2008).*

With the above mentioned background, our objective of this study was to assess the habitat use pattern of the translocated rhinos in their new environment. We also wanted to find out how many locations we need to reliably describe the habitat use of rhinos. Answering the second question was important as the number of translocated rhinos increases the tracking team would not be able to track them intensively as they did with just two rhinos.

Study Area:

The study was carried out in Manas National Park (MNP) located in the North Eastern part of India (Map1) and forms a part of the Northern Bank Landscape (NBL). MNP is situated between the latitude 26°30′ N to 27°00′ N and longitude 91°51′ E to 92°00′ E. It is located in the northern belt of Brahmaputra valley and falls within the newly created districts of Chirang and Baksa along the Indo-Bhutan international boundary of Assam, India. The biological richness of NBL has been recognized by WWF and is one of the Global 200 eco-regions of importance (*Olson, 2002*). Study by the North Bank Landscape Conservation Programme of WWF India has found the forest of the Pake Nameri Complex in NBL to be among the world richest (*Gillison, 2004*). The Landscape biodiversity values have been internationally recognized and find's a place among the WWF's Global 200 ecoregion (Eastern Himalayas). The rhinos were translocated to Manas National Park (500km^2) which is the core of Manas Tiger Reserve (2837km^2) and a UNESCO World Heritage Site.

MNP is known worldwide for its rich floral and faunal biodiversity. It is worth mentioning that Manas still has a good rhino habitat and had more than 100 rhinos till mid nineties (*Vigne L., 1994*). The rhino population of Manas was wiped out by poachers during the social unrest period of last decade of 20thcentury.

Methodology:

The study was carried out during April 2008 to March 2010. VHF radio collars (African Wildlife Tracking) were fitted in the rhinos and were tracked and located three times daily. Locations were recorded in the morning, afternoon and evening. We also tracked and observed the rhinos in the night at times, which largely depended on the accessibility factors. We carried out the tracking using directional antennae either on foot, elephant back, motorcycles and 4WD vehicles depending on the area where the rhinos were present. Homing using the VHF signal was done to locate the individual visually from a safe distance (50 – 100mts) and a handheld GPS (Garmin Inc.) was used to record the spatial information. Since both the rhinos were kept in an enclosure (*boma*) for a limited period as a part of the management strategy, we used only the locations when the animals were free ranging.

We used LISS III satellite data for 2005 for deriving the habitat information using standard Image Analysis techniques available in Erdas Imagine. The habitats that could be distinguished both visually and from satellite images were categorized into Woodland, Grassland, Swamp and/or Marshy areas and Water Bodies. There was a small set of pixels on the image that could not be classified into the above habitat types and was therefore listed under a category "Other". Home range, as defined by Minimum Convex Polygon (MCP) and 95% Adaptive Kernel (AK) was calculated using module within Arc View GIS (*Hooge, 1999*). The proportion of each habitat type within the Home Range for each individual was then derived.

Habitat preference was derived using Jacob's Index (*Jacob,1974*):

Jacob's Index- $D=(r - p) / (r + p – 2rp)$

Where, r = proportion of Rhino observed in particular habitat during free ranging period. p = area of land cover class within HR / HR area. Values of the index range from –1 to +1 indicating avoidance and preference respectively.

Results and Discussion:

The results of this study were based on monitoring and tracking the two translocated rhinos in Manas NP between 13April 2008 to 31March 2010. We obtained a total of 1243 locations for Rhino-1 and 803 locations for Rhino-2 during this period of about twenty-four months (Map2). Based on our observations, we found that spatially both rhinos preferred to use grasslands, swamps and marshy wetlands (*beels and rivulets*) areas of Basbari and Bhuyapara range (Table 1). It was also seen that they preferred short and open grass land areas adjoining the water bodies. The rhinos tended to stray outside the NP during summer season and spent a lot of time in the southern areas of the NP. In the dry season months (winter and spring), the rhinos were distributed over the central parts of the Park away from the crop fields.

Jacob's index values as calculated from availability and use proportion using two different home range methods indicate that rhinos consistently avoided woodlands and preferred swamp and marshy areas (Table 2). While

they used grasslands in proportion to availability, they did not spend a lot of time in the water bodies/ wetland (this may be due to low levels of detections in a submerged condition). The results did not significantly change between the two home range methods used for calculating availability of these habitats within the home ranges of these rhinos.

Although Jacob's index found no particular preference for any particular habitat by the rhinos, we observed that the rhinos spend a considerable time in grasslands. Similar result was also seen within the Karnali river floodplain where rhinos spend most of their time in the floodplain ecosystem of Chitwan NP, Nepal (*Dinerstein,* 2003).

We tracked and physically observed Rhino-1 on 362 occasions and rhino-2 on 242 occasions, during the study period. We also evaluated to see if one location per day would be enough to describe their habitat use accurately. We reanalyzed the data collected by taking just one location for the day selected randomly. The result (Table 3 & 4) indicates that there was not much difference in the overall conclusions when the result is compared with three locations a day. However, the time of the day used to track and locate the rhinos would influence the conclusions regarding the use of critical habitats like water bodies. In this case, probably as most of the data randomly selected were from the day time (pre-noon), the proportion of use of water bodies was higher since rhinos tend to cool off in water during the day. We think that analyzing habitat use from one location per day (taken at different time periods) may be tried out when there are more rhinos to be tracked and located.

Overall, among the major land cover classes categorized in the study area, we observed that the marshy/swampy and grassland areas were more preferred than the woodlands. Among the grasslands the rhinos preferred to occupy the areas dominated by *Cynodon dactylon, Andropogon sps., Leersia hexandra, Cyperus rotendus, Cyperusiria, Phragmites karka, Saccharum ravennae, Saccharum narenga, Imperata cylindrica, etc.* Translocated rhinos in Bardia National Park, Nepal preferred Khair-Sissoo forest, riverine forest and tall grassland and avoided Sal Forest, wooded grassland and river beds (*Jnawali, 1995*). It is known that the tall grass land and riverine forests are the critical habitats for the greater one horned rhinoceros (*Dinerstein,* 1991). In this study we also observed that short and open grass land was more preferred compared to the tall grasslands. Tall grass land was found highly preferred by both male and female during the monsoon (*Jnawali. 1995)*. We found that the rhinos were using grass land near to southern part of the National Park close to the boundary which is adjoined to the agricultural fields. Rhinos were found to raid crops during summer season when fringe villagers started paddy cultivation. But in Bardia National Park, Rhinos were also found to raid crops in the agricultural fields in the dry winter season. Lack of forage could be a reason for the crop-raiding observed during this season in Nepal *(Thapa Kanchan, 2009).*

Even though water bodies are much used areas by rhinos for wallowing, our observations were different in the study area. We believe that there could be two potential explanations for this discrepancy. The water bodies were not found as preferred during the study as the rhinos use them for limited time at a stretch and therefore were missed during the monitoring schedule of a day. Also, this may happen due to the nature of the terrain and low capability of VHF transmitters when the rhinos' stay underwater. A direct observation could not be made ca. 30.3% of time and the rhinos could have been wallowing in the small wetlands in the area during that period.

Management recommendations from this study as new rhinos are translocated into the Park;

1. In case of a large number of translocated rhinos to be tracked and followed, one observation per day following a systematic protocol may provide useful data and save limited resources (both manpower and logistics). Monitoring activities on elephant back improve the chance of visually sighting the rhinos in tall grasslands.

2. The two translocated rhinos primarily grazed on grasses like *Cynodon dactylon, Andropogon sps*. *Leersia hexandra, Paspalum conjugatum, Cyperus rotendus, Cyperusiria sps, Imperata cylindrica, Phragmites karka, Themeda villosa, Saccharum ravennae, Saccharum narenga, Hymenachne assamica, Hemarthia compresa*. However some of these grasslands are degrading with the invasion of *Bombax cieba*, and under shrubs like *Leea asiatica* and *Chromolaena odorata*. Installation of electric fences and protection infrastructure at the southern periphery of the park, improvement of patrolling as well as increasing the awareness about the need to conserve grasslands among local community is recommended to lower the anthropogenic pressure on grasslands. A grassland management protocol is a necessity for the park especially for the areas extensively used by the rhinos.

3. Habitat enrichment (e.g. removal of invasive species) of grasslands in and around the water bodies is suggested as this is among the most preferred habitat for rhinos.

4. Security measures and anti-poaching efforts should be more concentrated in the habitats preferred by the rhinos as indicated in the present study.

Conclusion:

This study's finding will provide new dimension on Greater One horned rhinos conservation area in the Country and this will provide important database and protocol to study any translocated wild life specially GoH rhinos in the State. It will help develop a scientific understanding of the species in its environ in Assam and also promote further studies to explore the behavior and ecology for the management of the GoH rhino.

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Table-1: Rhinos locations from three observations daily

Habitat Type	Rhino-1 locations from 3 observation daily (%)	Rhino-2 locations from 3 observation daily (%)
Woodland	6	12
Grasslands	49	53
Swampy / Marshy	43	29
Water bodies	2	5
others	0	0

Table-2: Habitat preference of Rhino-1 and Rhino-2 with Jacob Preference Index with three observations daily

Habitat Type	Jacob's Index for Rhino1 using 100% MCP Home Range	Jacob's Index for Rhino2 using 100% MCP Home Range	Jacob's Index for Rhino1 using Kernal (95%) Home Range	Jacob's Index for Rhino2 using Kernal (95%) Home Range
Woodland	-0.45	-0.46	-0.79	-0.62
Grassland	-0.31	0.02	0.11	0.26
Swampy / Marshy	0.90	0.88	0.83	0.75
Water bodies	-0.70	-0.28	-0.67	-0.30
Others	-1.00	-1.00	-1.00	-1.00

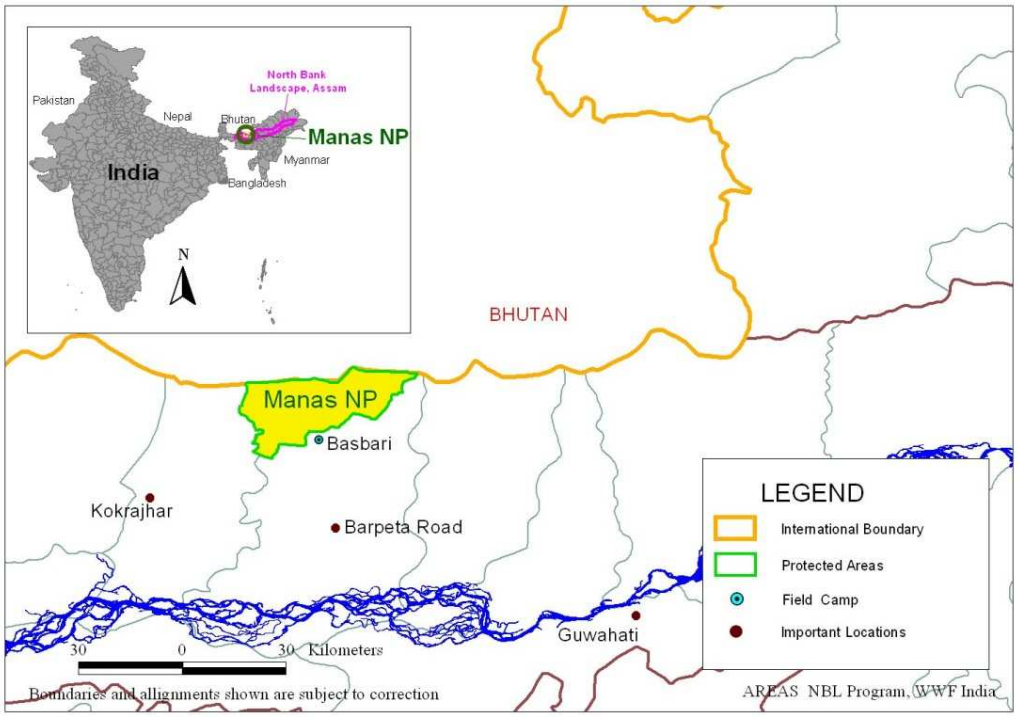
Table-3: Rhinos locations from single observation daily

Habitat Type	Rhino-1 locations from daily single observation (%)	Rhino-2 locations from daily single observation (%)
Woodland	3	9
Grasslands	45	55
Swampy / Marshy	44	22
Water bodies	6	12
others	0	0

Table-4: Habitat preference of Rhino-1 and Rhino-2 with Jacob Preference Index with a single observation daily

Habitat Type	Jacob's Index for Rhino1 using 100% MCP Home Range	Jacob's Index for Rhino2 using 100% MCP Home Range	Jacob's Index for Rhino1 using Kernal (95%) Home Range	Jacob's Index for Rhino2 using Kernal (95%) Home Range
Woodland	-0.45	-0.46	-0.79	-0.62
Grassland	-0.31	0.02	0.11	0.26
Swampy / Marshy	0.90	0.88	0.83	0.75
Water bodies	-0.70	-0.28	-0.67	-0.30
Others	-1.00	-1.00	-1.00	-1.00

Map1 – Location on the study area, Manas NP, India



Map2 - Ranging pattern of the Rhino's during April,2008 to March, 2010